MOTE MARINE LABORATORY & AQUARIUM

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Mote Marine Laboratory, Inc.
Elizabeth Moore Center for Coral Reef Research and Restoration
24244 Overseas Highway
Summerland Key, FL 33042
Contact: Kevin Claridge - VP Sponsored Research and Coastal Policy Programs

Mote Marine Laboratory, Inc. (MML) is an independent, 501(c)(3) nonprofit corporation dedicated to excellence in marine, estuarine and environmental research and education. Organized in the State of Florida in 1955 (70 years in business), MML has eight campuses stretching from Anna Maria Island to Key West. Five MML campuses are in the Florida Keys where we have had research facilities conducting diverse research for over 32 years, and now anchored by our International Center for Coral Reef Research and Restoration (IC2R3) on the MML Summerland Key campus. Laboratory finances are independently audited on an annual basis. In 2024, operating revenues totaled ~$40 million. Net assets of the Laboratory were ~$158 million. There are currently 38 very diverse MML Research Programs and Centers of Excellence ranging from Chemical & Physical Ecology, Ecotoxicology and Molecular Microbiology to Coral Reef Restoration, Fisheries, Seagrass and Harmful Algal Blooms. Of 315 MML staff, >45 are at the doctoral level with the majority of our nearly 50 full time resident Florida Keys staff being within 25-30 miles of Key West. Sponsors of research include federal, state, and local governments; public and private foundations, and corporations. MML is a 501(c)3 in the State of Florida in 1957.

Primary Person: Emily R. Hall, Ph.D.
Dr. Hall has >20 years working on developing, managing, and enacting water quality monitoring programs in the State of Florida. The Project Team commits to perform and complete the services within.

Thank you for the opportunity to submit this proposal, we look forward to assisting the City of Key West.

Sincerely,

MP Crosby

Michael P. Crosby, PhD, FLS
President & CEO

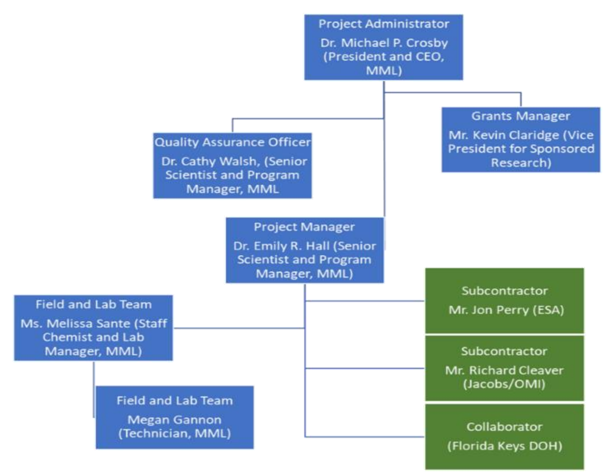
Executive Summary: The MML Project Team, consisting of MML PIs Emily R. Hall, Ph.D., Kevin Claridge, Kirstie Francis, Ph.D., Aspen Cook and subcontracts Jon Perry – Environmental Science Associates and Richard Cleaver – Jacobs, Inc., proposes to address the Request for Proposals (RFP) from the City of Key West by performing and completing all Tasks within the RFP. The MML Project Team will collaborate with the City of Key West and the Florida Department of Health. Tasks include reviewing current relevant data across all Geographic Areas of Concern (GOCs) and identifying opportunities to advise on a comprehensive water quality program for these sites, identifying actions that may mitigate pollutants and creating a list of actions which may mitigate the identified pollutants, designing water quality monitoring programs that will capture both the baseline levels of the prioritized pollutants and the changes to those pollutants based on the proposed mitigation actions, increasing beach reports (including sampling at all 4 beaches and addition of 2 new beaches and the mooring field) to once per week mirroring the current sampling regimen followed by FDOH, increasing community knowledge of data/beach report implications by adding all City of Key West beach sites to the MML Beach Conditions Reporting System (BCRS), and assisting with design of a new beach water quality monitoring plan for the City of Key West. The Project Team has >20 years of experience developing water quality monitoring programs for municipalities, has combined two labs (MML and Jacobs) that maintain NELAC certifications with the State of Florida Department of Health, Bureau of Public Health Laboratories, Florida Department of Environmental Protection, and has significant experience working throughout the Florida Keys, including within the City of Key West.

2. Qualifications and Relevant Experience

Mote Marine Laboratory (MML) is an independent, nonprofit marine research organization (not a sole proprietorship, corporation, partnership, or joint venture) based in Sarasota, Florida, with additional campuses throughout southwest Florida and the Florida Keys, founded by Eugenie Clark in 1955. MML is under the leadership of President and CEO, Dr. Michael P. Crosby who is advised by a Board of Directors. Current Board Officers include Chairman Sandi Stuart, Vice Board Chairman Howard "Skip" Swan, Treasurer Scott Collins, and Secretary Andrew Economos.

The organizational structure for the project is as follows: Dr. M.P. Crosby, President and CEO of Mote Marine Laboratory (MML), is responsible for overall Laboratory resource allocation. Reporting to him, and independent of the project, is Dr. Cathy J. Walsh, Senior Scientist and the Quality Assurance Officer for MML. The Project will be conducted under the Chemical and Physical Ecology and the Ocean Acidification Programs managed by Dr. Emily R. Hall, MML Senior Scientist and Program Manager. She will be assisted by Ms. Melissa Sante, Ms. Susan Launay, and Ms. Megan Gannon for laboratory oversight, logistical planning, and fieldwork. Dr. Kirstie Francis will lead Tasks 5 and 6 (evaluation of bacteria data and development of a sampling plan for bacterial source). Ms. Aspen Cook will lead Task 5 (development of a community-facing platform to present beach information). A subcontract will be provided to Mr. Jon Perry (Environmental Science Associates [ESA]) and to Mr. Richard Cleaver (Jacobs/OMI). Mr. Perry will provide expertise on water quality assessments (Tasks 1-3) and Mr. Cleaver will provide analyses of microbial samples (Task 4).

Key project personnel are listed below (resumes are included in **Appendix A**) with highlights of their experience and project assignments. In addition to those described, the staff who will be the primary sampling crew leaders have each received formal field sampling training and safe boating training. Sufficient additional staff are available as needed for the field and analytical needs of the project.



Project Team Organization Chart

Dr. Michael P. Crosby, MML President and CEO, is the project administrator of all research projects at MML. Dr. Crosby has > 30 years of experience in managing large, complex and multidisciplinary environmental studies, primarily in Florida. He is responsible for performance of the laboratory and all contractual issues affecting the project.

Mr. Kevin Claridge, MML Vice President for Sponsored Research and Coastal Policy Programs, assists Mote's 38 Research Programs and Centers of Excellence with the daily various operational aspects of budgets, contracts, grants, permits, policy and personnel towards the institutional mission and vision. He also serves as administrator for several research initiatives that organize numerous internal and external partners, through competitive grant processes, and navigation of related policy and regulatory compliance issues, to address an applied science need effecting our ocean and coastal resources. Mr. Claridge joined Mote in 2019 and has 20 years of public sector experience with the Florida Department of Environmental Protection directing statewide coastal management, restoration, and resilience programs; managing state lands and conservation easements; administering Air, Waste, Water Facility, and Environmental Resource Regulatory Programs in Southeast Florida and leading large scale mine reclamation efforts in Central Florida.

Dr. Cathy J. Walsh, MML Senior Scientist and Program Manager, is the Quality Assurance Officer for Mote Marine Laboratory and will continue in this role for this project. Her administration and routine assessments ensure that stated goals regarding accuracy, precision, and completeness of all technical elements, as specified in MML's Quality Plan, are met. Outside of the actual project structure, she will report her findings and recommendations directly to the President of MML, Dr. Crosby.

Dr. Emily R. Hall, MML Senior Scientist and Program Manager, has been with MML for 20 years. She is the project manager of multiple water quality assessment projects at MML. She has expertise with research and monitoring of nutrients, carbonate chemistry, and other water quality parameters, especially in relation to coral reefs and harmful algal blooms. She currently leads the Ambient Water Quality Monitoring Program in Sarasota Bay (for Sarasota County), the Hydrobiological Monitoring Plan and the Continuous Water Quality Monitoring Programs (for the City of North Port), a water quality monitoring program throughout the upper and lower Florida Keys (for the EPA), and carbonate chemistry monitoring at Looe Key (for NOAA). Previous work includes research on nutrients in tidal creeks to develop Total Maximum Daily Loads, developing optical models for seagrasses, and studying source of nutrient pollution in estuarine systems using stable isotope techniques. She has participated in the sampling efforts of all projects she manages and her experience in data analysis facilitates evaluation of sampling design. She is responsible for obtaining and maintaining Florida Lab Certification under the National Environmental Lab Accreditation Conference (NELAC) guidelines.
Ms. Melissa Sante, MML Staff Chemist and Lab Manager, has a background in analytical chemistry. She coordinates all field sampling efforts within the Florida Keys related to water quality programs, including the ongoing South Florida EPA projects, the NOAA carbonate chemistry monitoring project at Looe Key, and the FWRI/MML Cooperative sampling for Florida Red Tide in the Florida Keys. She is responsible for all chain of custody, lab management, QA/QC, ordering, field sampling, and analyses. She has been trained in all FDEP field SOPs and MML QA Manual requirements.
Megan Gannon, MML Technician, is currently responsible for field sampling, chain of custody, following QA/QC requirements, analyses, and general lab upkeep in the Florida Keys. She has been trained in all FDEP field SOPs and MML QA Manual requirements.
Dr. Kirstie Francis, MML Postdoctoral Research Fellow in Molecular Microbiology, has a background in environmental sampling for HAB toxin extraction and eDNA analysis, microbial culture, and molecular (qPCR) assay optimization. During her graduate studies she optimized and executed a differential gene expression assay using qPCR to determine mechanism of action of anti-tumor compounds. In her current work, she focuses on culturing marine microorganisms from diverse ecosystems in pursuit of novel secondary metabolites produced by the microbial isolates with therapeutic or commercial potential. In the project proposed herein, she will aid in analysis of bacterial contaminant data and contribute to the development of a comprehensive water quality monitoring plan focused on identifying the source of fecal contamination.
Ms. Aspen Cook, MML Senior Environmental Specialist and BCRS Operations Supervisor, maintains MML's Beach Conditions Reporting System (BCRS), conducting research for mitigation strategies of Florida red tide, and assisting with intern research projects. She leads projects to expand Mote's volunteer and community science programs, increase community engagement in scientific research, and help communicate scientific information to the public.
Mr. Jon Perry, Environmental Science Associates (ESA) Principal Environmental Scientist, has over 30 years of experience collecting and analyzing the physical, chemical, and biological properties of aquatic systems throughout Florida. His areas of expertise include monitoring design, watershed assessment (status and trends), pollutant loading and hydrodynamic modeling, and geographic information system technology. He has regulatory experience with developing Minimum Flows and Levels, Total Maximum Daily Loads, Reasonable Assurance Plan development, and National Pollution Discharge Elimination Systems reporting. His principal responsibilities are focused on providing clients with technical analysis to aid decision making.
Mr. Richard Cleaver, Jacobs Project Manager, Technical Director, and Laboratory Manager (City of Key West Waste Water Treatment Plant), is responsible for overall management and leadership including profit and loss, permit compliance, safety, quality, and client relationship management. He provides leadership and management for all 32 employee functions. He is responsible for the planning, organization, operations, maintenance, and improvement of the facility. His laboratory expertise includes supervision of all lab and operation staff, obtaining and maintaining Florida Lab Certification under NELAC.
FL Department of Health (DOH), will be formal collaborators on this work.

There are an additional 30-35 fulltime staff at the Elizabeth Moore International Center for Coral Reef Research and Restoration facility in Summerland Key who will be available for sampling and shipping of analyses should the need arise. This Project Team will remain committed to the project until completion.

Project History of MML. The research programs involved with the proposed work at MML include the Chemical and Physical Ecology Program and the Ocean Acidification Research program. Within these programs, studies of marine and estuarine environments pertinent to the RFP include investigations of water and sediment quality, coral environmental requirements, receiving water studies of stormwater and sewage effluents, thermal impacts, physical processes, water management approaches, and trend analyses.

MML proposes to assess the current state of water quality knowledge, in partnership with the City of Key West, establish a water quality monitoring program, and provide public communication on these topics. The following section demonstrates MML's experience and expertise in: conducting water quality and biological sampling and monitoring; managing water quality data; ability to collect environmental samples in accordance with Florida Department of Environmental Services (FDEP) Standard operating procedures; deploying and collecting data; conducting surface water sampling; maintaining and calibrating field meters that measure dissolved oxygen, pH, temperature, specific conductance, and salinity; performing laboratory analysis (either by Consultant or subconsultant), including laboratory certifications and method detection limits; and familiarity with Florida Keys study areas,

The capabilities of MML to conduct the field collections and laboratory analyses are clearly evidenced by the fact that MML has been a contractor to other municipalities for >20 years. Key staff have training and experience in agency-approved field sampling techniques (especially Florida Department of Environmental Protection [FDEP]). Staff also have an extensive navigational knowledge of the Florida Keys and can efficiently sample within the allowed time windows without violating no wake or slow speed zones. MML's abilities in data management have been demonstrated by assisting local, state and federal institutions to incorporate water quality data from monitoring programs into the data repositories such as the Sarasota County Water Atlas and the DEP Watershed Information Network (WIN).

Water quality monitoring and deployment of *in situ* instrumentation comprise a large proportion of MML's aggregate experience. MML already owns and operates all equipment necessary for the proposed monitoring project and can continue the sampling with no interruptions. Pertinent resources include MML vehicles (available for trailering boats as needed) and a full complement of boats suitable for safely negotiating the wide variety of sampling conditions encountered, which range from extremely shallow to turbulent, deeper water, and foul-weather conditions. Field equipment owned includes electronic *in situ* water quality instrumentation and backup instruments (dissolved oxygen, pH, temperature, specific conductance, and salinity), GPS navigation systems, water sampling devices, computing resources, laboratory space, analytical capabilities, analytical certifications, and experience in the analysis of nutrients, inorganics, metals, organics, and organics.

NELAC Audit Results The Chemical and Physical Ecology Program at MML is certified by the Florida Department of Health (DOH), Bureau of Laboratories, under the Non-Potable Water - general chemistry categories (#E84091, **Appendix B**). Certification is recognized by the National Environmental Laboratory Accreditation Program Institution (TNI) and extends to all parameters requested under this RFP other than bacteria. The most recent external audit was completed in February 2025. Samples for bacteria analyses will be collected by MML staff and will be analyzed by a subconsultant (Jacobs) who are also certified by TNI under the Non-Potable Water – general chemistry and non-potable water - microbiology (#E55389, **Appendix B**) and who currently analyze bacteria samples for the Department of Health in the Florida Keys. As part of the certification process, MML and Jacobs participates in blind sample proficiency testing program twice a year. Results with DOH-approved sample providers have been 100% acceptable since the inception of TNI, and both laboratories recently received a "Certificate of Quality" for proficiency testing for 2024.

MML has a long history of commitment to quality assurance procedures and prepared the first QA Plan in the State of Florida to meet Environmental Protection Agency (EPA) guidelines and to obtain the then-Florida Department of Environmental Regulation approval. When sampling and analytical efforts do not have a specific project quality assurance plan, the laboratory conducts activities under an approved Quality Manual which details the quality assurance procedures followed in order to produce high quality data in conformance with Florida Administrative Code, Chapter 62-160 and the Florida Department of Environmental Protection's Standard Operating Procedures (https://floridadep.gov/dear/quality-assurance/content/dep-sops). All laboratory standard operating procedures are listed in detail in the MML Quality Manual (**Appendix C**), include details on method detection limits, and are available upon request. All subcontract standard operating procedures (that are NELAC certified) are also available upon request.

Detailed Facilities After its construction in 2017, Mote's Elizabeth Moore International Center for Coral Reef Research & Restoration (IC2R3) became the first U.S. Green Building Council LEED Gold Commercial certified building in Monroe County, honored for its outstanding, eco-friendly design and construction. IC2R3 includes 19,000 ft^2 of research, education, offices and dormitories, WiFi and convenient access to Lower Florida Keys coral reef sites and the CKW. The IC2R3 building is a category-5 hurricane resistant, precast concrete-based building. The eco-friendly design includes 30.1 kilowatt solar panels, rainwater capture system, and high-efficiency heating and cooling. Formerly named the Tropical Research Laboratory, IC2R3 is now home to a variety of current Mote programs with ongoing research at IC2R3, including: Coral Reef Restoration, Coral Health & Disease Research, Ecotoxicology, Marine & Freshwater Aquaculture Research, Ocean Acidification Research, and more.

MML maintains a fleet of 17 fully insured/equipped sampling vessels ranging in length from 14 ft. to 46 ft located throughout all campuses. All but one offshore vessel at MML are able to be trailered and moved throughout campuses. Several boats are modified for task-specific duties including water quality monitoring, instrument deployment, fishing, specimen collection, observation, SCUBA diving, and bottom sampling. Vessels to be used for this project are currently located in Summerland Key, FL, equipped with GPS, fathometers, and communications. MML operates 23 vehicles including 16 pick-up trucks equipped for towing and equipment transport. Four of those vehicles are permanently located in the Florida Keys.

MML has an extensive inventory of field and laboratory equipment. Mote staff routinely design, fabricate, test, and deploy instruments for sampling and measurement, including miniaturized, robotic, autonomous, or electronic apparatus for specialized applications. Mote also advises instrument manufacturers on product performance, conducts independent audits, and performs beta-tests for prototypic devices, such as next-generation multiparameter probes.

Technological capabilities employed by MML scientists include remote sensing; atmospheric and oceanographic samplers; flow-through, and grab samplers for water chemistry; *in-situ* bioassay exposure systems; analytical laboratories for inorganic and organic chemistry; and exposure laboratories. Scientific data analysis employs proprietary software, citation systems, and software supporting specific hardware. In addition, commercial software in use at Mote for statistical and related analyses includes ArcGIS, Biostat, EcoHab, MatLab, Primer, Python, R, SigmaPlot, SigmaStat, Statistica, Surfer, and Systat.

A full range of information systems support is available to MML staff, from infrastructure, installation and maintenance to helpdesk support. A wide range of information systems services are available at all Mote Marine Laboratory campuses and remote sites. Infrastructure and system planning, installation and support is provided by three full time staff. The LANs consist of mixed level 2 and 3 switched gigabit Ethernet networks providing IPv4 connectivity to over 750 desktops, laptops and other network capable devices. Internet service for the various campuses is primarily provided by AT&T, Xfinity and Frontier with a combined bandwidth of 200Mbps to 1Gbps per site depending on location and ISP availability. Mote is also an Internet2 affiliate, sponsored by USF, which allows 100Mbps of low latency bandwidth connectivity to other research and educational institutions as well as certain commercial peers via Florida LambdaRail. Internet and cloud services are primarily provided by Google, Amazon and Microsoft, with an additional 2PB of NAS and SAN storage hosted locally.

Safety Hazardous Waste Plan MML is a small quantity generator, generating no more than 1,000 kg of hazardous wastes or 1 kg of acutely hazardous wastes during a month and accumulating no more than 6,000 kg of hazardous wastes at any one time. MML has no wastes which are excluded by 40 CFR 261. A copy of Mote's Chemical Hygiene Plan and Laboratory Requirements is found in **Appendix D**.

Number of Analyses MML routinely analyses over 100,000 water samples/year.

3. References and Quality of Past Performance on Similar Projects

Other projects which illustrate MML's specific experience in water quality, in conducting extensive monitoring programs, or expertise in managing large data sets are described briefly below. The water quality and data analysis portions of these projects were all conducted by the same staff proposed for this RFP. These examples serve to illustrate MML's and project staff's wealth of experience in the region. We urge you to contact the listed references (**Table 1**) for their personal evaluation of our professionalism and the quality of data produced. We also have provided two letters of references as an attachment to this package. One is from Ms. Heather Bryen at Sarasota County and one is from Mr. Michael Drennan at the City of North Port.

Relevant Experience

Sarasota County Ambient Water Quality Monitoring Program: For the last 28 years, the Chemical and Physical Ecology Program at MML has conducted Sarasota County's ambient monitoring program from southern Sarasota Bay to Lemon Bay, and within the Myakka River. The current program continues until 2028. Data collection includes sampling of all stations within two hours of local noon. *In situ* physical measurements, light attenuation, and samples for a variety of nutrients, and demands are collected monthly from 40 stations. The project has also included deployment of continuous monitors to collect 24-hour records of physical parameters, capturing diurnal and tidal signals in dissolved oxygen, salinity, and temperature at selected locations. Datasets are processed in a manner that they can be uploaded to the Sarasota County Water Atlas and WIN. Dr. Emily R. Hall is the project manager, Ms. Susan Launay is the laboratory and data manager, and fieldwork is coordinated by Senior Chemist Camia Buehler.

Initiation date:	2000; Completion date: 2028
Contract Officer:	Ms. Heather Bryen
Contract Office:	Sarasota County Public Works-Stormwater

City of Northport Minimum Flows and Levels: Since 2004, samples have been collected in the Myakkahatchee Creek monthly in support of the minimum flows and levels determination by the Southwest Florida Water Management District, but otherwise similar to the Sarasota County ambient water quality monitoring. Samples are analyzed for orthophosphorus, total phosphorus, nitrate-nitrite-nitrogen, ammonium-nitrogen, total Kjeldahl nitrogen, chlorophyll *a*, turbidity, color, total suspended solids, BOD, and specific conductance. Datasets are processed in a manner that they can be uploaded to WIN. Dr. Emily R. Hall is the project manager, Ms. Susan Launay is the laboratory and data manager, and fieldwork is coordinated by Senior Chemist Camia Buehler.

Initiation date:	2007; Completion date: 2026 (will be renewed for 2025-2026)
Contract Officer:	Mr. Chad Nosbisch
Contract Office:	City of North Port

EPA South Florida Program: Florida Keys Water Quality and Climate Monitoring to inform Lower Keys Reef Restoration: Initiated in 2023, this program measures monthly water quality and carbonate chemistry parameters at 6 coral restoration sites in the Lower Keys (Looe Key, Newfound Harbor, Munson Reef, American Shoals, Marker 32, and Eastern Dry Rocks). Water samples are collected by MML staff from Summerland Key, FL and either processed (e.g. carbonate chemistry) or immediately shipped to MML in Sarasota, FL for water quality (e.g. nutrients) analyses. This data is integrated into effectiveness of restoration sites as well as comparisons of coral restoration sites to provide some value for restoration efforts and for overall coral research questions in this region. This dataset is providing a more spatially and temporally frequent dataset that has not previously been included with coral restoration sites in the lower Florida Keys. This project is managed concurrently with the Florida International University (co-PI Dr. Henry Briceno) by Dr. Emily R. Hall. Ms. Melissa Sante (Florida Keys) is the laboratory manager and field coordinator in the Florida Keys and Ms. Susan Launay is the laboratory and data manager (Sarasota).

Initiation date: 2023; Completion date: 2026
Contract Officer: Ms. Elizabeth Smith
Contract Office: EPA South Florida Region

EPA South Florida Program: Florida Keys Water Quality to inform Upper and Lower Keys Reef Restoration: Beginning September 2025, this program will measure monthly water quality and carbonate chemistry parameters at 12 coral restoration sites in the Lower Keys (Looe Key, Newfound Harbor, Munson Reef, American Shoals, Marker 32, and Eastern Dry Rocks). Water samples are collected by MML staff from Summerland Key, FL and either processed (e.g. carbonate chemistry) or immediately shipped to MML in Sarasota, FL for water quality (e.g. nutrients) analyses. This data is integrated into effectiveness of restoration sites as well as comparisons of coral restoration sites to provide some value for restoration efforts and for overall coral research questions in this region. This dataset is providing a more spatially and temporally frequent dataset that has not previously been included with coral restoration sites in the lower Florida Keys. This project is managed concurrently with the Florida International University (co-PI Dr. Henry Briceno) by Dr. Emily R. Hall. Ms. Melissa Sante (Florida Keys) is the laboratory manager and field coordinator in the Florida Keys and Ms. Susan Launay is the laboratory and data manager (Sarasota).

Initiation date: 2025; Completion date: 2028
Contract Officer: Ms. Elizabeth Smith
Contract Office: EPA South Florida Region

FWRI/MML Red Tide Cooperative Program: This >20-year project is a cooperative effort between MML and the Florida Fish and Wildlife Conservation Commission, Fish and Wildlife Research Institute to determine and quantify the multiple factors that contribute to the initiation, maintenance and termination of harmful algal blooms, specifically Florida red tide (*Karenia brevis*) along the Florida Gulf coast (and includes within the Florida Keys). Samples are collected approximately monthly and during event responses, physical parameters are measured, and samples are analyzed for inorganic and total nutrients and chlorophyll. This project is managed by Dr. Emily R. Hall.

Initiation date: 2001; Completion date: 2025 (will be renewed for 2025-2028)
Contract Officer: Dr. Katherine Hubbard
Contract Office: Fish and Wildlife Research Institute

PCMHAB Florida Red Tide Mitigation: This is a multi-institutional project with the overall purpose to assess the effectiveness, environmental acceptability, costs, and scalability of clay dispersal as a *K. brevis* bloom control strategy. Goals include assessing the effects of dissolved organic matter on flocculation and modify clay chemistry as necessary to improve flocculation in natural waters, assessing the effectiveness and environmental impacts of clay flocculation in laboratory and mesocosm studies, conducting field trials using a tiered approach at increasing spatial scales and across different ecosystems, and assessing the overall effectiveness, feasibility, impacts, scalability, and acceptability of clay as a *Karenia* bloom control strategy. Dr. Emily R. Hall is the project manager for the MML team (overall project is led by Dr. Donald Anderson at Woods Hole Oceanographic Institute).

Initiation date: 2020; Completion date: 2026
Contract Officer: Dr. Felix Martinez
Contract Office: NOAA PCMHAB

Table 1. Client references and telephone numbers for MML.

Dr. Jorge Brenner	Executive Director GCOOS Texas A&M University, Dept. of Oceanography 3126 TAMU, College Station, TX 77843 361-696-1776 jorge.brenner@gcoos.org
Ms. Heather Bryen	Environmental Specialist III Sarasota County Public Works-Stormwater 1001 Sarasota Center Blvd., Sarasota, FL 34240 941-538-1462, hbryen@scgov.net
Mr. Michael G. Drennan	Water Plant Superintendent City of North Port 5655 North Port Blvd, North Port, Fl. 34287 941-445-7049, mdrennan@northportfl.gov
Ms. Debra Hernandez	Executive Director SECOORA P.O. Box 13856, Charleston, SC 29422 843-906-8686, debra@secoora.org
Dr. Katherine Hubbard	Director, FWC Center for Red Tide Research Harmful Algal Bloom Monitoring and Research Florida Fish and Wildlife Conservation Commission-Fish and Wildlife Research Institute (FWC-FWRI) 100 Eighth Avenue SE, St. Petersburg, FL 33701 (727)502-4961, katherine.hubbard@myfwc.com
Mr. Chad Nosbisch	Chief Operator City of North Port 5655 North Port Blvd, North Port, FL 34287 941-240-8009, cnosbisch@northportfl.gov
Ms. Elizabeth Smith	South Florida Program Coordinator Ocean & Estuarine Management Section U.S. EPA | Region 4 404-562-8721, smith.elizabeth@epa.gov
Dr. Felix Martinez	Program Manager NOS/NCCOS/Competitive Research Program National Oceanic and Atmospheric Administration 4840 South State Rd.; Ann Arbor, MI 48108 734-741-2254, Felix.Martinez@NOAA.gov

Sarasota County

Public Works

1001 Sarasota Center Blvd.
Sarasota, FL 34240

phone: 941-861-5000
scgov.net

Sarasota County has had a close partnership with Mote Marine Laboratory Inc. since 1998. We rely heavily on this entity for sampling and laboratory analysis every month for Sarasota County's eight bay segments for 40 sampling locations. Our Bay Ambient Sampling program fulfills the State of Florida Department of Environmental Protection NPDES and MS4 permit requirements for nutrient monitoring.

Sarasota is pleased to continue working with Mote's team due to their expertise, competence, consistency, and hard work. They handle our sampling and laboratory needs from start to finish. Mote takes care of all stages of coordinating three sampling crews that handle: all field meter calibrations and verifications, providing and maintaining necessary marine vessels, consistently providing field quality assurance measures, providing accurate field readings and environmental observations at every station, as well as water quality sample collection according to FDEP Standard Operating Methods. The County adheres to a rigorous parameter regime encompassing inorganic nitrogen, organic nitrogen, orthophosphate, total phosphate, chlorophyll a, color, and biochemical oxygen demand. The laboratory analysis is conducted in accordance with EPA and Standard Methods protocols along with numerous quality assurance procedures. Mote's analytical and management team submits monthly water quality to FDEP on the County's behalf. This final task involves all quality assurance of field and laboratory data, maintaining a water quality Laboratory Information Management System, preparing all final electronic deliverables, and interacting with FDEP for any data queries. The Sarasota County budget for calendar year 2025 for Mote Marine Laboratory Inc.'s suite of services is $193,944.00

I am pleased to provide this letter at Mote Marine and Emily Hall's request.

Heather Bryen

Heather Bryen
Public Works – Stormwater
Water Quality Specialist – Environmental Specialist III
hbryen@scgov.net
941-538-1462

NorthPort
FLORIDA

April 1, 2025

Dr. Emily R. Hall
Mote Marine Laboratory
1600 Ken Thompson Parkway
Sarasota, FL 34236

Dear Dr. Hall and review committee,

I am writing on behalf of the City of North Port Utilities Department. We have worked with Mote Marine Laboratory (Mote) since 2004 on three separate, but related, projects: North Port Hydrobiological Monitoring Plan, North Port Continuous Monitoring, and North Port Triennial Reporting. The City of North Port is operating under a Southwest Florida Water Management District Individual Water Use Permit No. 20 002923.015 (dated April 8, 2011). As part of this permit, Special Condition 17 requires monthly sample and data collection under a defined Hydrobiological Monitoring Plan (HBMP) as submitted to the District on June 13, 2006. Changes to the existing HBMP may be proposed but may require modification of the Water Use Permit. The HBMP effort is a recurring work element of the Utilities Department and is being performed by Mote in conjunction with Utilities staff. On a triennial basis, the District also requires a data summary and interpretation to evaluate if withdrawals by the City have caused, or will cause, adverse impacts to the ecology of the river and/or its estuary (as defined by District Rule and associated Performance Standards). The last of these reports was prepared by Mote and submitted in 2024. The upcoming report is due April 1, 2027 and provision for this report will be included in the FY 2026-2027 budget together with the ongoing monthly monitoring effort.

The City of North Port is happy to continue collaborating with Mote's team, recognizing their expertise, professionalism, reliability, and dedication. Mote handles all field meter (discrete and in situ) calibrations and verifications, marine vessels, field quality assurance, and water quality sample collection according to FDEP Standard Operating Methods. Mote conducts all laboratory analyses in accordance with EPA and Standard Methods protocols and follows all quality assurance/quality control protocols, as required by the NELAC Institute. I am pleased to provide this letter at Dr. Emily Hall's request. The 2024-2025 budget is $105,122. Please do not hesitate to reach out if you have any questions.

Michael G Drennan Jr
Digitally signed by Michael G Drennan Jr
Date: 2025.04.08 12:21:35 -04'00'

Michael Drennan
Water Plant Superintendent
5655 N Port Blvd. North Port Fl. 34287
mdrennan@northportfl.gov
941-445-7049

4. Project Approach. Water quality is of great importance to the City of Key West (CKW) because a healthy marine ecosystem supports not only the local economy, but also major environmental and aesthetical quality of life factors for residents and visitors. Therefore, the CKW has requested proposals to develop a rigorous, science-based water quality monitoring program that will provide actionable information on priority water quality issues (based on appropriate and effective scientific methods in accordance with local, state and federal regulations and best practices) within the targeted waterways of the CKW. The data derived from this monitoring program will be used to develop policies, programs, and practices to improve water quality.

The Impaired Waters Rule (IWR), Chapter 62-303, Florida Administrative Code (Identification of Impaired Surface Waters), establishes a formal mechanism for identifying surface waters in Florida that are impaired by pollutants. The 1998 Clean Water Act 303(d) Impaired Waters List listed "the Florida Keys" as impaired for nutrients (with some regions also impaired for dissolved oxygen). A Florida Keys Reasonable Assurance Plan (FKRAP) was developed by the Florida Department of Environmental Protection (FDEP) in cooperation with local governments (including the CKW), state agencies and federal agencies within the Florida Keys to address the impairments. The FKRAP was approved by the US EPA regulations and section 403.067, Florida Statutes and is listed on the 303(d) Clean Water Act list of impaired waters until all water quality standards are reached and maintained. The FKRAP is comprised of 23 estuarine waterbody assessment units identified by a water body identification (WBID) within the Halo Zone water, two of which are in the CKW (1N and 1S). As of 2022, the CKW WBIDs were listed in category 4b for total nitrogen (TN) and total phosphorus (TP) although recent evaluations show that those WBIDs are currently (as of 2023) meeting standards for TN and TP.

The CKW has completed or is in the progress of completing multiple water quality restoration projects to meet the FDEP standards. It is imperative to continue monitoring these WBIDs to assess the long-term results and functionality of these restoration activities. However, if monitoring is not conducted at appropriate spatial and/or frequency scale (at minimum once a month), short-term or localized impacts could be missed. Even if no longer listed, CKW must remain in compliance per Chapter 62-302.530(47)(b) – "in no case shall nutrient concentrations of a water body be altered so as to cause an imbalance of natural populations of flora and fauna." Water quality throughout the Florida Keys (including Key West) is currently monitored by the Water Quality Protection Program (WQPP), managed by the Florida Keys National Marine Sanctuary (FKNMS), which aims to maintain water quality targets set by the Environmental Protection Agency (EPA) in nearshore and coastal sites. This monitoring program includes over 100 stations from Biscayne Bay to the Dry Tortugas, has been sampled quarterly over the past 30 years, and provides a holistic view of water quality trends in the Florida Keys. There are other monitoring programs within the CKW geographic areas of concern (e.g. with funding provided by EPA (#02D43323). Water quality is being monitored monthly at 6 coral restoration sites in the lower keys by Mote Marine Laboratory (MML); other university projects, and other entities within the CKW, but these need to be evaluated to determine spatial gaps and other concerns. The WQPP is all-encompassing for the larger water quality picture throughout the Florida Keys yet <u>it doesn't include fine spatial and temporal changes at specific sites near and within the CKW</u>. Many agencies have discussed the need for more frequent sampling to determine as real-time effects as possible, and other municipalities throughout Florida have already embraced more frequent sampling/monitoring (e.g. Sarasota County). More frequent water quality monitoring is crucial for identifying and addressing emerging problems, determining compliance with regulations, and ensuring water safety for human and environmental health. It helps track changes in water quality over time, provide more information for source of pollution, and enables proactive measures to protect water resources.

The proposed MML Project Team (led by MML and composed of MML scientist with MML subcontractors from Environmental Science Associates [ESA] and Jacobs, Inc. [Jacobs]) acknowledge that the scope of work provided in the RFP represents the general requirements and objectives for the project but does not constitute an exhaustive list of all tasks, services, or deliverables that may be required to appropriately address the CKW water quality priorities. The MML Project Team will be responsible for conducting a thorough review of the project's needs and has the expertise and experience to provide all necessary services and support to fulfill the project's goals, even if not explicitly mentioned in the scope. Any additional work, tasks, or services required to complete the project in full compliance with the objectives, industry standards, and applicable regulations shall be deemed the responsibility of the MML Project Team and will be provided at no additional cost, unless otherwise agreed upon in writing by both parties.

Proposed Activity Schedule. Proposed activity schedules are presented in **Table 2** and **3**.

Table 2. Activity schedule for Year 1

Task	**Description**	**Month**											
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Task 1	Review summarize and present data across GOCs.	x	x	x									
Task 2	Identify and present mitigation actions				x	x	x	x					
Task 3	Design and present a water quality monitoring program							x	x	x	x	x	
Task 4	Bacteria monitoring at 6 beaches (weekly)	x	x	x	x	x	x	x	x	x	x	x	x
Task 5	Increase community knowledge on beaches (BCRS)		x	x	x	x	x	x	x	x	x	x	x
Task 6	Design new beach water quality monitoring program								x	x	x	x	x

Table 3. Proposed activity schedule for years 2-5 (depending on results from year 1).

Years	**Description**	**Month (frequency tbd in year 1)**											
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Years 2-5	Implement new water quality sampling program for nutrients and other contaminants at GOCs (established in year 1)	x	x	x	x	x	x	x	x	x	x	x	x
Years 2-5	Weekly samples of bacteria analyses in collaboration with DOH (established in year 1)	x	x	x	x	x	x	x	x	x	x	x	x
Years 2-5	Data uploads to WIN	x	x	x	x	x	x	x	x	x	x	x	x
Years 2-5	Presentations to WQIPP and CKW Commissioners quarterly (timeline tbd in year 1)	x			x			x			x		
Years 2-5	BCRS community reporting continued use	x	x	x	x	x	x	x	x	x	x	x	x
Years 2-5	Implement new beach bacteria source monitoring program	x	x	x	x	x	x	x	x	x	x	x	x

<u>OPERATIONS PLAN</u>:

Task 1. The MML Project Team will identify and obtain all existing water quality data including, but not limited to nutrients, chlorophyll-a, in situ parameters (dissolved oxygen, salinity, temperature, and light extinction coefficients) and fecal indicator bacteria parameters across several key geographic areas of concern (GOCs) within the CKW waterways, including but not limited to: Key West Harbor & Outer Harbor; popular recreational areas such as beaches and docks; Florida Keys National Marine Sanctuary (FKNMS); waters within the sanctuary boundaries; Stock Island Channel; and Swimming Beaches. The primary source will be the Florida Department of Environmental Protection's (DEP) Impaired Waters Rule database. Additional data will be identified from the DEP Watershed Information Network (WIN), the Environmental Protection Agency's Water Quality Exchange (WQX), and other data generators, e.g., university and researchers working in the region. The data will be reviewed for quality prior to inclusion before further analysis. Ancillary data, such as rainfall data will also be obtained to determine if any water quality trends identified can be attributed to these phenomena. Following development of the water quality database the next step will entail an assessment of temporal and spatial trends in the data collected. The primary analytical tool to investigate the temporal trends will be the Seasonal Kendall-Tau trend test. Spatial trends will be achieved primarily using GIS techniques.

The MML Project Team will also ascertain compliance with the current applicable state and federal criteria. The targets of primary concern are nutrients, chlorophyll-a, dissolved oxygen, and fecal indicator bacteria. We will also attempt to analyze compliance with the applicable water quality targets listed in the Florida Keys Reasonable Assurance Plan. The results of this task will be presented to the City Commission to develop a prioritized list of pollutants and Geographic Areas of Concern.

Task 2. Based on the results of the Task 1 assessment, the MML Project Team will identify mitigation strategies to address any deficiencies identified. Due to many confounding factors, such as the lack of available space and geomorphic conditions, there are not many viable locations within the watershed to implement the typical stormwater BMPs such as stormwater retention systems. In these cases, the MML Project Team will look for methods that reduce pollutants, while not restricting stormwater flow, that have a small footprint. Low Impact Development (LID) is an alternative that may be a viable alternative. LID systems generally work by reducing the volume of runoff at the source through facilities that hold water back and allow it to "soak" into the ground. These can take many forms such as rain gardens, vegetated swales, rainwater water harvesting (rain barrels). Many of these techniques can be combined with others in what are called "treatment trains" to multiply the load reductions.

Task 3. After completion of Tasks 1 and 2, including presentation to the CKW Commissioners, the MML Project Team will evaluate and develop a comprehensive water quality program for the CKW. The MML Project Team will utilize the Prioritized List by GOCs developed as part of Task 1 to develop a comprehensive water quality monitoring plan that will be proposed for years 2-5. It will include, at minimum the GOCs (unless determined unnecessary by Tasks 1 and 2). The plan will look to maximize the existing information and will allow the City to track improving/degrading trends in those parameters and communicate those results to its citizens. The monitoring plan will likely include the use of *in situ* techniques as well as laboratory analysis. All sampling will be aligned with the procedures outlined in FDEP's Standard Operating Procedures for Field Activities (DEP_SOP-001/01, Effective 04/16/2018) and all laboratory analyses will be conducted by a NELAC certified laboratory where necessary. To ensure these quality measures are adhered to, a comprehensive quality assurance plan will be developed and agreed upon by all parties associated with the monitoring prior to the start. Once approved by the CKW, this project will begin implementation.

Task 4. The MML Project Team will sample weekly for general water quality (salinity, temperature, dissolved oxygen and pH) and bacteria (*Enteroccocus*) on 6 CKW beaches including: 1. Smathers Beach, 2. Rest Beach, 3. Higgs Beach, 4. Fort Zachary Taylor State Park Beach, 5. South Beach, and 6. Dog Beach, and the mooring field (7 total stations), at the start of this contract. Sampling and analyses will follow current FDOH methods and will commence upon approval of this work.

Sampling activities will be conducted in accordance with Florida Administrative Code 62-160, Quality Assurance Rule (including revisions), and the Florida Department of Environmental Protection's Standard Operating Procedures (SOPs), each with an effective date of April 16, 2018. See: (https://floridadep.gov/dear/water-quality-standards-program/content/revisions-chapter-62-160-fac-quality-assurance-and-dep; https://floridadep.gov/dear/quality-assurance/content/dep-sops). Please note that field entities submitting data to FDEP are required to use the new SOPs, unless otherwise specified in a permit, contract, or consent order. If the scope of the CKW RFP substantively differs from FDEP SOP's, these instances will be identified. The following section only identifies highlights of some of these procedures and is not intended to be all-inclusive.

Logistic Planning/Mobilization. Prior to each sampling, station locations and probable conditions, speed zones, and allowed time windows will be compiled to determine the most effective sampling strategy consistent with sampling all stations within one day. Instruments, both primary and backup, will be calibrated at the lab (MML). Check lists of boat, sampling gear, and backup instruments (both *in situ* and navigation) will be used to minimize down time while in the field. Pre-cleaned sample containers will be pre-labeled with unique ID numbers and assembled into kits to be used at each station. Preservatives to be used in the field will be prepared and documented. Cleaning and kit preparation will be documented in accordance with FDEP SOPs and the MML Quality Assurance Plan.

Instrument Calibrations. Bench calibrations will be performed before and after each sampling event on all parameter subsections of the *in-situ* instrumentation. Parameters which have electronic adjustments possible will be calibrated to read the correct values of known standards; KCl solutions for specific conductance and salinity, two buffers for pH, and 100% saturation in air for dissolved oxygen (DO). Temperature values have no adjustment possible but are confirmed at two points.

Field calibrations will be performed at the beginning and at the end of each day's fieldwork. For pH, and conductivity, standards are measured and required to fall within specified limits. DO calibration is checked as % saturation of air readings at each station. Salinity data are calculated from conductance values and temperature has been demonstrated to be extremely stable, and so these parameters are not field calibrated. Bench calibrations of instruments will be repeated at the end of sampling for final calibration verification.

Station Identification. Each month's station locations have been selected prior to fieldwork and are loaded into the primary GPS units and back-up GPS handheld units. Field crews will also have a mapped representation of the stations to be sampled. Crews will navigate to the station locations, approaching as closely as possible given tidal conditions and water depths. Stations that have been selected to be mid-channel in congested area may have to be moved to the side of the channel for safety. The sampling location recorded will be the latitude and longitude readout of the primary GPS unit.

Grab Sample Collection. All field sampling will be completed according to Chapter 62-160, F.A.C., and the DEP standard operating procedures (SOPs) for QA/QC required therein. Subsurface samples for bacteria will be collected by hand between 1-2 feet below the surface using 300 ml sterile whirlpaks that are opened and closed underwater to prevent contamination. Samples will be placed on ice for transport to the Jacobs Lab. Staff from MML will sample the 6 beach locations and 1 mooring field location once/week (excluding the weeks that FDOH samples are already collected). Samples for the 2 beaches that are not covered by FDOH will also be collected on weeks that FDOH collects. FDOH and the MML Project Team will communicate frequently to ensure collaborative efforts. All samples will be collected according to FDEP Standard Operating Procedures (https://floridadep.gov/dear/quality-assurance/content/dep-sops). Samples will be returned immediately (within 6 hours) to the Jacobs Lab for analysis. Weekly samples from each of the 6 beaches will be collected in one day. Subsurface samples for other water quality (determined after Tasks 1-3 are completed and planned for years 2-5) will be collected using a Niskin sampler rigged horizontally to collect discrete depths within +/- 0.1 m. Niskin samples will be collected at 1.0 m below the surface or at mid-depth (whichever is shallower).

All bacteria sampling will be completed on a single day and will be on a Monday through Thursday schedule (excluding federal holidays). No samples will be collected on a Friday. Sampling schedule for proposed water quality monitoring (after Tasks 1-3 are complete) will be determined at a later date.

In Situ Data Profiles. Physical data (temperature, specific conductance, salinity, pH, dissolved oxygen [DO] and % saturation of DO) will be measured with multiparameter instrumentation (Hydrolab, YSI, or equivalent) at each station. Instruments will be bench calibrated with known standards both before and after each sampling day and are also subject to field calibrations. Backup instrumentation typically accompanies all sampling crews to prevent any data losses due to instrument malfunction.

When probes are lowered to the proper depth (based on cable markings) and a stable reading obtained, data will be electronically stored for later download. Data will also be recorded manually on the field data sheet as a backup. Electronic data will be incorporated in the final data deliverable, but anomalous readings can be confirmed with the field data hard copy. Raw electronic files will be archived as are the hard copies of field data sheets.

Field Data Records. We will record field data on log sheets specifically designed for the project. Field data forms proposed include the identification of specific field instruments and results of field calibrations of *in situ* instrumentation for specific conductance, pH, and DO, and any other information generic to the sampling crew and date. Station forms record all station-specific information (see FAC 62-160.240). Forms will be produced on waterproof paper and bound for all field work. The proposed forms, together with custody sheets incorporate all the data elements required by FDEP and the CKW.

Sample Custody. Sample chain of custody will be documented from time of collection until receipt at the laboratory and storage in a secure area. Field activities on samples, preservatives and preservation checks will be recorded on custody sheets as well. Custody of samples will be transferred as a group for all samples collected by the MML Project Team, including field and temperature blanks.

Bacteria Analysis. Analysis of Enterococci will be completed by the MML Project Team subcontractor Jacobs Lab and will follow FDOH methods under NELAC certificate #E55389-24 (method ENTEROLERT/QUANTI-TRAY; same methods for samples already collected by the FDOH).

Task 5. The MML Project Team will develop and integrate all FDOH bacteria monitoring data into the Beach Conditions Reporting System (BCRS; visitbeaches.org) to lead to a better understanding of public health effects due to natural and anthropogenic impacts and communicate bacteria-related health risk to the public. These efforts will provide information to the public by providing, near real-time beach information to ensure healthy and happy beach experiences. Year 1 will include implementation of technical plans for web development and design for integration of bacteria data sharing, volunteer outreach and public education, and expansion of BCRS reporting locations in Key West. This will include implementation of technical plans to display bacteria data on the BCRS, including web development, design, and data sharing capabilities by Mote staff and subcontracted wed/app development team and conducting volunteer and public outreach to expand BCRS reporting in Key West. This will continue through years 2-5, if selected.

Task 6. The MML Project Team will develop a new beach water quality monitoring program specific to bacteria. We will coordinate with stakeholders to guide expansion of existing nowcasting and forecasting tools, in support of environmental health, economic vitality, and public health. The comprehensive bacterial monitoring plan will be designed to include Microbial Source Tracking (MST) methods, a non-culture-based approach in which DNA is extracted directly from the water at a site, and PCR primers are used for the amplification and detection of species-specific markers of fecal contamination. Primers have been identified which differentiate between human (HF183/BacR287), avian (Gull2), cow (CowM2 and CowM3), dog (DG3 and DG37), etc. sources of fecal contamination. While these methods have traditionally been used to answer research questions rather than regulatory or public health applications, the US EPA released a standard protocol for the detection of human waste marker HF183 in water samples in 2019. Integrating MST into the new water quality monitoring plan would identify fecal contamination source and serve to place the CKW on the forefront of cutting-edge monitoring strategies.

Organization and Coordination of Field Staff and Support Staff

PI Emily R. Hall, Ph.D. (Senior Scientist and Program Manager, MML) will be responsible for overall project management, data interpretation, meetings with the CKW, presentations to the CKW Commissioners and WQIPP, and report writing. She will be responsible for communicating directly with the funding agency.

Co-PI Kevin Claridge (Vice President for Sponsored Programs & Coastal Policy, MML) will play a significant role in Tasks 1 &2 and provide oversight for Task 4.

Co-PI Kirstie Francis, Ph.D. (Postdoctoral Associate, MML) will be responsible for assistance with interpretation of bacteria data and development of Task 6.

Co-PI Aspen Cook (Staff Biologist, MML) will be responsible for all aspects of Task 4, including development and maintenance of the BCRS Program for the CKW.

MML Field and Support Staff: Melissa Sante (Lab Manager and Staff Chemist, MML), located in Summerland Key, FL will be responsible for all field work, sample collection, sample shipment/delivery, field log processing, field instrument processing, and data upload to WIN. She will dedicate 2.9-month time to this project. Megan Gannon (Technician, MML), located in Summerland Key, FL, will be responsible for all field work, sample collection, sample shipment/delivery. She will dedicate 2.4-month time to this project. All field analyses will be completed by 2 staff members each time. If injuries or illness prevents either of these staff members from participating, other staff within MML in the Florida Keys will be made available for field sampling and sample shipping/delivery.

MML Project Team Subcontractors: Jon Perry (Principle Environmental Scientist, ESA) will play a significant role for historical data collation, analysis and interpretation, and water quality program planning. Richard Cleaver (Jacobs) will play a significant role for all bacteria analyses.

Scheduling Activities. An initial sampling schedule will be submitted by the MML Project Team to the CKW (see **Table 2**). This schedule will occur Monday through Thursday excluding any federal holidays. All tasks for each station will be completed on the same day as a group. If there are any deviations from the schedule (e.g. high water, weather, equipment failure, etc.), the CKW will be informed immediately and the samples will be collected the next available day within a week.

Field data entry, QA, and correction procedures. Quality Assurance/Quality Control (QA/QC) Methods. MML has a long history of commitment to quality assurance procedures and prepared the first QA Plan in the State of Florida to meet EPA guidelines and to obtain the then-Florida Department of Environmental Regulation approval. When sampling and analytical efforts do not have a specific project quality assurance plan, MML conducts activities under an approved Quality Plan which details the quality assurance procedures followed to produce high quality data in conformance with Florida Administrative Code, Chapter 62-160 and the Florida Department of Environmental Protection's Standard Operating Procedures. The MML Project Team is familiar with standard sample submission requirements. All requirements have been discussed with FDOH and the current FDOH contract lab who are a part of the MML Project Team. The MML Project Team will be responsible for entering and verifying field data. When probes are lowered to the proper depth (based on cable markings) and a stable reading obtained, data will be electronically stored immediately for later download. Data will also be immediately recorded manually on the field data sheet as a backup. Electronic data will be downloaded within 48 hours and incorporated in the final data deliverable, but anomalous readings will be able to be confirmed with the field data hard copy. Raw electronic files will be archived as are the hard copies of field data sheets. A copy of the field sheets will be provided to the subcontract lab with the samples. All data will be, at minimum, uploaded to WIN, BCRS, and other parties as requested by the CKW.

<u>QA/QC Methods</u>: All field and laboratory procedures are controlled by MML's Quality Manual (**Appendix C**), which meets NELAC standards, Chapter 5, Quality Systems. From sample receipt to data reporting, required activities are clearly documented. Specific quality assurance activities pertinent to analyses include: collection of replicate samples for chemical analyses; precision criteria applied to duplicate samples; maintenance of sample chain-of-custody from collection until receipt at MML and storage in a secure area; matrix/method compatibility check of at least 5 percent of all samples (spiked samples); analysis of field, container and preservative blanks; accuracy criteria applied to spiked samples or standards; adherence to EPA, FDEP parameter-specific holding times and preservation methods; replicate test and/or supervisor approval of all anomalous results or reports; documentation of all reagent preparation; validation of all data; routine calibration of all analytical instrumentation; rechecking of 100% of all manual data transfers; initial, continuing and final calibration standards (ICV, CCV, FCV); specifications for data reduction and analysis, and for the presentation and evaluation of results; accepted or verified analytical methodologies as standard operating procedure; external audits; duplicate analyses of at least 10% of water quality samples processed in the laboratory; and participation in semi-annual studies of Proficiency Testing.

The MML Project Team strives for the highest level of performance in both the field and the lab, however, plans are in place to minimize errors. Some examples (an all-inclusive description of error minimization is provided in the MML QA Manual) include:

- Custody documentation is completed in permanent, waterproof ink with any errors corrected according to standard laboratory practice of a single line drawn through the error and initialed by the corrector.
- Any anomalies, transcriptional or transpositional errors are noted on the custody sheet and tentatively rectified by the Sample Custodian and finalized after review of the field log and consultation with the crew leader who collected the sample in question. For all errors other than transcription errors, an explanation for the correction is also included.
- MML takes all error factors into account in developing environmental test methods and procedures, in training and qualification of personnel, and in selection and calibration of equipment.
- If an error is found in data or reporting, corrective actions are initiated. Procedures are described in the MML Quality Manual.

Project Management. MML has an extensive inventory of field and laboratory equipment at our International Center for Coral Reef Research & Restoration in Summerland Key as well as our other 4 sites in the Florida Keys that can be augmented if ever needed by Sarasota facilities. MML staff routinely design, fabricate, test, and deploy instruments for sampling and measurement, including miniaturized, robotic, autonomous, or electronic apparatus for specialized applications. MML also advises instrument manufacturers on product performance, conducts independent audits, and performs beta-tests for prototypic devices, such as next-generation multiparameter probes.

Technological capabilities employed by MML scientists include a fleet of surface vessels and submarine platforms; atmospheric and oceanographic samplers and measurement systems; laser-based sediment particle sizers; through-hull, flow-through, and grab samplers for water chemistry; in-situ bioassay exposure systems; fully-instrumented analytical laboratories for inorganic and organic chemistry (including support equipment such as filtration apparatuses, deionized water systems, carbon-free water systems, pumps, hoses, tubing, chemicals [certified standards, gasses, solvents, etc.]); exposure laboratories; chemical clean-rooms; and other equipment such as scuba gear, portable generator, hoses, pumps, artificial substrate samplers, dip nets, microscopes, and stocks of calibration standards and other required chemicals. Scientific data analysis employs proprietary software, citation systems, and software supporting specific hardware. In addition, commercial software in use at MML for statistical and related analyses includes Biostat, EcoHab, EcoSim, IDL, MathCad, MatLab, Microsoft applications, Paradox, Primer, SigmaPlot, SigmaStat, Statistica, Surfer, and Systat. If any equipment were to fail, MML has backups for all equipment. MML routinely brings backup coolers, multiparameter meters, GPS, scuba gear, etc. to all field studies and MML has the ability to purchase emergency equipment as needed.

All equipment required for this work is owned by MML, except for bacteria analyses (owned by Jacobs).

<u>MML Project Team NELAC:</u> Both participating labs are NELAC accredited as described in Tab 2.

<u>Laboratory Analysis</u>: NELAC certificates for both labs in this MML Project Team are included in **Appendix B**. Standard Operating Procedures for all laboratory procedures will also be made available upon selection of this contract. Current MDL for *Enteroccocus* is 10MPN/100ml and matches current MDLs with the FDOH. MDLs for other water quality parameters (e.g. nutrients, chlorophyll, etc.) that may be selected for years 2-5 are presented in the MML QA Manual.

<u>Subcontractor Documentation</u>: All subcontractor forms are presented in **Appendix E**.

5. Other Information / Value Added Options / Contract Deviations / Other Clients/ Local Familiarity

Since 1955, MML has been a leader in marine science, research, restoration, and education. Our coral reef science and restoration operations in the Florida Keys have been the center of media attention for many years already and now that large scale coral reef restoration is a reality, our marketing department and community relations team are constantly promoting this story to media outlets, websites, magazines and cable networks. Additionally, our facilities in Summerland Key and Islamorada serve as centers for coral restoration, water quality monitoring, and tourism and outreach capabilities for the reefs in the upper, middle and lower keys.

The Project Team has a long history of working within the CKW and throughout the Florida Keys. MML has several current projects in the region including a coral reef restoration project in the CKW and a water quality monitoring project in the upper and lower Florida Keys. Other clients throughout the Florida Keys include The Nature Conservancy, the Smithsonian, South Florida Environmental Protection Agency, and the Southeast Coastal and Ocean Observation Research Association (SECOORA).

The Elizabeth Moore International Center for Coral Reef Research and Restoration (IC2R3) is located 24 miles from the CKW. Staff who will be responsible for the proposed sampling and analyses are permanently located at this facility. Dr. Hall will be providing 1-month salary, fringe and IDC as in-kind to the proposed work (valued at >$20,000).

MML currently has a contract with the CKW to outplant over 1,000 corals to restore nearly 100 m^2 of a targeted coral reef to ~30% coral cover in CKW waters. MML also has other projects with municipalities (e.g. Sarasota County, the City of North Port), state (Florida Fish and Wildlife, FWC), and federal agencies (NOAA, EPA) to monitor water quality. These projects also require MML to follow FDEP field SOPs and have the data analyzed by a NELAC laboratory or follow a Quality Assurance Project Plan. Some of these projects are described in Tab 3 (References and Examples).

6. Cost Effectiveness
Total requested cost (Year 1) - $104,998
<u>Year 1:</u>
Task 1 - $20,905 total requested

Salary – $2,231 is requested for 1-week salary for Dr. Hall's time to manage, data assessment, report writing and presentation to the CKW *(Another week of Dr. Hall's salary and fringe will be provided as in kind - $3,008)*

Fringe – $777 is requested for fringe. At MML, fringe benefits are currently 34.81% of salary. Rates used incorporate FICA, health insurance, Worker's Compensation, state unemployment insurance, pension plan, vacation, sick, and holidays.

IDC – No IDC is requested from MML *(MML IDC is waived)*

Travel – $1,059 is requested for travel. Federal per diem lodging rates for the CKW currently range from $258-456 (depending on month of travel). Meals and incidentals are $86 per day, and $64.50 for first and last day of travel. Travel is requested for Dr. Hall to travel to present results to the CKW. This includes roundtrip flight to Key West (estimated at $200), and 2 nights at a local hotel. (*note – any other required travel for Dr. Hall will be provided as in-kind*)

Subcontract - $16,838 is requested for subcontract ESA for compilation - $5,088, trends – $2,830, assessment - $2,204, report writing - $2,987, and meetings - $3,729

Task 2 - $8,211 total requested

Salary – No salary is requested from MML *(1-week salary and fringe will be provided as in-kind for Kevin Claridge for mitigation action assessments and report writing - $5,553.63)*

Fringe – No salary is requested from MML

IDC – No IDC is requested from MML *(MML IDC is waived)*

Travel – No travel is requested from MML

Subcontract - $8,211 is requested for subcontract ESA for BMPs - $5,088 and report writing – $2,830

Task 3 - $13,275 total requested

Salary – $2,231 is requested for 1-week salary for Dr. Hall's time to develop a water quality monitoring plan, report writing, and presentation to the CKW *(Another week of Dr. Hall's salary and fringe will be provided as in kind - $3,008)*

Fringe – $777 is requested for fringe.

IDC – No IDC is requested from MML *(MML IDC is waived)*

Travel – $1,059 is requested for travel. Federal per diem lodging rates for the CKW currently range from $258-456 (depending on month of travel). Meals and incidentals are $86 per day, and $64.50 for first and last day of travel. Travel is requested for Dr. Hall to travel to present results to the CKW. This includes roundtrip flight to Key West (estimated at $200), and 2 nights at a local hotel. (*note – any other required travel for Dr. Hall will be provided as in-kind*)

Subcontract - $16,838 is requested for subcontract ESA for assistance with a water quality monitoring plan - $5,480 and meetings - $3,729

Task 4 - $51,674 total requested

Salary – $20,997 salary is requested for staff (Ms. Sante and Ms. Gannon) at MML to collect bacteria samples from 6 beaches and 1 mooring field every other week and to collect bacteria samples from 2 beaches (that are not already collected by DOH) every other week.

Fringe – $7,309 in fringe is requested.

IDC – No IDC is requested from MML *(MML IDC is waived)*

Travel - $1,820 in travel is requested for the Project Team to travel to each site and to the Jacobs Lab for sample collection and delivery.

Supplies - $3,920 is requested for supplies for sample collection and delivery. This includes: gloves, sterile whirlpaks, ice, transport coolers, replacement probes for YSIs, waterproof paper, and calibration standards.

Vendor Services - $16,900 is requested for vendor services to Jacobs to analyze samples for *Enterococcus* at a cost of $65/sample.

Task 5 - $3,945 total requested

Salary – $2,141 salary is requested for staff (Ms. Cook) at MML to run and manage the addition of BCRS sites at the CKW beaches. *(1-week salary and fringe will be provided as in-kind for Kevin Claridge for MML BCRS assessments and report writing - $5,553.63)*

Fringe – $745 in fringe is requested.

IDC – No IDC is requested from MML *(MML IDC is waived)*

Travel - $1,059 is requested for travel. Federal per diem lodging rates for the CKW currently range from $258-456 (depending on month of travel). Meals and incidentals are $86 per day, and $64.50 for first and last day of travel. Travel is requested for Ms. Cook to travel to present results to the CKW. This includes roundtrip flight to Key West (estimated at $200), and 2 nights at a local hotel. (*note – any other required travel for Ms. Cook, Mr. Claridge or Dr. Hall will be provided as in-kind*)

Task 6 - $7,800 requested

Salary – $4,398 salary is requested for staff (Dr. Francis) at MML to design a new beach water quality monitoring plan based on results from Tasks 1-5. This will include collaborating with the City's Water Quality Improvement Plan (WQIPP) members, DOH, and other relevant technical experts to design a more detailed bacteria (amount and source) monitoring plan.

Fringe – $1,531 in fringe is requested.

IDC – No IDC is requested from MML *(MML IDC is waived)*

Travel - $1,059 is requested for travel. Federal per diem lodging rates for the CKW currently range from $258-456 (depending on month of travel). Meals and incidentals are $86 per day, and $64.50 for first and last day of travel. Travel is requested for Dr. Francis to travel to present results to the CKW. This includes roundtrip flight to Key West (estimated at $200), and 2 nights at a local hotel. (*note – any other required travel for Dr. Francis or Dr. Hall will be provided as in-kind*)

<u>Years 2-5</u> (Extended Water Quality Monitoring Program (GOCs including beaches and mooring field initiated in year 1) – Estimated costs $100,000/year

This is an estimated cost and will not be finalized until Tasks 1-4 from year 1 are completed.

VOLUNTARY LEVERAGING. MML offers college internships year-round and will provide opportunities to students from the College of the Florida Keys and other Universities throughout Florida (at no cost to the CKW) on this study to assist with sample collection, sample preservation and data logging and interpretation. IDC is being waived from MML. Two weeks of salary and fringe are being provided as in kind for Dr. Hall and Mr. Claridge.

7. Project Schedule and Deliverables (see Table 1)
Task 1 will be completed by month 3 after grant initiation.
Total expected time: 3 months
Deliverables. Draft and final Technical Memorandum containing a summary of the available data, results of the trend analysis and water quality assessments. Draft and final database of the available water quality data. Communicate the database and assessments as a presentation to the City Council.

Task 2 will begin after Task 1 is complete. It is estimated to be complete by month 7 after grant initiation.
Total expected time: 4 months
Deliverables: Draft and final Technical Memorandum identifying potential mitigation strategies related to the water quality deficiencies identified in Task 1. Communicate the Technical Memorandum as a presentation to the City Council.

Task 3 will begin by month 7 after grant initiation. It is estimated to be complete no later than month 12 after grant initiation.
Total expected time: 6 months
Deliverables: Draft and final Technical Memorandum of a detailed water quality monitoring program for years 2-5 throughout the GOCs after approval of Tasks 1 and 2.

Task 4 will begin upon grant initiation and will continue throughout 12 months, to be extended for four additional years if selected and after evaluation of year 1.
Total expected time: 12 months
Deliverable: Weekly reports of water quality will be provided to FDOH, CKW, BCRS, and other interested parties. A year-long dataset of bacteria and other water quality parameters (temperature, specific conductance, salinity, pH, dissolved oxygen [DO]) along with QA/QC will be provided.

Task 5 will begin by month 2 after grant initiation. It will continue throughout 12 months, to be extended for four additional years if selected and after evaluation of year 1.
Total expected time: 11-12 months
Deliverables: Expand BCRS reporting in Key West and support integration of bacteria data. Communicate the BCRS as a presentation to the City Council.

Task 6 will begin by month 8 after grant initiation. It is estimated to be complete no later than month 12 after grant initiation.
Total expected time: 5 months
Deliverable: Draft and final Technical Memorandum of a detailed water quality monitoring program for years 2-5 throughout the CKW beaches.

The full description of each task and an activity schedule are presented in **Tab 4 (Project Approach)**. Sampling is currently scheduled to align with FDOH healthy beaches sampling (every other week) for the 2 extra beach samples, and to follow a similar sampling regime in alternate weeks. Sampling will occur on a M, T, W, or R (no sampling will occur on a F) and will not include federal holidays or weekends. All sampling costs (travel, staff time, sampling supplies, and sample analyses) are included in the budget justification under Task 4. The Project Team has >20 years of experience generating these reports and providing information to municipalities.

Tab 8 Litigation

- A list of the person's or entity's shareholders with five (5) percent or more of the stock or, if a general partnership, a list of the general partners; or, if a limited liability company, a list of its members; or, if a solely owned proprietorship, names(s) of owner(s);
  Mote does not have Shareholders

- A list of the officers and directors of the entity;
  BOARD OF TRUSTEES:
  Sandi Stuart, Hobart (Skip) Swan, Scott Collins, Dr. Andrew Economos, Dr. Michael P. Crosby, Eugene Beckstein, Barbara Brizdle, Robert (Bob) Carter, Richard Donegan, Dean Eisner, James (Jim) Ericson, Robert (Bob) Essner, Donald Featherman, Susan Gilmore, Judy Graham, Rod Hershberger, Barbara Jennings, Penelope Kingman, Jonathan Mitchell, Susan Molinari, Elizabeth Moore, Jourdan Reinhart, Rtc Frances Presley Rice, Alan Rose, Dr. Howard (Sam) Seider, Dr. Harris Silverman, Jeanie Stevenson

- The number of years the person or entity has been operating and, if different, the number of years it has been providing the services, goods, or construction services called for in the bid specifications (include a list of similar projects);
  70 years (established 1955, 501©3 1957) Incorporation docs attached

- The number of years the person or entity has operated under its present name and any prior names;
  70 years (established 1955, 501©3 1957 Incorporation docs attached

- Answers to the following questions regarding claims and suits:
  a. Has the person, principals, entity, or any entity previously owned, operated or directed by any of its officers, major shareholders or directors, ever failed to complete work or provide the goods for which it has contracted? If yes, provide details;
  No

  b. Are there any judgments, claims, arbitration proceeding or suits pending or outstanding against the person, principal of the entity, or entity, or any entity previously owned, operated or directed by any of its officers, directors, or general partners? If yes, provide details;
  No

  c. Has the person, principal of the entity, entity, or any entity previously owned, operated or directed by any of its officers, major shareholders or directors, within the last five (5) years, been a party to any lawsuit, arbitration, or mediation with regard to a contract for services, goods or construction services similar to those requested in the specifications with private or public entities? If yes, provide details;
  No

  d. Has the person, principal of the entity, or any entity previously owned, operated or directed by any of its officers, owners, partners, major shareholders or directors, ever initiated litigation against the City or been sued by the City in connection with a contract to provide services, goods or construction services? If yes, provide details;
  No

  e. Whether, within the last five (5) years, the owner, an officer, general partner, principal, controlling shareholder or major creditor of the person or entity was an officer, director, general partner, principal, controlling shareholder or major creditor of any other entity that failed to perform services or furnish goods similar to those sought in the request for competitive solicitation;
  No

f. Customer references (minimum of three), including name, current address and current telephone number;

Dr. Jorge Brenner	Executive Director, GCOOS, Texas A&M University, Dept. of Oceanography 3126 TAMU, College Station, TX 77843, 361-696-1776, jorge.brenner@gcoos.org
Ms. Heather Bryen	Environmental Specialist III, Sarasota County Public Works-Stormwater, 1001 Sarasota Center Blvd., Sarasota, FL 34240, 941-538-1462, hbryen@scgov.net
Mr. Michael G. Drennan	Water Plant Superintendent, City of North Port, 5655 North Port Blvd, North Port, Fl. 34287 941-445-7049, mdrennan@northportfl.gov
Ms. Debra Hernandez	Executive Director, SECOORA, P.O. Box 13856, Charleston, SC 29422 843-906-8686, debra@secoora.org
Dr. Katherine Hubbard	Director, FWC Center for Red Tide Research, Harmful Algal Bloom Monitoring and Research, Florida Fish and Wildlife Conservation Commission-Fish and Wildlife Research Institute (FWC-FWRI), 100 Eighth Avenue SE, St. Petersburg, FL 33701 (727)502-4961, katherine.hubbard@myfwc.com
Mr. Chad Nosbisch	Chief Operator, City of North Port, 5655 North Port Blvd, North Port, FL 34287 941-240-8009, cnosbisch@northportfl.gov
Ms. Elizabeth Smith	South Florida Program Coordinator, Ocean & Estuarine Management Section, U.S. EPA | Region 4, 404-562-8721, smith.elizabeth@epa.gov
Dr. Felix Martinez	Program Manager, NOS/NCCOS/Competitive Research Program National Oceanic and Atmospheric Administration, 4840 South State Rd.; Ann Arbor, MI 48108 734-741-2254, Felix.Martinez@NOAA.gov

g. Credit References (minimum of three), including name, current address and current telephone number; and

Champion Lighting & Supply
291 North Main Street
Ambler, PA 19002
Contact: George Banyai
Phone: 215-643-2700
email: billing@championlighting.com

Covetrus North America
Post Office Box 734579
Chicago, IL 60613
Contact: Tina Ferguson
Phone: 800-258-2148, extension 7846
FAX: 614-210-5615
email: tina.ferguson@covetrus.com

Harrington Industrial Plastics, LLC
Post Office Box 676273
Dallas, TX 75267
Contact: Mellisa Kulick-Smith
Phone: 909-597-8641
email: newaccountadmin@hipco.com

h. Financial statements for the prior three years for the responding entity or for any entity that is a subsidiary to the responding entity. **Audits Attached**

MOTE MARINE LABORATORY

1600 Ken Thompson Parkway
Sarasota, Florida 34236-1096 USA
PHONE: (941) 388-4441 FAX: (941) 388-4312
INTERNET: info@mote.org • www.mote.org

Mike B. McKee
Chairman of the Board

Kumar Mahadevan, Ph.D.
President

FIELD STATIONS: ***Florida Keys*** • 24244 Overseas Highway • Summerland Key, FL 33042 • PHONE: (305) 745-2729 • FAX: (305) 745-2730
• 631 Greene Street • Key West, FL 33040 • PHONE: (305) 296-3551 • FAX: (305) 296-2325
Charlotte Harbor • P.O. Box 2197 • Pineland, FL 33945 • PHONE: (239) 283-1622 • FAX: (239) 283-2466
Mote Aquaculture Park • 12300 Fruitville Road • Sarasota, FL 34240 • PHONE: (941) 388-4541 • FAX: (941) 377-2905

To Whom It May Concern:

☑ Enclosed is a copy of Internal Revenue Service determination letter dated January 15, 1957, advising that Mote Marine Laboratory is exempt from taxation under Section 501(c)(3) of the Internal Revenue Code, together with a copy of Internal Revenue Service letter dated June 10, 2002, continuing recognition of this organization as tax-exempt.

☑ This is to certify that the Internal Revenue Service has not withdrawn, revoked or modified such determination letters since they were issued.

~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~

☑ Enclosed is a copy of Internal Revenue Service determination letter dated October 20, 1970, classifying Mote Marine Laboratory as "not a private foundation as defined in Section 509(a) of the Internal Revenue Code," together with copy of Internal Revenue Service letter of August 22, 1977, determining that Mote Marine Laboratory is an organization of the type described in Section 509(a)(1) and 170(b)(1)(A)(vi).

☑ This is to certify that the Internal Revenue Service has not withdrawn, revoked, or modified such determination letters since they were issued.

Kumar Mahadevan, Ph.D.
President/CEO

9-20-06
Date

U. S. TREASURY DEPARTMENT
WASHINGTON 25

Photostatic copy [illegible]
by R.E.E. [illegible] 3/4/57.

OFFICE OF
COMMISSIONER OF INTERNAL REVENUE

ADDRESS REPLY TO
COMMISSIONER OF INTERNAL REVENUE
AND REFER TO

T:R:PEO:S
MCK

JAN 15 1957

Cape Haze Marine Laboratory, Inc.

Placida, Florida

Gentlemen:

It is the opinion of this office, based upon the evidence presented, that you are exempt from Federal income tax as an organization described in section 501(c)(3) of the Internal Revenue Code of 1954, as it is shown that you are organized and operated exclusively for scientific purposes.

Accordingly, you are not required to file income tax returns unless you change the character of your organization, the purposes for which you were organized, or your method of operation. Any such changes should be reported immediately to the District Director of Internal Revenue for your district in order that their effect upon your exempt status may be determined.

You are required, however, to file an information return, Form 990A, annually, with the District Director of Internal Revenue for your district so long as this exemption remains in effect. This form may be obtained from the District Director and is required to be filed on or before the fifteenth day of the fifth month following the close of your annual accounting period.

Contributions made to you are deductible by the donors in computing their taxable income in the manner and to the extent provided by section 170 of the 1954 Code.

Bequests, legacies, devises or transfers to or for your use are deductible in computing the value of the taxable estate of a decedent for Federal estate tax purposes in the manner and to the extent provided by sections 2055 and 2106 of the 1954 Code. Gifts of property to or for your use are deductible in computing taxable gifts for Federal gift tax purposes in the manner and to the extent provided by section 2522 of the 1954 Code.

No liability is incurred by you for the taxes imposed under the Federal Insurance Contributions Act (social security taxes) unless you have filed a waiver of exemption certificate in accordance with the applicable provisions of such Act. In the event you desire social security coverage for your employees or have any questions relating to the filing of a waiver of exemption certificate you should take the matter up with your District Director of Internal Revenue.

Your attention is called to the provisions of section 501(c)(3) of the Internal Revenue Code of 1954 under which your exemption will be revoked if any substantial part of your activities consists of carrying on propaganda, or otherwise attempting, to influence legislation, or if you participate in, or intervene in (including the publishing or distributing of statements), any political campaign on behalf of any candidate for public office.

For the purpose of applying this ruling to any period with respect to which the Internal Revenue Code of 1954 is not applicable, any reference herein to a provision of the 1954 Code shall be deemed a reference to the corresponding provision of the 1939 Code.

The District Director of Internal Revenue, Jacksonville, Florida, is being advised of this action.

Very truly yours,

C. Henry Nickham

Chief, Pensions and
Exempt Organizations Branch

Internal Revenue Service

Department of the Treasury

P. O. Box 2508
Cincinnati, OH 45201

Date: June 10, 2002

Person to Contact:
April C. Howard
Customer Service Representative
Toll Free Telephone Number:
8:00 a.m. to 6:30 p.m. EST
877-829-5500
Fax Number:
513-263-3756
Federal Identification Number:
59-0756643

Mote Marine Laboratory
1600 Ken Thompson Pkwy
Sarasota, FL 34236

Dear Sir or Madam:

This letter is in response to your request for a copy of your organization's determination letter. This letter will take the place of the copy you requested.

Our records indicate that a determination letter issued in July 1977 granted your organization exemption from federal income tax under section 501(c)(3) of the Internal Revenue Code. That letter is still in effect.

Based on information subsequently submitted, we classified your organization as one that is not a private foundation within the meaning of section 509(a) of the Code because it is an organization described in sections 509(a)(1) and 170(b)(1)(A)(vi).

This classification was based on the assumption that your organization's operations would continue as stated in the application. If your organization's sources of support, or its character, method of operations, or purposes have changed, please let us know so we can consider the effect of the change on the exempt status and foundation status of your organization.

Your organization is required to file Form 990, Return of Organization Exempt from Income Tax, only if its gross receipts each year are normally more than $25,000. If a return is required, it must be filed by the 15th day of the fifth month after the end of the organization's annual accounting period. The law imposes a penalty of $20 a day, up to a maximum of $10,000, when a return is filed late, unless there is reasonable cause for the delay.

All exempt organizations (unless specifically excluded) are liable for taxes under the Federal Insurance Contributions Act (social security taxes) on remuneration of $100 or more paid to each employee during a calendar year. Your organization is not liable for the tax imposed under the Federal Unemployment Tax Act (FUTA).

Organizations that are not private foundations are not subject to the excise taxes under Chapter 42 of the Code. However, these organizations are not automatically exempt from other federal excise taxes.

Donors may deduct contributions to your organization as provided in section 170 of the Code. Bequests, legacies, devises, transfers, or gifts to your organization or for its use are deductible for federal estate and gift tax purposes if they meet the applicable provisions of sections 2055, 2106, and 2522 of the Code.

Mote Marine Laboratory
59-0756643

Your organization is not required to file federal income tax returns unless it is subject to the tax on unrelated business income under section 511 of the Code. If your organization is subject to this tax, it must file an income tax return on the Form 990-T, Exempt Organization Business Income Tax Return. In this letter, we are not determining whether any of your organization's present or proposed activities are unrelated trade or business as defined in section 513 of the Code.

The law requires you to make your organization's annual return available for public inspection without charge for three years after the due date of the return. If your organization had a copy of its application for recognition of exemption on July 15, 1987, it is also required to make available for public inspection a copy of the exemption application, any supporting documents and the exemption letter to any individual who requests such documents in person or in writing. You can charge only a reasonable fee for reproduction and actual postage costs for the copied materials. The law does not require you to provide copies of public inspection documents that are widely available, such as by posting them on the Internet (World Wide Web). You may be liable for a penalty of $20 a day for each day you do not make these documents available for public inspection (up to a maximum of $10,000 in the case of an annual return).

Because this letter could help resolve any questions about your organization's exempt status and foundation status, you should keep it with the organization's permanent records.

If you have any questions, please call us at the telephone number shown in the heading of this letter.

This letter affirms your organization's exempt status.

Sincerely,

John E. Ricketts

John E. Ricketts, Director, TE/GE
Customer Account Services

Internal Revenue Service
Washington, DC 20224

Date: 10-20-70

In reply refer to:

MOTE MARINE LABORATORY INC
9501 BLIND PASS ROAD
SARASOTA, FLA 33581

Gentlemen:

Based on the information you recently submitted, we have classified you as an organization that is not a private foundation as defined in section 509(a) of the Internal Revenue Code.

Your classification is based on the assumption that your operations will be as stated in your notification. Any changes in your purposes, character, or method of operation must be reported to your District Director so he may consider the effect on your status.

Sincerely yours,

J. A. Teeles

Chief, Rulings Section
Exempt Organizations Branch

FORM M-0714 (8-70) (CONTINUOUS)

Internal Revenue Service

Department of the Treasury

District
Director

Mote Marine Laboratory
9501 Blind Pass Road
Sarasota, Florida 33581

Person to Contact:
R. Wright

Telephone Number:
(904) 791-2636

Refer Reply to:
720-2

Date: AUG 22 1977

Dear Applicant:

This modifies our letter of October 20, 1970, which stated that you were not a private foundation because you were an organization of the type described in section 509(a)(2) of the Internal Revenue Code.

Based on information submitted, we have determined that you are not a private foundation within the meaning of section 501(a) of the Internal Revenue Code because you are an organization of the type described in section 509(a)(1) and 170(b)(1)(A)(vi).

Grantors and contributors may rely on this determination until the Internal Revenue Service publishes notice to the contrary. However, a grantor or a contributor may not rely on this determination if he was in part responsible for, or was aware of the act or failure to act that resulted in your loss of section 509(a)(1) status, or acquired knowledge that the Internal Revenue Service had given notice that you would be removed from classification as a section 509(a)(1) organization.

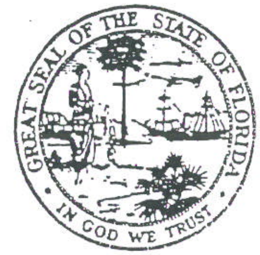
Sincerely yours,

Charles O. DeWitt

Charles O. DeWitt
District Director

State of Florida

Secretary of State



I, Tom Adams, Secretary of State of the State of Florida,

Do Hereby Certify That the following is a true and correct copy of

Certificate of Amendment to Certificate of Incorporation of CAPE HAZE MARINE LABORATORY, INC., --- the original charter having been filed in the Circuit Court of Charlotte County, Florida, on the 13th day of June, A. D., 1955, according to documents filed in this office, --- AMENDING ARTICLE I, changing the corporate name to

MOTE MARINE LABORATORY, INC.,

a corporation not for profit, organized and existing under the Laws of the State of Florida, filed in the Office of the Secretary of State on the 21st day of November, A. D., 1967, pursuant to Chapter 617, Florida Statutes, as shown by the records of this office.

Given under my hand and the Great Seal of the State of Florida at Tallahassee, the Capital, this the 21st day of November, A.D. 19 67.

Secretary of State

Mote Marine Laboratory, Inc.

Financial Statements,
Supplemental Information,
Contract Compliance and
Independent Auditor's Report
September 30, 2021 and 2020

KB KERKERING BARBERIO
ACCOUNTING • TAX • CONSULTING

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KERKERING BARBERIO

Kerkering, Barberio & Co.
Certified Public Accountants

Independent Auditor's Report

The Board of Trustees
Mote Marine Laboratory, Inc.
Sarasota, Florida

Report on the Financial Statements
We have audited the accompanying financial statements of Mote Marine Laboratory, Inc. (Laboratory), a nonprofit organization, which comprise the statements of financial position as of September 30, 2021 and 2020, and the related statements of activities and cash flows, and statements of functional expenses for the years then ended, and the related notes to the financial statements.

Management's Responsibility for the Financial Statements
Management is responsible for the preparation and fair presentation of these financial statements in accordance with accounting principles generally accepted in the United States of America; this includes the design, implementation, and maintenance of internal control relevant to the preparation and fair presentation of financial statements that are free from material misstatement, whether due to fraud or error.

Auditor's Responsibility
Our responsibility is to express an opinion on these financial statements based on our audits. We conducted our audits in accordance with auditing standards generally accepted in the United States of America and the standards applicable to financial audits contained in *Government Auditing Standards*, issued by the Comptroller General of the United States. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free from material misstatement.

An audit involves performing procedures to obtain audit evidence about the amounts and disclosures in the financial statements. The procedures selected depend on the auditor's judgment, including the assessment of the risks of material misstatement of the financial statements, whether due to fraud or error. In making those risk assessments, the auditor considers internal control relevant to the entity's preparation and fair presentation of the financial statements in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of the entity's internal control. Accordingly, we express no such opinion. An audit also includes evaluating the appropriateness of accounting policies used and the reasonableness of significant accounting estimates made by management, as well as evaluating the overall presentation of the financial statements.

We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our audit opinion.

Opinion
In our opinion, the financial statements referred to above present fairly, in all material respects, the financial position of Mote Marine Laboratory, Inc. as of September 30, 2021 and 2020, and the changes in net assets and its cash flows for the years then ended in accordance with accounting principles generally accepted in the United States of America.

Other Matters
Our audit was conducted for the purpose of forming an opinion on the basic financial statements of Mote Marine Laboratory, Inc. as a whole. The accompanying Schedule of Expenditures of Federal Awards and State Financial Assistance, as required by Title 2 U.S. *Code of Federal Regulations (CFR)* Part 200, *Uniform Administration Requirements, Cost Principles, and Audit Requirements for Federal Awards,* and Chapter 10.650, *Rules of the Auditor General,* is presented for the purposes of additional analysis and is not a required part of the financial statements. Such information is the responsibility of the Laboratory's management and was derived from and relates directly to the underlying accounting and other records used to prepare the financial statements. The information has been subjected to the auditing procedures applied in the audit of the basic financial statements and certain additional procedures, including comparing and reconciling such information directly to the underlying accounting and other records used to prepare the financial statements or to the financial statements themselves, and other additional procedures in accordance with auditing standards generally accepted in the United State of America. In our opinion, the Schedule of Expenditures of Federal Awards and State Financial Assistance is fairly stated, in all material respects, in relation to the financial statements as a whole.

Other Reporting Required by *Government Auditing Standards*
In accordance with *Government Auditing Standards*, we have also issued our report dated April 13, 2022 on our consideration of Mote Marine Laboratory, Inc.'s internal control over financial reporting and on our tests of its compliance with certain provisions of laws, regulations, contracts and grant agreements and other matters. The purpose of that report is solely to describe the scope of our testing of internal control over financial reporting and compliance and the results of that testing, and not to provide an opinion on the effectiveness of Mote Marine Laboratory, Inc.'s internal control over financial reporting or on compliance. That report is an integral part of an audit performed in accordance with *Government Auditing Standards* in considering Mote Marine Laboratory, Inc.'s internal control over financial reporting and compliance.

Kerkering Barberio & Co.

Sarasota, Florida
April 13, 2022

Mote Marine Laboratory, Inc.

Statements of Financial Position

September 30, 2021 and 2020

		2021		2020
Assets				
Cash and cash equivalents	$	16,351,517	$	11,279,117
Accounts receivable		4,295,917		4,901,537
Pledges receivable, net		7,847,579		7,752,054
Due from Mote Marine Foundation, Inc.		529,282		719,638
Prepaid expenses and other assets		126,016		67,297
Investments - certificates of deposit		392,197		627,629
Patents, net		88,139		95,780
Investment in deferred compensation plan		595,355		604,044
Land		7,498,190		7,498,190
Property and equipment, net		14,999,685		16,381,831
Construction in progress		15,972,540		5,195,720
Beneficial interest in the net assets of Mote Marine Foundation, Inc.		20,678,361		17,141,448
Total Assets	$	89,374,778	$	72,264,285
Liabilities and Net Assets				
Liabilities:				
Accounts payable	$	3,543,776	$	1,085,721
Accrued payroll		931,701		820,946
Memberships relating to future periods		639,825		375,913
Funds advanced on research programs		4,840,451		9,041,015
Deferred compensation payable		595,355		604,044
Lines of credit		1,402,101		1,402,101
Paycheck Protection Program forgiveable loan		-		2,318,259
Notes payable		6,715,042		6,076,783
Total liabilities		18,668,251		21,724,782
Net Assets:				
Without donor restrictions:				
Undesignated		35,585,348		21,044,957
Board designated		390,818		390,818
Total net assets without donor restrictions		35,976,166		21,435,775
With donor restrictions:				
Purpose and time restrictions		24,684,247		19,064,139
Perpetual in nature		10,046,114		10,039,589
Total net assets with donor restrictions		34,730,361		29,103,728
Total net assets		70,706,527		50,539,503
Total Liabilities and Net Assets	$	89,374,778	$	72,264,285

See accompanying notes to the financial statements.

Mote Marine Laboratory, Inc.

Statement of Activities
Year Ended September 30, 2021
(With Summarized Totals for 2020)

	Without Donor Restrictions	With Donor Restrictions	Total	2020 Total
Support, Revenue and Reclassifications:				
Program revenue:				
Research revenue:				
Federal	$ 4,697,906	$ -	$ 4,697,906	$ 3,224,509
State	5,242,015	-	5,242,015	7,718,918
Other	7,004,272	531,674	7,535,946	4,754,268
Aquarium:				
Admission fees	5,485,931	-	5,485,931	2,740,772
Gift shop	556,749	-	556,749	266,065
Other	371,717	-	371,717	220,129
Memberships	604,506	-	604,506	1,002,248
Education	472,256	-	472,256	431,498
Protect Our Reefs-License Plate	875,077	-	875,077	893,264
Other programs	517,396	3,399,997	3,917,393	506,683
Contributions:				
Construction	-	7,833,755	7,833,755	9,255,770
Aquarium	92,085	8,600	100,685	33,334
Other programs	2,702,482	31,000	2,733,482	2,768,428
Paycheck Protection Program loan forgiveness	2,318,259		2,318,259	-
Non-cash contributions	84,381	605,700	690,081	332,563
Grants from Mote Marine Foundation, Inc.	524,748	-	524,748	985,483
Investment income	22,025	5,710	27,735	41,524
Unrealized gain (loss) on investments, net	(2,939)	(5,673)	(8,612)	1,148
Realized gain on investments, net	2,689	-	2,689	1,017
Realized gain (loss) on disposal of assets	(653)	(296)	(949)	19,876
Change in beneficial interest in the net assets of Mote Marine Foundation, Inc.	369,390	3,167,523	3,536,913	273,634
Net assets released from restrictions	9,951,357	(9,951,357)	-	-
Total support, revenue and reclassifications	41,891,649	5,626,633	47,518,282	35,471,131
Expenses:				
Program services:				
Research	16,842,052	-	16,842,052	14,110,002
Education	980,292	-	980,292	1,082,389
Aquarium	4,232,382	-	4,232,382	3,979,596
Protect Our Reefs-License Plate	505,156	-	505,156	739,137
MAP facility operations	639,506	-	639,506	498,002
Other	692,048	-	692,048	435,814
Supporting services:		-		-
Administrative and general	1,437,163	-	1,437,163	1,942,504
Fundraising	2,022,659	-	2,022,659	2,017,957
Total expenses	27,351,258	-	27,351,258	24,805,401
Change in net assets	14,540,391	5,626,633	20,167,024	10,665,730
Net assets at beginning of year	21,435,775	29,103,728	50,539,503	39,873,773
Net assets at end of year	$ 35,976,166	$ 34,730,361	$ 70,706,527	$ 50,539,503

See accompanying notes to the financial statements.

Mote Marine Laboratory, Inc.

Statement of Activities
Year Ended September 30, 2020
(With Summarized Totals for 2021)

	Without Donor Restrictions	With Donor Restrictions	Total	2021 Total
Support, Revenue and Reclassifications:				
Program revenue:				
Research revenue:				
Federal	$ 3,224,509	$ -	$ 3,224,509	$ 4,697,906
State	7,718,918	-	7,718,918	5,242,015
Other	4,754,018	250	4,754,268	7,535,946
Aquarium:		-	-	
Admission fees	2,740,772	-	2,740,772	5,485,931
Gift shop	266,065	-	266,065	556,749
Other	220,129	-	220,129	371,717
Memberships	1,002,248	-	1,002,248	604,506
Education	431,498	-	431,498	472,256
Protect Our Reefs-License Plate	893,264	-	893,264	875,077
Other programs	506,683	-	506,683	3,917,393
Contributions:		-		
Construction	-	9,255,770	9,255,770	7,833,755
Aquarium	-	33,334	33,334	100,685
Other programs	2,738,578	29,850	2,768,428	2,733,482
Paycheck Protection Program loan forgiveness				2,318,259
Non-cash contributions	332,563	-	332,563	690,081
Grants from Mote Marine Foundation, Inc.	985,483	-	985,483	524,748
Investment income	40,441	1,083	41,524	27,735
Unrealized gain (loss) on investments, net	-	1,148	1,148	(8,612)
Realized gain on investments, net	1,017	-	1,017	2,689
Realized gain (loss) on disposal of assets	21,000	(1,124)	19,876	(949)
Change in beneficial interest in the net assets of Mote Marine Foundation, Inc.	26,383	247,251	273,634	3,536,913
Net assets released from restrictions	4,819,710	(4,819,710)	-	-
Total support, revenue and reclassifications	30,723,279	4,747,852	35,471,131	47,518,282
Expenses:				
Program services:				
Research	14,110,002	-	14,110,002	16,842,052
Education	1,082,389	-	1,082,389	980,292
Aquarium	3,979,596	-	3,979,596	4,232,382
Protect Our Reefs-License Plate	739,137	-	739,137	505,156
MAP facility operations	498,002	-	498,002	639,506
Other	435,814	-	435,814	692,048
Supporting services:		-		
Administrative and general	1,942,504	-	1,942,504	1,437,163
Fundraising	2,017,957	-	2,017,957	2,022,659
Total expenses	24,805,401	-	24,805,401	27,351,258
Change in net assets	5,917,878	4,747,852	10,665,730	20,167,024
Net assets at beginning of year	15,517,897	24,355,876	39,873,773	50,539,503
Net assets at end of year	$ 21,435,775	$ 29,103,728	$ 50,539,503	$ 70,706,527

See accompanying notes to the financial statements.

Mote Marine Laboratory, Inc.

Statements of Cash Flows

Years Ended September 30, 2021 and 2020

	2021	2020
Cash Flows from Operating Activities:		
Change in net assets	$ 20,167,024	$ 10,665,730
Adjustments to reconcile change in net assets to net cash provided by operating activities:		
Depreciation and amortization	2,879,804	2,928,660
Realized (gain) loss on disposal of assets	949	(19,876)
Unrealized / realized (gain) loss on investments, net	5,923	(2,165)
Change in beneficial interest in the net assets of Mote Marine Foundation, Inc.	(3,536,913)	(273,634)
Non-cash contributions	(690,081)	(308,479)
Proceeds from donated assets held for sale	83,209	330,496
Contribution from forgiveness of note payable	-	(2,000,000)
Paycheck Protection Program loan forgiveness	(2,318,259)	-
Change in operating assets:		
Accounts receivable	605,620	(3,345,835)
Pledges receivable, net	(95,525)	(4,043,218)
Due from Mote Marine Foundation, Inc.	190,356	(605,526)
Prepaid expenses and other assets	(58,719)	82,002
Change in operating liabilities:		
Accounts payable	2,458,055	681,874
Accrued payroll	110,755	(126,303)
Memberships relating to future periods	263,912	(381,429)
Funds advanced on research programs	(4,200,564)	1,859,414
Total adjustments	(4,301,478)	(5,224,019)
Net cash provided by operating activities	15,865,546	5,441,711
Cash Flows from Investing Activities:		
Purchases of property and equipment	(10,156,952)	(5,394,120)
Proceeds from sale of property and equipment	-	1,500
Proceeds from maturity of certificate of deposit	235,432	232,258
Patent costs	(9,467)	(13,306)
Net cash used in investing activities	(9,930,987)	(5,173,668)
Cash Flows from Financing Activities:		
Net change in lines of credit	-	(65,500)
Repayments of notes payable	(862,159)	(529,386)
Proceeds from Paycheck Protection Program loan	-	2,318,259
Net cash provided by (used in) financing activities	(862,159)	1,723,373
Net change in cash and cash equivalents	5,072,400	1,991,416
Cash and cash equivalents, beginning of year	11,279,117	9,287,701
Cash and cash equivalents, end of year	$ 16,351,517	$ 11,279,117
Cash and cash equivalents, end of year, consist of the following:		
Cash	15,799,009	10,977,549
Restricted cash	552,508	301,568
	$ 16,351,517	$ 11,279,117
Supplemental Disclosure of Non-Cash:		
Investing and Financing Activity:		
Cash paid for interest	$ 161,922	$ 193,237
Construction in progress purchased through financing	$ 1,500,418	$ -
Construction in progress non-cash contribution	$ 600,000	$ -
Forgiveness of note payable reclassified as contribution	$ -	$ 2,000,000
Forgiveness of Paycheck Protection Program Loan	$ 2,318,259	$ -

See accompanying notes to the financial statements.

Mote Marine Laboratory, Inc.
Statement of Functional Expenses
Year Ended September 30, 2021
(With Summarized Totals for 2020)

	Program Services				
	Research	Education	Aquarium	Protect our Reefs License Plate	MAP Facility Operations
Salaries and benefits	$ 7,756,169	$ 616,372	$ 2,586,002	$ 175,997	$ 74,126
Contracted services	1,972,978	214,158	130,951	61,981	2,863
Depreciation	-	-	230,583	-	320,971
Repairs and maintenance	409,849	1,121	508,227	123,970	72,257
Travel, meals and seminars	236,841	8,819	11,484	5,170	-
Research supplies	1,325,336	15,090	2,647	22,805	57
Merchandise	-	250	23,304	-	-
Office expense	128,654	27,872	358,019	5,858	2,210
Electricity	45,210	21	164,357	51,285	82,547
Insurance	21,912	-	46,768	10,304	37,989
Telephone	23,950	5,596	10,198	12,953	3,855
Promotion and advertising	135,047	38,520	36,830	9,062	-
Expendable supplies	697	4,625	11,963	-	-
Printing and publication	6,439	1,967	10,312	307	-
Vessel	44,262	-	7,966	(105)	2,408
Vehicle	-	-	2,123	2,239	-
Interest	-	-	-	-	-
Accounting and legal	5,074	1,586	1,586	-	-
Equipment rental	23,171	8	3,043	1,292	19,966
Library	-	-	-	-	-
Licenses and fees	69,233	2,547	25,595	2,202	20,257
Rent	25,501	21,705	-	-	-
Miscellaneous	-	-	-	-	-
	12,230,323	960,257	4,171,958	485,320	639,506
Overhead allocation	4,320,607	8,965	-	16,185	-
Rental use charges allocation:					
Vessel, vehicle and equipment	291,122	11,070	60,424	3,651	-
Total Expenses	$ 16,842,052	$ 980,292	$ 4,232,382	$ 505,156	$ 639,506
Percent of Total					

		Supporting Services			2021	2020
Other	Total	Administrative and General	Fund Raising	Total	Functional Expenses	Functional Expenses
$ 243,444	$ 11,452,110	$ 2,018,456	$ 1,465,197	$ 3,483,653	$ 14,935,763	$ 13,848,042
12,866	2,395,797	129,863	141,591	271,454	2,667,251	2,167,088
-	551,554	2,311,142	-	2,311,142	2,862,696	2,910,709
180,206	1,295,630	322,639	8,561	331,200	1,626,830	1,497,803
18,032	280,346	10,730	97,708	108,438	388,784	595,092
4,148	1,370,083	17,229	-	17,229	1,387,312	871,091
-	23,554	-	-	-	23,554	13,558
47,592	570,205	85,470	99,372	184,842	755,047	490,291
62,815	406,235	276,601	-	276,601	682,836	619,924
31,447	148,420	362,241	-	362,241	510,661	492,757
4,437	60,989	38,284	2,099	40,383	101,372	112,056
9,468	228,927	6,864	110,045	116,909	345,836	367,585
-	17,285	-	-	-	17,285	46,248
155	19,180	640	72,680	73,320	92,500	79,622
97,559	152,090	232	-	232	152,322	110,279
76	4,438	39,839	-	39,839	44,277	31,868
5,573	5,573	156,349	-	156,349	161,922	193,237
107,509	115,755	59,937	4,440	64,377	180,132	79,615
10,537	58,017	46,987	675	47,662	105,679	97,429
40,525	40,525	-	-	-	40,525	24,362
26,571	146,405	44,502	13,353	57,855	204,260	111,337
100	47,306	-	-	-	47,306	27,447
17,108	17,108	-	-	-	17,108	17,961
920,168	19,407,532	5,928,005	2,015,721	7,943,726	27,351,258	24,805,401
3,786	4,349,543	(4,349,543)	-	(4,349,543)	-	-
(231,906)	134,361	(141,299)	6,938	(134,361)	-	-
$ 692,048	$ 23,891,436	$ 1,437,163	$ 2,022,659	$ 3,459,822	$ 27,351,258	$ 24,805,401
	87%	6%	7%		100%	

Mote Marine Laboratory, Inc.
Statement of Functional Expenses
Year Ended September 30, 2020
(With Summarized Totals for 2021)

	Program Services				
	Research	Education	Aquarium	Protect our Reefs License Plate	MAP Facility Operations
Salaries and benefits	$ 6,856,785	$ 753,895	$ 2,376,766	$ 312,523	$ 22,072
Contracted services	1,475,660	184,090	144,821	80,796	9,146
Depreciation	-	-	291,436	-	348,931
Repairs and maintenance	296,670	6,863	540,864	83,547	59,009
Travel, meals and seminars	238,679	29,598	18,934	3,664	-
Research supplies	819,440	12,522	66	27,178	-
Merchandise	-	-	13,558	-	-
Office expense	86,688	17,922	201,383	(3,357)	6,164
Electricity	23,625	-	152,314	37,156	74,342
Insurance	18,236	3,842	58,928	9,455	37,988
Telephone	26,733	6,682	17,653	12,886	3,787
Promotion and advertising	106,282	31,891	33,057	82,693	-
Expendable supplies	5,914	13,576	26,668	-	-
Printing and publication	7,742	1,469	1,503	1,405	-
Vessel	18,366	616	6,398	8,671	3,312
Vehicle	1,056	416	2,829	185	-
Interest	-	-	-	933	-
Accounting and legal	13,747	-	-	-	-
Equipment rental	40,511	1,203	3,086	1,382	2,253
Library	-	-	-	-	-
Licenses and fees	35,881	2,827	14,740	2,239	20,021
Rent	26,447	-	-	-	-
Miscellaneous	10	-	-	-	-
	10,098,472	1,067,412	3,905,004	661,356	587,025
Overhead allocation	3,724,237	-	-	63,554	(89,098)
Rental use charges allocation:					
Vessel, vehicle and equipment	287,293	14,977	74,592	14,227	75
Total Expenses	$ 14,110,002	$ 1,082,389	$ 3,979,596	$ 739,137	$ 498,002
Percent of Total					

		Supporting Services			2020	2021
		Administrative	Fund		Total Functional	Total Functional
Other	Total	and General	Raising	Total	Expenses	Expenses
$ 285,655	$ 10,607,696	$ 1,908,098	$ 1,332,248	$ 3,240,346	$ 13,848,042	$ 14,935,763
9,617	1,904,130	111,254	151,704	262,958	2,167,088	2,667,251
-	640,367	2,270,342	-	2,270,342	2,910,709	2,862,696
125,513	1,112,466	366,949	18,388	385,337	1,497,803	1,626,830
32,670	323,545	29,818	241,729	271,547	595,092	388,784
1,371	860,577	10,514	-	10,514	871,091	1,387,312
-	13,558	-	-	-	13,558	23,554
30,905	339,705	70,133	80,453	150,586	490,291	755,047
68,474	355,911	264,013	-	264,013	619,924	682,836
64,455	192,904	299,853	-	299,853	492,757	510,661
4,310	72,051	37,605	2,400	40,005	112,056	101,372
7,303	261,226	11,280	95,079	106,359	367,585	345,836
-	46,158	90	-	90	46,248	17,285
2,065	14,184	1,890	63,548	65,438	79,622	92,500
72,440	109,803	276	200	476	110,279	152,322
204	4,690	27,163	15	27,178	31,868	44,277
-	933	192,304	-	192,304	193,237	161,922
-	13,747	65,868	-	65,868	79,615	180,132
7,575	56,010	24,252	17,167	41,419	97,429	105,679
-	-	24,362	-	24,362	24,362	40,525
761	76,469	28,973	5,895	34,868	111,337	204,260
1,000	27,447	-	-	-	27,447	47,306
-	10	17,951	-	17,951	17,961	17,108
714,318	17,033,587	5,762,988	2,008,826	7,771,814	24,805,401	27,351,258
(49,245)	3,649,448	(3,649,448)	-	(3,649,448)	-	-
(229,259)	161,905	(171,036)	9,131	(161,905)	-	-
$ 435,814	$ 20,844,940	$ 1,942,504	$ 2,017,957	$ 3,960,461	$ 24,805,401	$ 27,351,258
	84%	8%	8%		100%	

See accompanying notes to the financial statements.

1. Organization

Mote Marine Laboratory, Inc. (Laboratory), a nonprofit corporation, operates and maintains a marine and environmental sciences laboratory for the encouragement and development of the study of marine sciences and the advancement of the general knowledge of kindred subjects through education, training, scientific research, exchange of scientific information and dissemination of information to the public. The Laboratory began operations in 1955.

2. Summary of Significant Accounting Policies

Financial Statements

The financial statements and notes are representations of the Laboratory's management who is responsible for their integrity and objectivity. The accounting policies conform to accounting principles generally accepted in the United States of America and have been consistently applied in the preparation of the financial statements.

Basis of Accounting

The Laboratory prepares its financial statements on the accrual basis of accounting in accordance with accounting principles generally accepted in the United States of America.

Use of Estimates and Assumptions

The preparation of financial statements in conformity with accounting principles generally accepted in the United States of America requires management to make estimates and assumptions that affect certain reported amounts of assets and liabilities and disclosure of contingent assets and liabilities at the date of the financial statements and the reported amounts of revenues and expenses during the reporting period. Accordingly, actual results could differ from those estimates and assumptions.

Accounts Receivable

Accounts receivable consist primarily of amounts due from program fees and grants receivable. A significant portion of grants receivable are research grants.

Substantially all research grants are cost reimbursement grants. Research grants receivable consists of billed and unbilled costs incurred on research contracts. Due to the nature of the grants, management considers them to be collectible and no allowance has been established. These amounts are included in accounts receivable on the statements of financial position.

Based on the Laboratory's collection history, management believes no allowance for uncollectible amounts is necessary.

Bequest Receivable

Bequests are recorded as support when the amount to be received can be reasonably estimated as provided by the executor of the estate.

Pledges Receivable

Pledges are recorded as support when the donor's commitment has been received. Pledges receivable due in more than one year are reflected at the present value of estimated future cash flows using an appropriate discount rate in the year pledged.

2. Summary of Significant Accounting Policies (Continued)

Property and Equipment

Property and equipment are stated at cost, if purchased, or fair market value at the date of gift, if donated.

Depreciation is provided over the estimated useful lives of the assets using the straight-line half-year method. Estimated useful lives are as follows:

	Years
Vehicles	3
Vessels	5
Buildings and improvements	5 - 40
Furniture, fixtures and exhibits	5 - 10
Laboratory equipment	5 - 20
Trailers	5 - 10

The Laboratory capitalizes all fixed asset purchases or donations with an estimated useful life of greater than one year and a cost or fair market value of $5,000 or greater.

Revenue Recognition

Revenue associated with research grants or contracts is generally recognized as related costs are incurred. Membership revenue is recognized ratably throughout the membership year.

All contributions are considered to be available for use without donor restriction unless specifically restricted by the donor. Contributions which are designated by the donor to be used in future periods, or for specific purposes, are recorded as net assets with donor restrictions. When the purpose of the restriction is accomplished, or passage of time has occurred, net assets with donor restrictions are reclassified to net assets without donor restrictions and reported in the statements of activities as net assets released from restrictions.

Gifts of cash restricted for the purpose of acquiring or constructing long-lived assets are recorded as net assets with donor restrictions until the long-lived assets are acquired or constructed at which time the net assets are released from the restriction and reclassified as net assets without donor restrictions. Any conditional gifts for which the conditions are not met at year-end are recorded as refundable advances.

Patents

Patents are stated at the cost to acquire. Amortization is provided for using the straight-line method over the estimated useful life of ten years.

Contributed Services and Nonfinancial Assets

A substantial number of volunteers have made significant contributions of their time to the operations of the Laboratory. The amount of volunteer hours contributed to the Laboratory during the years ended September 30, 2021 and 2020 were 160,208 and 156,660 hours, respectively. The estimated value of these donated services has not been recorded in the accompanying financial statements because it does not meet the criteria for recognition under generally accepted accounting principles.

However, management estimates the fair value of these services contributed to the Laboratory during the years ended September 30, 2021 and 2020 amounted to $4,572,324 and $4,261,152, respectively. These estimates are based on an article published in the NonProfit Times that estimates volunteer time to be worth $28.54 and $27.20 per hour in 2021 and 2020, respectively, according to the Independent Sector, a Washington D.C. based coalition of nonprofits and foundations.

2. Summary of Significant Accounting Policies (Continued)

Contributed Services and Nonfinancial Assets (Continued)

Contributed nonfinancial assets are recognized at their estimated fair value when they create or enhance nonfinancial assets, they require specialized skills that would need to be purchased if they were not donated, or they are nonfinancial assets which are directed by the Laboratory for its benefit and have been provided at no cost. Amounts are recorded at their estimated fair value at the date of donation using published rates and prices. Contributed nonfinancial assets for the year ended September 30, 2021 totaled $600,000 and is included in construction in progress on the statements of financial position. There were no contributed nonfinancial assets for the year ended September 30, 2020.

Donated property and vessels, which are not classified by management for use by the Laboratory, are recorded as assets held for sale. The carrying value of such assets is adjusted to the lower of fair market value or the recorded value at the date of gift in order to more closely reflect the net realizable value.

Advertising and Promotion

Advertising and promotion costs are expensed as incurred. Advertising and promotion expense for the years ended September 30, 2021 and 2020 totaled $345,836 and $367,585, respectively.

Income Tax Status

The Laboratory is exempt from income taxes under Section 501(c)(3) of the Internal Revenue Code.

Under the Income Taxes topic of the FASB Accounting Standards Codification, the Laboratory has reviewed and evaluated the relevant technical merits of each of its tax positions in accordance with accounting principles generally accepted in the United States of America for accounting for uncertainty in income taxes, and determined that there are no uncertain tax positions that would have a material impact on the financial statements of the Laboratory.

The Laboratory files income tax returns in the U.S. federal jurisdiction and the State of Florida. The tax periods open to examination by the major taxing jurisdictions to which the Laboratory is subject include fiscal years ended September 30, 2018 through September 30, 2021.

Financial Instruments Not Measured at Fair Value

Certain of the Laboratory's financial instruments are not measured at fair value on a recurring basis but nevertheless certain financial instruments are recorded at amounts that approximate fair value due to their liquid or short-term nature. Such financial assets and financial liabilities include cash and cash equivalents, accounts receivable, due from Mote Marine Foundation, Inc., prepaid expenses and other assets, accounts payable, accrued payroll, memberships relating to future periods, funds advanced on research programs and deferred compensation payable.

Overhead Allocation

Overhead is allocated to research programs at a rate established with the cognizant federal agency, The Department of Commerce and National Oceanic and Atmospheric Administration. Certain research contracts limit the amount of reimbursement for overhead expenses to a rate specified in the individual contracts.

2. Summary of Significant Accounting Policies (Continued)

Functional Allocation of Expenses

The costs of providing the various programs and other activities have been summarized on a functional basis in the statement of activities. Accordingly, certain costs have been allocated among the programs and supporting services that benefited. The expenses that are allocated include salaries, benefits, payroll taxes, depreciation, and other expenses for services which are allocated on the basis of estimated time and effort.

Cash and Cash Equivalents

Cash on hand and highly liquid investments with a maturity of three months or less at date of acquisition are considered to be cash and cash equivalents. Cash restricted for the endowment and included as cash and cash equivalents in the financial statements amounted to $552,508 and $301,568 as of September 30, 2021 and 2020, respectively.

Beneficial Interest in the Net Assets of Mote Marine Foundation, Inc.

The Laboratory follows the *Not-for-Profit Entities* Topic of the FASB Accounting Standards Codification. *The Not-for-Profit Entities* Topic establishes standards for transactions in which a donor makes a contribution to a not-for-profit organization (the recipient) that agrees to transfer those assets to another entity (the beneficiary). The statement requires that, if the specified beneficiary is financially interrelated to the recipient organization, the beneficiary must recognize its interest in the net assets of the recipient organization. As presented in the financial statements, the Laboratory is financially interrelated to Mote Marine Foundation, Inc. and therefore, is required to report its beneficial interest in the net assets of Mote Marine Foundation, Inc.

Reclassifications

To facilitate comparison of financial data, certain amounts in the 2020 financial statements have been reclassified to conform to the 2021 reporting presentation. Such reclassifications had no effect on the change in net assets previously reported.

3. Liquidity and Availability

Financial assets available within one year of the statement of financial position date for general expenditures are as follows:

	2021	2020
Cash and cash equivalents	$ 16,351,517	$ 11,279,117
Accounts receivable	4,295,917	4,901,537
Pledges receivable	7,847,579	7,752,054
Due from Mote Marine Foundation, Inc.	529,282	719,638
Investments - certificates of deposit	392,197	627,629
Beneficial interest in the net assets of Mote Marine Foundation, Inc.	20,678,361	17,141,448
Total financial assets available	50,094,853	42,421,423
Less: Amounts unavailable for general expenditures within one year due to:		
Investments - certificates of deposit without donor restrictions maturing after one year	(392,197)	(627,629)
Restricted by donors with purpose and time restrictions	(24,684,247)	(19,064,139)
Restricted by donors in perpetuity	(10,046,114)	(10,039,589)
Total amounts unavailable for general expenditures within one year	(35,122,558)	(29,731,357)

3. Liquidity and Availability (Continued)

	2021	2020
Less: Amounts unavailable to management without Board approval:		
Board designated for SEA project	(390,818)	(390,818)
Total financial assets available to management for general expenditure within one year	$ 14,581,477	$ 12,299,248

The Laboratory manages its liquid assets in accordance with regular budgeting processes developed through the coordinated efforts of management and the Board of Trustees. Monthly reporting by management to those charged with governance ensures the results from operating activities are monitored closely.

The Board of Trustees has designated $390,818 as of September 30, 2021 and 2020, respectively, for the construction of the Mote Science Education Aquarium. Although the Laboratory does not intend to spend from board designated funds, these amounts could be made available if necessary.

4. Pledges Receivable

At September 30, 2021 and 2020, the Laboratory held written unconditional pledges receivable in the amounts of $7,942,514 and $7,810,000, respectively. The pledges have been restricted by the donors for future projects. Management considers all pledges receivable to be fully collectible as of September 30, 2021 and 2020, therefore no allowance for uncollectible pledges has been established.

Pledges receivable consist of the following as of September 30:

	2021	2020
Pledges receivable	$ 7,942,514	$ 7,810,000
Less: discount to net present value (rates of 1% and .40%)	(94,935)	(57,946)
Pledges receivable, net	7,847,579	7,752,054
Less amount due in less than one year	3,739,647	2,177,500
Amount collectible in one to five years	$ 4,107,932	$ 5,574,554

5. Accounts Receivable

Accounts receivable consists of the following at September 30:

	2021	2020
Costs billed on research grants and other contracts	$ 1,442,217	$ 3,401,103
Unbilled costs incurred on research grants	2,844,855	1,497,584
Accounts receivable - other	8,845	2,850
	$ 4,295,917	$ 4,901,537

During the years ended September 30, 2021 and 2020, the Laboratory had no write-offs of uncollectible accounts receivable.

6. Investments

The Laboratory has certificates of deposit that earn interest at rates ranging between 3.0% and 3.45% and mature in one to twenty-five months. As of September 30, 2021, the certificates of deposit totaled $392,197 and are stated at fair value. As of September 30, 2020, the certificates of deposit totaled $627,629 and are stated at fair value. Of these amounts, $127,576 and $370,754 is restricted for endowments as of September 30, 2021 and 2020, respectively. There were no unrealized gains on the certificates of deposit for the years ended September 30, 2021 and 2020, respectively.

The Laboratory had realized gains of $2,689 and $1,017 on the sales of investments in for the years ended September 30, 2021 and 2020, respectively.

Additionally, assets held at a community foundation during the years ended September 30, 2021 and 2020 incurred unrealized losses of $8,612 and unrealized gains of $1,148, respectively.

7. Property and Equipment

Property and equipment consists of the following as of September 30:

	2021	2020
Vehicles	$ 591,237	$ 705,541
Vessels	1,544,500	1,575,515
Buildings and improvements	42,570,072	42,616,856
Furniture, fixtures and exhibits	5,199,638	8,560,012
Laboratory equipment	9,583,282	11,082,647
Trailers	109,131	109,902
	59,597,860	64,650,473
Less accumulated depreciation	44,598,175	48,268,642
	$ 14,999,685	$ 16,381,831

Depreciation expense was $2,862,696 and $2,910,709 for the years ended September 30, 2021 and 2020, respectively.

Construction in progress consists of the following at September 30:

	2021	2020
Mote Science Education Aquarium preconstruction	$ 15,905,034	$ 5,195,720
Aquarium and Laboratory improvements	67,506	-
	$ 15,972,540	$ 5,195,720

In accordance with contract provisions, the Laboratory has segregated and identified property and equipment that has been purchased or improved with funds received from government agencies. Title to these assets acquired with government agency funds vests with the Laboratory as long as the Laboratory has a contract with the agency. Upon contract termination, title to these assets reverts to the agencies. At September 30, 2021 and 2020, property and equipment purchased or improved with funds received from government agencies, net of accumulated depreciation, totaled $756,662 and $95,831, respectively.

8. Patents

During the years ended September 30, 2021 and 2020, the Laboratory incurred costs to maintain certain patents. The costs capitalized and the related amortization provided for is as follows:

	2021	2020
Patents	$ 197,344	$ 190,453
Less: accumulated amortization	109,205	94,673
	$ 88,139	$ 95,780

No significant residual value is estimated for these patents. Amortization expense for the years ended September 30, 2021 and 2020 totaled $17,108 and $17,951, respectively.

The following table represents the total estimated amortization of patents for the five succeeding years and thereafter ending September 30:

2022	$ 16,971
2023	16,284
2024	15,320
2025	13,619
Thereafter	25,945
	$ 88,139

9. Long-Term Debt

Notes Payable

Notes payable consists of the following as of September 30:

	2021	2020
Note payable in 180 monthly installments of $17,579 plus interest based on overnight LIBOR plus 2.18%, maturing on August 5, 2028 and secured with personal property and pledges and guaranteed by Mote Marine Foundation, Inc. with a $1,500,000 limitation. Interest rate at September 30, 2021 was 2.26%.	$ 1,880,960	$ 2,091,909
Note payable in 60 monthly installments of $624, interest at 2.39% due 2021, secured by vehicle.	622	8,002
Note payable in 48 monthly installments of $348, interest at 3.64% due 2022, secured by vehicle.	1,381	5,431
Note payable in 60 monthly installments of $665, interest at 2.39% due 2021, secured by vehicle.	663	8,530
Note payable in 48 monthly installments of $382, interest at 3.64% due 2022, secured by vehicle.	1,516	5,957
Note payable in 60 monthly installments of $413, interest at 2.39% due 2021, secured by vehicle.	411	5,289
Note payable in 60 monthly installments of $427, interest at 4.44% due 2024, secured by vehicle.	13,654	18,060

9. Long-Term Debt (Continued)
Notes Payable (Continued)

		2021		2020
Note payable in 60 monthly installments of $695, interest at 3.99% due 2024, secured by vehicle.		19,794		27,180
Note payable in 119 monthly installments of $13,668 plus 4.2% interest, with final payment of $1,348,395 due on October 1, 2028, secured by mortgage on real property located in Sarasota County.		1,989,276		2,066,425
Note payable annually at $200,000 plus 0.5% interest. A final balloon payment is due July 11, 2027. Additionally, the payment scheduled for fiscal year 2021 is due as part of the final balloon payment.		1,840,000		1,840,000
Note payable for insurance premiums financed by a third party. The note is payable in 22 installments of $63,845, which include principal and interest at 3.99%, due in 2023.		966,765		-
		6,715,042		6,076,783
Less current portion		1,250,216		330,146
Non-current portion	$	5,464,826	$	5,746,637

Interest expense incurred under these notes payable totaled $140,352 and $155,466 for the years ended September 30, 2021 and 2020, respectively.

Lines of Credit

Pursuant to loan agreements with two banks, the Laboratory has a revolving line of credit of $1,500,000 with each bank. One loan agreement expires on December 14, 2021 and the other is open-ended subject to renewal provisions. Interest on one line of credit is charged at the bank's prime rate less a margin of 1.25% with a 0% floor and is payable monthly. At September 30, 2021 and 2020, borrowings outstanding under this line of credit and secured by pledges and accounts receivable of the Laboratory amounted to $1,217,102.

Interest on the second revolving line of credit is charged at one month LIBOR plus 1.90% per annum, payable monthly. There were no borrowings outstanding at September 30, 2021 and 2020. This line of credit is secured by assets of Mote Marine Foundation, Inc.

The Laboratory also has a line of credit of $185,000 from Sarasota-Manatee Airport Authority. The loan represents advanced funding for the improvements to the Airport Aquarium and has no expiration date or interest rate and will be repaid with any funds raised associated with the Airport Aquarium. At September 30, 2021 and 2020, borrowings outstanding totaled $185,000.

The multiple lines of credit outstanding at September 30, 2021 and 2020 totaled $1,402,101.

Interest expense incurred under these lines of credit totaled $21,570 and $37,771 for the years ended September 30, 2021 and 2020, respectively.

Certain loan agreements described above require that the Laboratory meet certain debt covenant compliance requirements. As of September 30, 2021, the Laboratory was in full compliance with all requirements.

9. Long-Term Debt (Continued)

Paycheck Protection Program Forgivable Loan

On April 16, 2020, the Laboratory qualified for and received a loan pursuant to the Paycheck Protection Program, a program implemented by the U.S. Small Business Administration (the SBA) under the Coronavirus Aid, Relief, and Economic Security Act for an aggregate principal amount of $2,318,259 (the PPP Loan). The Laboratory applied for forgiveness of the PPP Loan in September 2020. On April 30, 2021, the Laboratory received notice of forgiveness from the SBA of the entire principal of $2,318,259 and the 1% calculated accrued interest of $24,072. The Laboratory has recorded $2,318,259 as Paycheck Protection Program loan forgiveness in the statement of activities for the year ended September 30, 2021. The Laboratory did not accrue interest on the PPP Loan. The outstanding balance of the PPP Loan was $2,318,259 as of September 30, 2020.

Future Maturities of Long-Term Debt

Aggregate maturities of long-term debt at September 30, are as follows:

2022	$ 1,250,216
2023	736,170
2024	508,469
2025	503,993
2026	507,977
Thereafter	3,208,217
Total	$ 6,715,042

10. Net Assets with Donor Restrictions

Net assets with donor restrictions are available for the following purposes as of September 30:

	2021	2020
Subject to expenditure for specific purpose:		
Future projects	$ 659,700	$ 119,697
Construction	13,660,702	11,741,595
Library expenses	26,587	26,587
Beneficial interest in net assets of Mote Marine Foundation, Inc.	10,337,258	7,176,260
Total purpose restrictions	24,684,247	19,064,139
Perpetual in nature:		
Cultural endowment	600,000	600,000
Keys endowment	12,050	12,050
Beneficial interest in the net assets of Mote Marine Foundation, Inc.	9,434,064	9,427,539
Total perpetual in nature restrictions	10,046,114	10,039,589
Total net assets with donor restrictions	$ 34,730,361	$ 29,103,728

11. Net Assets Released from Restrictions

Net assets released from donor restriction by incurring expenses satisfying the restricted purposes as of September 30:

	2021	2020
Aquarium expenses	$ 32,883	$ 33,334
Other	-	345,349
Library	2,000	-
Construction	9,916,474	4,441,027
	$ 9,951,357	$ 4,819,710

12. Retirement Plan

The Laboratory provides a 403(b) retirement plan. The Laboratory matches employee contributions based on an employee's length of service and gross salary. Retirement plan expense was $578,363 and $612,105 for the years ended September 30, 2021 and 2020, respectively.

13. Matching Requirements on Governmental Grants

The Laboratory is awarded grants from federal agencies which require matching contributions by the Laboratory. The matching requirements were met or exceeded on completed federal grants during 2021 and 2020.

14. Rental Use Charges

Periodically, certain programs require utilization of vessels, vehicles and equipment provided by the Laboratory. Each program is charged rent, based on use, at a pre-established rental fee that reflects the cost of operating the asset.

15. Financial Instruments with Off-Balance Sheet Risk

The Laboratory maintains its cash in bank deposit accounts which, at times, may exceed federally insured limits. Accounts are guaranteed by the Federal Deposit Insurance Corporation (FDIC) up to certain limits. At any given time, the Laboratory may have cash and investment balances exceeding the insured amount. The Laboratory has not experienced any losses in such accounts and does not believe it is exposed to any significant credit risk on cash and investments.

16. Related Party Transactions

The Mote Marine Foundation, Inc. (Foundation), a financially interrelated organization, provides support to the Laboratory in the form of grants. For the years ended September 30, 2021 and 2020, the Laboratory received grants from the Foundation in the amount of $524,748 and $985,483, respectively.

Mote Marine Foundation, Inc. is dependent on Laboratory personnel for administration and certain aspects of fund raising.

From time to time, the Laboratory will provide grants, receive donations and pay certain expenses on behalf of the Foundation. As of September 30, 2021 and 2020, the Foundation owed the Laboratory $529,282 and $719,638 respectively.

Certain trustee members are affiliated with organizations that transact with the Laboratory. Trustee members are required to complete conflict of interest disclosure statements and abstain from voting on related issues.

During the years ended September 30, 2021 and 2020, a trustee donated the use of an aircraft for travel accommodations for employees and trustees. The value of this donation for the years ended September 30, 2021 and 2020 is estimated to be $2,603 and $2,364, respectively.

From time to time, the trustees make pledges and contributions to the Laboratory.

17. Leased Facility

The Laboratory has a leasehold agreement with a municipality for real property on which the Laboratory has constructed its facilities. The agreement requires the Laboratory to pay the municipality one dollar per year until the agreement expires in the year 2050. The fair market value of the leasehold agreement is not determinable and therefore has not been recorded in the accompanying financial statements.

18. Endowments

The Laboratory's endowment consists of funds established for several purposes. Its endowment includes donor-restricted endowment funds. As required by accounting principles generally accepted in the United States of America, net assets associated with endowment funds are classified and reported based on the existence or absence of donor-imposed restrictions. It is typical to establish all endowment funds in Mote Marine Foundation, Inc.

Interpretation of Relevant Law

The Board of Trustees of the endowment has interpreted the Florida Uniform Prudent Management of Institutional Funds Act (FUPMIFA) as requiring the preservation of the fair value of the original gift as of the gift date of the donor-restricted endowment funds absent explicit donor stipulations to the contrary. As a result of this interpretation, the Laboratory classifies as net assets with donor restrictions in perpetuity (a) the original value of gifts donated to the perpetual endowment and (b) the original value of subsequent gifts to the perpetual endowment.

Endowment Net Asset Composition

As of September 30, 2021, endowment net assets consisted of the following:

	With Donor Restrictions
Donor-restricted endowment funds:	
Endowment balance	$ 612,050
Un-appropriated income with purpose restrictions	14,281
Total donor-restricted endowment funds	$ 626,331

As of September 30, 2020, endowment net assets consisted of the following:

	With Donor Restrictions
Donor-restricted endowment funds:	
Endowment balance	$ 612,050
Un-appropriated income with purpose restrictions	10,809
Total donor-restricted endowment funds	$ 622,859

Changes in endowment net assets for the year ended September 30, 2021 are as follows:

	With Donor Restrictions
Endowment net assets, October 1, 2020	$ 622,859
Endowment investment return:	
Investment income	205
Realized and unrealized gains	3,267
Total endowment investment return	3,472
Appropriation of endowment for expenditures	-
Endowment net assets, September 30, 2021	$ 626,331

18. Endowments (Continued)

Changes in Endowment Net Assets (Continued)

Changes in endowment net assets for the year ended September 30, 2020 are as follows:

		With Donor Restrictions
Endowment net assets, October 1, 2019	$	622,492
Endowment investment return:		
Investment income		344
Realized and unrealized gains		23
Total endowment investment return		367
Appropriation of endowment for expenditures		-
Endowment net assets, September 30, 2020	$	622,859

Funds with Deficiencies

From time to time, the fair value of assets associated with individual donor restricted endowment funds may fall below the level classified as net assets with donor restrictions that are perpetual in nature. These deficiencies result from unfavorable market fluctuations that occurred shortly after the investment of new contributions of net assets with donor restrictions that are perpetual in nature and continued appropriation for certain programs that was deemed prudent by the Board of Trustees. There were no deficiencies of this nature reported in net assets without donor restrictions as of September 30, 2021 and 2020.

Return Objectives and Risk Parameters

The Laboratory has adopted investment policies and spending polices for endowment assets that attempt to provide a predictable stream of funding to programs supported by its endowment while seeking to maintain the purchasing power of the endowment assets. Endowment assets include those assets of donor-restricted funds that the Laboratory must hold in perpetuity or for donor-specified periods. Under this policy, as approved by the Board of Trustees, the endowment assets are invested in a manner that is intended to produce a long-term rate of return on assets of to match or exceed the rate of return determined from the sum of the annual distribution percentage, inflation measured by the CPI, and real growth of 1%.

The Cultural Endowment Program has a primary investment constraint to preserve principal along with restrictions on investment instruments, so the Laboratory uses an alternative approved investment policy for this program.

Strategies Employed for Achieving Objectives

To satisfy its long-term rate-of-return objectives, the Laboratory relies on a total return strategy in which investment returns are achieved through both capital appreciation (realized and unrealized) and current yield (interest and dividends). The Laboratory targets a diversified asset allocation that places a greater emphasis on equity-based investments to achieve its long-term return objectives within prudent risk constraints.

18. Endowments (Continued)

Spending Policy and How the Investment Objectives Relate to Spending Policy

The Laboratory has a policy of appropriating for distribution each year 5% percent of its endowment funds average fair value over the period of 12 quarters through the calendar year end preceding the fiscal year in which the distribution is planned. In establishing this policy, the Laboratory considered the long-term expected return on its endowment. Accordingly, over the long term, the Laboratory expects the current spending policy to allow its endowment to grow at an average of 1% percent annually. This is consistent with the Laboratory's objective to maintain the purchasing power of the endowment assets held in perpetuity or for a specified term as well as to provide additional real growth through new gifts and investment return. The established policy for the Cultural Endowment Program distributes 100% of current income for use in operating costs for cultural activities expecting no further growth in this endowment.

19. Fair Value of Financial Assets and Liabilities

The Laboratory adopted the Fair *Value Measurements and Disclosures* Topic of the FASB Accounting Standards Codification which provides enhanced guidance for using fair value to measure assets and liabilities and clarifies the principle that fair value should be based on the assumptions market participants would use when pricing the assets or liabilities and establishes a hierarchy that prioritizes the information used to develop those assumptions. The Laboratory has adopted Accounting Standards Update No. 2010-06, *Improving Disclosures about Fair Value Measurements*, which requires the Laboratory to present fair value measurements separately for each class of assets and liabilities held as of September 30, 2021 and 2020.

The following tables present information about the Laboratory's assets and liabilities that are measured at fair value on a recurring and non-recurring basis as of September 30, 2021 and 2020, and indicate the fair value hierarchy of the valuation techniques used to determine such fair value. The three levels for measuring fair value are based on the reliability of inputs and are as follows:

Level 1 - quoted market prices in active markets for identical assets or liabilities, such as publicly traded equity securities. This level includes common and preferred stock, cash and money market funds, mutual funds, corporate bonds and bond funds, and government obligations.

Level 2 - inputs, other than quoted prices included in Level 1 that are observable, either directly or indirectly. Such inputs may include quoted prices for similar assets, observable inputs other than quoted prices (interest rates, yield curves, etc.), or inputs derived principally from or corroborated by observable market data by correlation or other means.

Level 3 - inputs are unobservable data points for the asset or liability, and include situations where there is little, if any, market activity for the asset or liability. The inputs reflect the Laboratory's assumptions based on the best information available in the circumstance.

The following sets forth the fair value hierarchy by level for the Laboratory's assets measured at fair value on a recurring basis as of September 30, 2021:

Description	Total	Level 1	Level 2	Level 3	NAV*
Beneficial interest in the net assets of Mote Marine Foundation, Inc.	$ 20,894,243	$ 18,136,475	$ 2,736,253	$ -	$ 21,515

19. Fair Value of Financial Assets and Liabilities (Continued)

The following sets forth the fair value hierarchy by level for the Laboratory's assets measured at fair value on a non-recurring basis as of September 30, 2021:

Description	Total	Level 1	Level 2	Level 3	NAV*
Beneficial interest in the net assets of Mote Marine Foundation, Inc.	$ 16,144	$ -	$ -	$ 16,144	$ -
Pledges receivable	7,847,579	-	-	7,847,579	-
Ending balance	$ 7,863,723	$ -	$ -	$ 7,863,723	$ -

The following sets forth the fair value hierarchy by level for the Laboratory's assets measured at fair value on a recurring basis as of September 30, 2020:

Description	Total	Level 1	Level 2	Level 3	NAV*
Beneficial interest in the net assets of Mote Marine Foundation, Inc.	$ 17,516,824	$ 14,857,801	$ 2,623,498	$ -	$ 35,525

The following sets forth the fair value hierarchy by level for the Laboratory's assets measured at fair value on a non-recurring basis as of September 30, 2020:

Description	Total	Level 1	Level 2	Level 3	NAV*
Beneficial interest in the net assets of Mote Marine Foundation, Inc.	$ 39,797	$ -	$ -	$ 39,797	$ -
Pledges receivable	7,752,054	-	-	7,752,054	-
Ending balance	$ 7,791,851	$ -	$ -	$ 7,791,851	$ -

(*)Certain investments of Mote Marine Foundation, Inc. that are measured at fair value using the net asset value (NAV) per share (or its equivalent) practical expedient have not been categorized in the fair value hierarchy. The fair value amounts presented in the tables above are intended to permit reconciliation of the fair value hierarchy to the amounts presented in the statements of financial position.

20. Subsequent Events

The Laboratory has evaluated all events subsequent to the statement of financial position date of September 30, 2021 and through the date these financial statements were available to be issued, April 13, 2022, and have determined that, except as set forth below, there are no subsequent events that require disclosure.

In October 2021, the Laboratory transferred cash in the amount of $5,736,170 to an escrow account pursuant to the terms of an agreement between the Laboratory and Sarasota County. The depositing of funds into the escrow account allowed the Laboratory to begin the Enabling Work phase of construction of the Mote Science Education Aquarium.

Supplemental Information

Mote Marine Laboratory, Inc.
Schedule of Expenditures of Federal Awards and
State Financial Assistance
Year Ended September 30, 2021

Grantor	Assistance Listing # or CSFA#	Pass-through Entity Identification or Grant Number	Total Expenditures		Transfer to Subrecipients
Federal Contracts and Grants					
RESEARCH AND DEVELOPMENT CLUSTER					
Department of Agriculture					
Agricultural Research Service					
Agricultural Research Basic and Applied Research					
Passed through Florida Atlantic University	10.001	59-6034-9-007	$ 135,341	$ 135,341	$ -
Department of Commerce					
National Oceanic and Atmospheric Administration (NOAA)					
Ocean Exploration	11.011	NA18OAR0110291	7,260	7,260	2,516
Integrated Ocean Observing System (IOOS)					
Passed through Texas A&M University	11.012	NA16NOS0120018	107,158		
Passed through Southeast Coastal Ocean Observing Regional Association	11.012	NA16NOS0120028	66,556	173,714	-
Sea Grant Support					
Passed through University of Florida	11.417	NA18OAR4170085	65,261		
Passed through University of Miami	11.417	NA19OAR4170414	77,018	142,279	33,733
Fisheries Development and Utilization Research and					
Development Grants and Cooperative Agreements Program	11.427	NA20NMF4270199	124,115		
	11.427	NA18NMF4270201	38,840	162,955	16,617
National Oceanic and Atmospheric Administration					
(NOAA) Cooperative Institutes					
Passed through Research Foundation CUNY	11.432	16126-Z7813001	6,383	6,383	-
Marine Fisheries Initiative	11.433	NA15NMF4330152	65,574	65,574	14,443
Marine Mammal Data Program	11.439	NA19NMF9390178	22,638		
	11.439	NA20NMF4390106	41,003		
	11.439	NA18NMF4390064	3,360		
	11.439	NA17NMF4390089	10,790	77,791	2,443
Unallied Management Projects					
Passed through National Fish and Wildlife Foundation	11.454	NA16NMF4540085	8,932		
	11.454	NA16NMF4540289	500		
	11.454	NA20NMF4540082	191,192	200,624	20,500
Habitat Conservation	11.463	NA19NMF4630259	740,456	740,456	-
Unallied Science Program					
Passed through National Fish and Wildlife Foundation	11.472	NA18NMF4720287	2,265		
	11.472	NA20NMF4720265	93,399		
	11.472	NA19NMF4720290	195,706		
Passed through Florida Fish & Wildlife Conservation Commission	11.472	NA15NMF4720018	47,374	338,744	79,862
Office for Coastal Management					
Passed through National Fish and Wildlife Foundation	11.473	NA18NOS4730204	505,267		
	11.473	NA20NOS4730027	170,209	675,476	-
Center for Sponsored Coastal Ocean Research Coastal Ocean Program	11.478	NA19NOS4780183	514,997		332,591
Passed through Florida International University	11.478	NA18NOS4780171	17,664	532,661	-
Environmental Protection Agency					
Office of Water					
Surveys, Studies, Investigations, Demonstrations,					
and Training Grants and Cooperative Agreements -					
Section 104(b)(3) of the Clean Water Act					
Passed through Florida Fish & Wildlife Conservation Commission	66.436	01D00820	20,789	20,789	-

Mote Marine Laboratory, Inc.
Schedule of Expenditures of Federal Awards and
State Financial Assistance (Continued)
Year Ended September 30, 2021

Grantor	Assistance Listing # or CSFA#	Pass-through Entity Identification or Grant Number		Total Expenditures	Transfer to Subrecipients
Federal Contracts and Grants (Continued)					
RESEARCH AND DEVELOPMENT CLUSTER (Continued)					
National Science Foundation					
Geosciences	47.050	1452538	78,272		
	47.050	2050892	114,217		
	47.050	1928817	15,421		
	47.050	OCE - 1757419	17,485		
	47.050	1923926	51,261	276,656	-
Education and Human Resources	47.076	1922351	578,250	578,250	24,263
U.S. Department of Defense					
Defense Advanced Research Projects Agency (DARPA)					
Research and Technology Development					
Passed through Florida Atlantic University	12.910	AWD - 001612 / AWD - 002091	110,237	110,237	-
Department of the Interior					
U.S. Fish and Wildlife Service					
State Wildlife Grants					
Passed through Florida Fish & Wildlife Conservation Commission	15.634	FL-T-F18AF00492	32,302	32,302	-
National Park Service					
National Park Service Conservation, Protection, Outreach and Education	15.954	P19AC01005	87,189	87,189	-
Department of Treasury					
Resources and Ecosystems Sustainability, Tourist Opportunities, and Revived Economies of the Gulf Coast States					
Passed through The Nature Conservancy	21.015	RDCGR170068	63,353		
Passed through the Florida Institute of Oceanography	21.015	8-RCEGR020005-01-02	37,094	100,447	-
Department of State					
General Department of State Assistance	19.700	SIS-70017G33038	156,100	156,100	139,006
TOTAL RESEARCH AND DEVELOPMENT CLUSTER				$ 4,621,228	$ 665,974
Total Federal Contracts and Grants				$ 4,621,228	$ 665,974
State Contracts and Grants					
State of Florida					
Florida Fish & Wildlife Conservation Commission					
Cooperative Red Tide Research Program - Reduction of Harmful Impacts from Red Tide - Red Tide Mitigation and Technology Development Initiative	77.010	15003	162,511		
	77.010	19153	3,330,116		75,609
	77.010	20034	1,026,695	4,519,322	
Marine Fisheries Assessment	77.023	16024-A1	36,142		
	77.023	16024-A3	158,256		
	77.023	20,317	85,158	279,556	-
Mote Marine Laboratory Coral Reef Restoration Program	77.036	20151	739,999	739,999	-
Department of Highway Safety & Motor Vehicles					
Protect Wild Dolphins License Plate Project	76.011	1600	554	554	-
Protect Our Reefs License Plate Project	76.069	POR	1,016,724	1,016,724	46,043
Sea Turtle License Plate Project	76.070	20-004C	265		
	76.070	20-022R	2,551		
	76.070	21-033C	16,095	18,911	-
Department of Environmental Protection					
Coral Reef Protection and Restoration Grant	37.107	C2002	75,371	75,371	-
Department of Economic Opportunity					
Division of Housing and Community Development	40.038	HL120	1,010,268	1,010,268	-
Total State Contracts and Grants				$ 7,660,705	$ 121,652
Total Federal and State Contracts and Grants				$ 12,281,933	$ 787,626

1. Basis of Presentation

The accompanying schedule of expenditures of federal awards (the Schedule) includes the federal award and state financial assistance activity of Mote Marine Laboratory, Inc. under programs of the federal government and State of Florida for the year ended September 30, 2021. The information in this Schedule is presented in accordance with the requirements of Title 2 U.S. Code of Federal Regulations Part 200, *Uniform Administrative Requirements, Cost Principles, and Audit Requirements for Federal Awards* (Uniform Guidance) and Chapter 10.650, Rules of the Auditor General. Because the Schedule presents only a selected portion of the operations of Mote Marine Laboratory, Inc., it is not intended to and does not present the financial position, changes in net assets, or cash flows of Mote Marine Laboratory, Inc.

2. Summary of Significant Accounting Policies

Expenditures reported on the Schedule are reported on the accrual basis of accounting. Such expenditures are recognized following the cost principles contained in the Uniform Guidance, wherein certain types of expenditures are not allowable or are limited as to reimbursement.

3. Indirect Cost Election

Mote Marine Laboratory, Inc. has not elected to use the 10% de minimis cost rate as allowed under the Uniform Guidance, and has a federally negotiated rate with its cognizant agency.

Contract Compliance

Kerkering, Barberio & Co.
Certified Public Accountants

Report on Internal Control Over Financial Reporting and on Compliance and Other Matters Based on an Audit of Financial Statements Performed in Accordance With *Government Auditing Standards*

Independent Auditor's Report

The Board of Trustees
Mote Marine Laboratory, Inc.
Sarasota, Florida

We have audited, in accordance with the auditing standards generally accepted in the United States of America and the standards applicable to financial audits contained in *Government Auditing Standards*, issued by the Comptroller General of the United States and Chapter 10.650, *Rules of the Auditor General*, the financial statements of Mote Marine Laboratory Inc. (Laboratory), which comprise the statement of financial position as of September 30, 2021, and the related statement of activities, and cash flows for the year then ended, and the related notes to the financial statements, and have issued our report thereon dated April 13, 2022.

Internal Control over Financial Reporting
In planning and performing our audit of the financial statements, we considered the Laboratory's internal control over financial reporting (internal control) as a basis for designing audit procedures that are appropriate in the circumstances for the purpose of expressing our opinion on the financial statements, but not for the purpose of expressing an opinion on the effectiveness of the Laboratory's internal control. Accordingly, we do not express an opinion on the effectiveness of the Laboratory's internal control.

A *deficiency in internal control* exists when the design or operation of a control does not allow management or employees, in the normal course of performing their assigned functions, to prevent, or detect and correct, misstatements on a timely basis. A *material weakness* is a deficiency, or a combination of deficiencies, in internal control, such that there is a reasonable possibility that a material misstatement of the entity's financial statements will not be prevented, or detected and corrected, on a timely basis. A *significant deficiency* is a deficiency, or a combination of deficiencies, in internal control that is less severe than a material weakness, yet important enough to merit attention by those charged with governance.

Our consideration of internal control was for the limited purpose described in the first paragraph of this section and was not designed to identify all deficiencies in internal control that might be material weaknesses or significant deficiencies. Given these limitations, during our audit we did not identify any deficiencies in internal control that we consider to be material weaknesses. However, material weaknesses may exist that have not been identified.

Compliance and Other Matters
As part of obtaining reasonable assurance about whether the Laboratory's financial statements are free from material misstatement, we performed tests of its compliance with certain provisions of laws, regulations, contracts and grant agreements, noncompliance with which could have a direct and material effect on the financial statements. However, providing an opinion on compliance with those provisions was not an objective of our audit, and accordingly, we do not express such an opinion. The results of our tests disclosed no instances of noncompliance or other matters that are required to be reported under *Government Auditing Standards.*

Purpose of this Report
The purpose of this report is solely to describe the scope of our testing of internal control and compliance and the results of that testing, and not to provide an opinion on the effectiveness of the entity's internal control or on compliance. This report is an integral part of an audit performed in accordance with *Government Auditing Standards* in considering the entity's internal control and compliance. Accordingly, this communication is not suitable for any other purpose.

Kerkering, Barberio & Co.

Sarasota, Florida
April 13, 2022

KERKERING
BARBERIO

Kerkering, Barberio & Co.
Certified Public Accountants

Report on Compliance for Each Major Federal Program and State Project; and Report on Internal Control over Compliance Required by the Uniform Guidance and Chapter 10.650, *Rules of the Auditor General* of the State of Florida

Independent Auditor's Report

The Board of Trustees
Mote Marine Laboratory, Inc.
Sarasota, Florida

Report on Compliance for Each Major Federal Program and State Financial Assistance Project

We have audited Mote Marine Laboratory, Inc.'s (Laboratory) compliance with the types of compliance requirements described in the *OMB Compliance Supplement* and the requirements described in the State of Florida Department of Financial Services Statements Projects Compliance Supplement that could have a direct and material effect on each of the Laboratory's major federal programs and state financial assistance projects for the year ended September 30, 2021. The Laboratory's major federal programs and state financial assistance projects are identified in the summary of auditor's results section of the accompanying schedule of findings and questioned costs.

Management's Responsibility

Management is responsible for compliance with federal statutes, regulations, and the terms and conditions of its federal and state awards applicable to its federal programs and state financial assistance projects.

Auditor's Responsibility

Our responsibility is to express an opinion on compliance for each of the Laboratory's major federal programs and state financial assistance projects based on our audit of the types of compliance requirements referred to above. We conducted our audit of compliance in accordance with auditing standards generally accepted in the United States of America; the standards applicable to financial audits contained in *Government Auditing Standards*, issued by the Comptroller General of the United States; and the audit requirements of Title 2 U.S. *Code of Federal Regulations (CFR)* Part 200, *Uniform Administrative Requirements, Cost Principles, and Audit Requirements for Federal Awards* (Uniform Guidance) and Chapter 10.650, *Rules of the Auditor General.* Those standards, and the Uniform Guidance and Chapter 10.650, *Rules of the Auditor General* require that we plan and perform the audit to obtain reasonable assurance about whether noncompliance with the types of compliance requirements referred to above that could have a direct and material effect on a major federal program and state financial assistance project occurred. An audit includes examining, on a test basis, evidence about the Laboratory's compliance with those requirements and performing such other procedures as we considered necessary in the circumstances.

We believe that our audit provides a reasonable basis for our opinion on compliance for each major federal program and state financial assistance project. However, our audit does not provide a legal determination of the Laboratory's compliance.

Opinion on Each Major Federal Program and State Financial Assistance Project
In our opinion, Mote Marine Laboratory, Inc. complied, in all material respects, with the types of compliance requirements referred to above that could have a direct and material effect on each of its major federal programs and state financial assistance projects for the year ended September 30, 2021.

Report on Internal Control Over Compliance
Management of the Laboratory is responsible for establishing and maintaining effective internal control over compliance with the types of compliance requirements referred to above. In planning and performing our audit of compliance, we considered the Laboratory's internal control over compliance with the types of requirements that could have a direct and material effect on each major federal program and state financial assistance project to determine the auditing procedures that are appropriate in the circumstances for the purpose of expressing an opinion on compliance for each major federal program and state financial assistance project and to test and report on internal control over compliance in accordance with the Uniform Guidance and Chapter 10.650 *Rules of the Auditor General,* but not for the purpose of expressing an opinion on the effectiveness of internal control over compliance. Accordingly, we do not express an opinion on the effectiveness of the Laboratory's internal control over compliance.

A *deficiency in internal control over compliance* exists when the design or operation of a control over compliance does not allow management or employees, in the normal course of performing their assigned functions, to prevent, or detect and correct, noncompliance with a type of compliance requirement of a federal program or state financial assistance project on a timely basis. A *material weakness in internal control over compliance* is a deficiency, or combination of deficiencies, in internal control over compliance, such that there is a reasonable possibility that material noncompliance with a type of compliance requirement of a federal program or state financial assistance project will not be prevented, or detected and corrected, on a timely basis. A *significant deficiency in internal control over compliance* is a deficiency, or a combination of deficiencies, in internal control over compliance with a type of compliance requirement of a federal program or state financial assistance project that is less severe than a material weakness in internal control over compliance, yet important enough to merit attention by those charged with governance.

Our consideration of internal control over compliance was for the limited purpose described in the first paragraph of this section and was not designed to identify all deficiencies in internal control over compliance that might be material weaknesses or significant deficiencies. We did not identify any deficiencies in internal control over compliance that we consider to be material weaknesses. However, material weaknesses may exist that have not been identified.

The purpose of this report on internal control over compliance is solely to describe the scope of our testing of internal control over compliance and the results of that testing based on the requirements of Uniform Guidance and the Chapter 10.650, *Rules of the Auditor General.* Accordingly, this report is not suitable for any other purpose.

Kerkering, Barberio & Co.

Sarasota, Florida
April 13, 2022

Mote Marine Laboratory, Inc.

Schedule of Findings and Questioned Costs

Year Ended September 30, 2021

Section I - Summary of Auditor's Results

Financial Statements

Type of auditor's report issued: Unmodified

Internal control over financial reporting:

- Material weakness(es) identified?______ yes___x___ no
- Significant deficiency(ies) identified?______ yes___x___ none reported

Noncompliance material to financial statements
noted? ______ yes___x___ no

Federal and State Awards

Internal control over major programs and projects:

- Material weakness(es) identified?______ yes___x___ no
- Significant deficiency(ies) identified?______ yes___x___ none reported

Type of auditors' report issued on compliance for major programs and projects: Unmodified

Any audit findings disclosed that are required to
be reported in accordance with section 2 CFR
200.516(a) and the provisions of the Florida Single
Audit Act in accordance with Chapter 10.650 of
the Rules of the Auditor General______ yes___x___ no

Section I - Summary of Auditor's Results (Continued)

Identification of major programs and projects:

CFDA Numbers	*Name of Federal Program or Cluster*
	Research and Development Cluster:
10.001	Agricultural Research Basic and Applied Research
11.011	Ocean Exploration
11.012	Integrated Ocean Observing System (IOOS)
11.417	Sea Grant Support
11.427	Fisheries Development and Utilization Research and Development Grants and Cooperative Agreements Program
11.432	National Oceanic and Atmospheric Administration (NOAA) Cooperative Institutes
11.433	Marine Fisheries Initiative
11.439	Marine Mammal Data Program
11.454	Unallied Management Projects
11.463	Habitat Conservation
11.472	Unallied Science Program
11.473	Office for Coastal Management
11.478	Center for Sponsored Coastal Ocean Research Coastal Ocean Program
66.436	Surveys, Studies, Investigations, Demonstrations, and Training Grants and Cooperative Agreements – Section 104(b)(3) of the Clean Water Act
47.050	Geosciences
47.076	Education and Human Resources
12.910	Research and Technology Development
15.634	State Wildlife Grants
15.954	National Park Service Conservation, Protection, Outreach and Education
21.015	Resources and Ecosystems Sustainability, Tourist Opportunities, and Revived Economies of the Gulf Coast States
19.700	General Department of State Assistance

Mote Marine Laboratory, Inc.

Schedule of Findings and Questioned Costs (Continued)
Year Ended September 30, 2021

Section I - Summary of Auditor's Results (Continued)

CSFA Numbers	*Name of State Projects*
76.069	Protect Our Reefs License Plate Project
77.010	Cooperative Red Tide Research Program- Reduction of Harmful Impact from Red Tide

Dollar threshold used to distinguish between type A and type B Federal programs: $ 750,000
Dollar threshold used to distinguish between type A and type B State projects: $ 750,000

Auditee qualified as low-risk auditee? __x__ yes______ no

Section II - Financial Statement Findings

None

Section III - Federal and State Award Findings and Questioned Costs

None

Section IV - Summary Schedule of Prior Audit Findings and Questioned Costs

No prior audit findings or questioned costs to be addressed

Section V - Other

No management letter is required because there were no findings to be reported in a management letter as required by Section 215.97 (9)(f) and 215.97 (10)(d) of the Florida Statutes, Auditor General Rule 10.654 (1)(e) or 10.656 (3)(e).

Mote Marine Laboratory, Inc.

Financial Statements,
Supplemental Information,
Contract Compliance and
Independent Auditor's Report
September 30, 2022 and 2021

KERKERING BARBERIO
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Mote Marine Laboratory, Inc.

Financial Statements,
Supplemental Information,
Contract Compliance and
Independent Auditor's Report
September 30, 2023 and 2022

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KERKERING BARBERIO
Kerkering, Barberio & Co.
Certified Public Accountants

Independent Auditor's Report

The Board of Trustees
Mote Marine Laboratory, Inc.
Sarasota, Florida

Opinion

We have audited the financial statements of Mote Marine Laboratory, Inc. (Laboratory), a nonprofit organization, which comprise the statements of financial position as of September 30, 2023 and 2022, the related statements of activities, cash flows, and functional expenses for the years then ended, and the related notes to the financial statements.

In our opinion, the accompanying financial statements present fairly, in all material respects, the financial position of the Laboratory as of September 30, 2023 and 2022, and the changes in its net assets and its cash flows for the years then ended in accordance with accounting principles generally accepted in the United States of America.

Basis for Opinion

We conducted our audit in accordance with auditing standards generally accepted in the United States of America (GAAS) and the standards applicable to financial audits contained in *Government Auditing Standards*, issued by the Comptroller General of the United States (*Government Auditing Standards*). Our responsibilities under those standards are further described in the Auditor's Responsibilities for the Audit of the Financial Statements section of our report. We are required to be independent of the Laboratory and to meet our other ethical responsibilities, in accordance with the relevant ethical requirements relating to our audits. We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our audit opinion.

Responsibilities of Management for the Financial Statements

Management is responsible for the preparation and fair presentation of the financial statements in accordance with accounting principles generally accepted in the United States of America, and for the design, implementation, and maintenance of internal control relevant to the preparation and fair presentation of financial statements that are free from material misstatement, whether due to fraud or error.

In preparing the financial statements, management is required to evaluate whether there are conditions or events, considered in the aggregate, that raise substantial doubt about the Laboratory's ability to continue as a going concern within one year after the date that the financial statements are available to be issued.

Auditor's Responsibilities for the Audit of the Financial Statements

Our objectives are to obtain reasonable assurance about whether the financial statements as a whole are free from material misstatement, whether due to fraud or error, and to issue an auditor's report that includes our opinion. Reasonable assurance is a high level of assurance but is not absolute assurance and therefore is not a guarantee that an audit conducted in accordance with GAAS and *Government Auditing Standards* will always detect a material misstatement when it exists. The risk of not detecting a material misstatement resulting from fraud is higher than for one resulting from error, as fraud may involve collusion, forgery, intentional omissions, misrepresentations, or the override of internal control. Misstatements are considered material if there is a substantial likelihood that, individually or in the aggregate, they would influence the judgment made by a reasonable user based on the financial statements.

In performing an audit in accordance with GAAS and *Government Auditing Standards*, we:

- Exercise professional judgment and maintain professional skepticism throughout the audit.
- Identify and assess the risks of material misstatement of the financial statements, whether due to fraud or error, and design and perform audit procedures responsive to those risks. Such procedures include examining, on a test basis, evidence regarding the amounts and disclosures in the financial statements.
- Obtain an understanding of internal control relevant to the audit in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of the Laboratory's internal control. Accordingly, no such opinion is expressed.
- Evaluate the appropriateness of accounting policies used and the reasonableness of significant accounting estimates made by management, as well as evaluate the overall presentation of the financial statements.
- Conclude whether, in our judgment, there are conditions or events, considered in the aggregate, that raise substantial doubt about the Laboratory's ability to continue as a going concern for a reasonable period of time.

We are required to communicate with those charged with governance regarding, among other matters, the planned scope and timing of the audit, significant audit findings, and certain internal control-related matters that we identified during the audit.

Other Matters

Our audit was conducted for the purpose of forming an opinion on the financial statements as a whole. The accompanying Schedule of Expenditures of Federal Awards and State Financial Assistance, as required by Title 2 U.S. *Code of Federal Regulations (CFR)* Part 200, *Uniform Administrative Requirements, Cost Principles, and Audit Requirements for Federal Awards* and Chapter 10.650, *Rules of the Auditor General* of the State of Florida is presented for purposes of additional analysis and is not a required part of the financial statements. Such information is the responsibility of management and was derived from and relates directly to the underlying accounting and other records used to prepare the financial statements. The information has been subjected to the auditing procedures applied in the audit of the financial statements and certain additional procedures, including comparing and reconciling such information directly to the underlying accounting and other records used to prepare the financial statements or to the financial statements themselves, and other additional procedures in accordance with GAAS. In our opinion, the information is fairly stated, in all material respects, in relation to the financial statements as a whole.

Other Reporting Required by *Government Auditing Standards*

In accordance with *Government Auditing Standards*, we have also issued our report dated February 22, 2024, on our consideration of the Laboratory's internal control over financial reporting and on our tests of its compliance with certain provisions of laws, regulations, contracts, and grant agreements and other matters. The purpose of that report is solely to describe the scope of our testing of internal control over financial reporting and compliance and the results of that testing, and not to provide an opinion on the effectiveness of the Laboratory's internal control over financial reporting or on compliance. That report is an integral part of an audit performed in accordance with *Government Auditing Standards* in considering the Laboratory's internal control over financial reporting and compliance.

Kerkering Barberio & Co.

Sarasota, Florida
February 22, 2024

Mote Marine Laboratory, Inc.
Statements of Financial Position
September 30, 2023 and 2022

	2023	2022
Assets		
Cash and cash equivalents	$ 12,541,540	$ 15,353,772
Accounts receivable	4,967,920	4,919,837
Promises to give, net	7,581,319	9,554,050
Due from Mote Marine Foundation, Inc.	449,892	470,049
Prepaid expenses and other assets	273,957	179,710
Investments - certificates of deposit	119,840	119,193
Patents, net	79,923	79,286
Investment in deferred compensation plan	591,270	611,078
Land	7,519,082	7,519,082
Property and equipment, net	14,270,964	14,064,103
Construction in progress	70,864,506	30,339,458
Beneficial interest in the net assets of Mote Marine Foundation, Inc.	18,589,544	16,481,634
Total Assets	$ 137,849,757	$ 99,691,252
Liabilities and Net Assets		
Liabilities:		
Accounts payable	$ 5,322,220	$ 2,680,699
Accrued payroll	1,179,701	1,058,914
Memberships relating to future periods	585,397	546,511
Funds advanced on research programs	3,368,561	5,154,051
Deferred revenue	2,250,000	-
Deferred compensation payable	591,270	611,078
Lines of credit	16,226,314	1,397,647
Notes payable	4,731,392	5,466,368
Total liabilities	34,254,855	16,915,268
Net Assets:		
Without donor restrictions:		
Undesignated	75,009,760	51,673,165
Board designated	390,818	390,818
Total net assets without donor restrictions	75,400,578	52,063,983
With donor restrictions:		
Purpose and time restrictions	18,145,227	20,664,511
Perpetual in nature	10,049,097	10,047,490
Total net assets with donor restrictions	28,194,324	30,712,001
Total net assets	103,594,902	82,775,984
Total Liabilities and Net Assets	$ 137,849,757	$ 99,691,252

Mote Marine Laboratory, Inc.

Statement of Activities
Year Ended September 30, 2023
(With Summarized Totals for 2022)

	Without Donor Restrictions	With Donor Restrictions	Total	2022 Total
Support, Revenue and Reclassifications:				
Program revenue:				
Research revenue:				
Federal	$ 5,591,380	$ -	$ 5,591,380	$ 5,677,236
State	7,399,790	-	7,399,790	6,814,217
Other	3,705,517	-	3,705,517	5,122,356
Aquarium:				
Admission fees	6,552,472	-	6,552,472	6,230,784
Gift shop	633,173	-	633,173	644,078
Other	383,051	-	383,051	699,109
Memberships	1,070,026	-	1,070,026	1,118,070
Education	748,989	-	748,989	617,845
Protect Our Reefs-License Plate	1,569,844	-	1,569,844	1,350,873
Other programs	268,534	6,085,000	6,353,534	2,165,902
Contributions:				
Construction	-	11,145,408	11,145,408	13,556,039
Education	452,627	122,037	574,664	495,808
Aquarium	84,481	113,822	198,303	139,718
Other programs	4,927,143	3,979,056	8,906,199	2,884,852
Non-cash contributions	203,504	75,430	278,934	115,532
Grants from Mote Marine Foundation, Inc.	361,842	-	361,842	465,741
Investment income	7,463	103,988	111,451	68,043
Unrealized gain (loss) on investments, net	727	2,458	3,185	(121,052)
Realized gain (loss) on investments, net	4,131	316	4,447	(14,393)
Realized loss on disposal of assets	-	-	-	(1,599)
Change in beneficial interest in the net assets of Mote Marine Foundation, Inc.	178,965	1,928,945	2,107,910	(4,196,727)
Net assets released from restrictions	26,074,137	(26,074,137)	-	-
Total support, revenue and reclassifications	60,217,796	(2,517,677)	57,700,119	43,832,432
Expenses:				
Program services:				
Research	22,516,029	-	22,516,029	19,693,397
Education	1,525,406	-	1,525,406	1,221,417
Aquarium	5,239,570	-	5,239,570	4,679,048
Protect Our Reefs-License Plate	1,238,729	-	1,238,729	970,118
Other	1,565,151	-	1,565,151	944,684
Supporting services:				
Research facilities and operations	1,017,161	-	1,017,161	788,080
Administrative and general	1,296,409	-	1,296,409	1,224,295
Fundraising	2,482,746	-	2,482,746	2,241,936
Total expenses	36,881,201	-	36,881,201	31,762,975
Change in net assets	23,336,595	(2,517,677)	20,818,918	12,069,457
Net assets at beginning of year	52,063,983	30,712,001	82,775,984	70,706,527
Net assets at end of year	$ 75,400,578	$ 28,194,324	$ 103,594,902	$ 82,775,984

See accompanying notes to the financial statements.

Mote Marine Laboratory, Inc.
Statement of Activities
Year Ended September 30, 2022
(With Summarized Totals for 2023)

	Without Donor Restrictions	With Donor Restrictions	Total	2023 Total
Support, Revenue and Reclassifications:				
Program revenue:				
Research revenue:				
Federal	$ 5,677,236	$ -	$ 5,677,236	$ 5,591,380
State	6,814,217	-	6,814,217	7,399,790
Other	5,023,170	99,186	5,122,356	3,705,517
Aquarium:				
Admission fees	6,230,784	-	6,230,784	6,552,472
Gift shop	644,078	-	644,078	633,173
Other	699,109	-	699,109	383,051
Memberships	1,118,070	-	1,118,070	1,070,026
Education	617,845	-	617,845	748,989
Protect Our Reefs-License Plate	1,350,873	-	1,350,873	1,569,844
Other programs	358,684	1,807,218	2,165,902	6,353,534
Contributions:				
Construction	-	13,556,039	13,556,039	11,145,408
Education	470,808	25,000	495,808	574,664
Aquarium	94,826	44,892	139,718	198,303
Other programs	2,859,602	25,250	2,884,852	8,906,199
Non-cash contributions	99,328	16,204	115,532	278,934
Grants from Mote Marine Foundation, Inc.	465,741	-	465,741	361,842
Investment income	16,144	51,899	68,043	111,451
Unrealized gain (loss) on investments, net	(8,318)	(112,734)	(121,052)	3,185
Realized gain (loss) on investments, net	5,152	(19,545)	(14,393)	4,447
Realized loss on disposal of assets	(1,599)	-	(1,599)	-
Change in beneficial interest in the net assets of Mote Marine Foundation, Inc.	(366,359)	(3,830,368)	(4,196,727)	2,107,910
Net assets released from restrictions	15,681,401	(15,681,401)	-	-
Total support, revenue and reclassifications	47,850,792	(4,018,360)	43,832,432	57,700,119
Expenses:				
Program services:				
Research	19,693,397	-	19,693,397	22,516,029
Education	1,221,417	-	1,221,417	1,525,406
Aquarium	4,679,048	-	4,679,048	5,239,570
Protect Our Reefs-License Plate	970,118	-	970,118	1,238,729
Other	944,684	-	944,684	1,565,151
Supporting services:				
Research facilities and operations	788,080	-	788,080	1,017,161
Administrative and general	1,224,295	-	1,224,295	1,296,409
Fundraising	2,241,936	-	2,241,936	2,482,746
Total expenses	31,762,975	-	31,762,975	36,881,201
Change in net assets	16,087,817	(4,018,360)	12,069,457	20,818,918
Net assets at beginning of year	35,976,166	34,730,361	70,706,527	82,775,984
Net assets at end of year	$ 52,063,983	$ 30,712,001	$ 82,775,984	$ 103,594,902

See accompanying notes to the financial statements.

Mote Marine Laboratory, Inc.
Statements of Cash Flows
Years Ended September 30, 2023 and 2022

	2023	2022
Cash Flows from Operating Activities:		
Change in net assets	$ 20,818,918	$ 12,069,457
Adjustments to reconcile change in net assets to net cash provided by operating activities:		
Depreciation and amortization	2,625,339	2,517,601
Realized loss on disposal of assets	-	1,599
Unrealized / realized loss (gain) on investments, net	(7,632)	135,445
Change in beneficial interest in the net assets of Mote Marine Foundation, Inc.	(2,107,910)	4,196,727
Non-cash contributions	(278,934)	(115,532)
Proceeds from donated assets held for sale	237,040	-
Change in operating assets:		
Accounts receivable	(48,083)	(623,920)
Promises to give, net	1,972,731	(1,706,471)
Due from Mote Marine Foundation, Inc.	20,157	59,233
Prepaid expenses and other assets	(94,247)	(53,694)
Change in operating liabilities:		
Accounts payable	(317,189)	(149,636)
Accrued payroll	120,787	127,213
Memberships relating to future periods	38,886	(93,314)
Funds advanced on research programs	(1,785,490)	313,600
Deferred revenue	2,250,000	-
Total adjustments	2,625,455	4,608,851
Net cash provided by operating activities	23,444,373	16,678,308
Cash Flows from Investing Activities:		
Purchases of property and equipment	(40,330,493)	(16,670,197)
Proceeds from sale of property and equipment	-	3,200
Proceeds from maturity of certificate of deposit	-	253,091
Patent costs	(19,803)	(9,019)
Net cash used in investing activities	(40,350,296)	(16,422,925)
Cash Flows from Financing Activities:		
Net change in lines of credit	14,828,667	(4,454)
Repayments of notes payable	(734,976)	(1,248,674)
Net cash provided by (used in) financing activities	14,093,691	(1,253,128)
Net change in cash and cash equivalents	(2,812,232)	(997,745)
Cash and cash equivalents, beginning of year	15,353,772	16,351,517
Cash and cash equivalents, end of year	$ 12,541,540	$ 15,353,772
Cash and cash equivalents, end of year, consist of the following:		
Cash	11,956,890	14,780,482
Restricted cash	584,650	573,290
	$ 12,541,540	$ 15,353,772
Supplemental Disclosure of Non-Cash:		
Operating, Investing, and Financing Activity:		
Cash paid for interest	$ 204,201	$ 207,150
Construction in progress included in accounts payable	$ 4,716,298	$ 1,757,588
Construction in progress non-cash contribution	$ 48,879	$ -

See accompanying notes to the financial statements.

Mote Marine Laboratory, Inc.

Statement of Functional Expenses
Year Ended September 30, 2023
(With Summarized Totals for 2022)

	Program Services					
	Research	Education	Aquarium	Protect our Reefs License Plate	Other	Total
Salaries and benefits	$ 9,280,990	$ 958,532	$ 3,152,033	$ 519,426	$ 757,413	$ 14,668,394
Contracted services	3,649,264	306,929	111,068	74,905	56,248	4,198,414
Depreciation	-	-	174,670	-	51,778	226,448
Repairs and maintenance	602,925	2,597	630,332	140,005	184,863	1,560,722
Travel, meals and seminars	631,007	48,856	39,813	11,181	138,280	869,137
Research supplies	2,116,460	33,553	(226)	87,625	1,076	2,238,488
Merchandise	2,629	10,606	56,447	177	540	70,399
Office expense	198,489	28,632	395,382	16,546	132,396	771,445
Electricity	72,382	-	251,592	95,705	102,755	522,434
Insurance	35,363	-	41,845	10,603	38,004	125,815
Telephone	28,172	6,893	10,972	13,956	7,820	67,813
Promotion and advertising	192,888	57,939	62,544	16,100	47,628	377,099
Expendable supplies	2,403	6,191	7,436	749	1,599	18,378
Printing and publication	12,094	2,712	36,826	974	11,225	63,831
Vessel	30,876	400	-	4,033	189,740	225,049
Vehicle	50,084	-	8,533	538	31,418	90,573
Interest	-	-	-	-	-	-
Accounting and legal	9,088	916	13,703	-	21,139	44,846
Equipment rental	5,196	31	15,290	58,133	29,181	107,831
Library	292	45	-	-	64,924	65,261
Licenses and fees	41,656	5,126	108,373	3,100	16,862	175,117
Rent	35,631	30,323	2,390	-	11,180	79,524
Miscellaneous	-	-	-	-	24,128	24,128
	16,997,889	1,500,281	5,119,023	1,053,756	1,920,197	26,591,146
Overhead allocation	5,109,606	2,332	35,094	169,497	-	5,316,529
Rental use charges allocation:						
Vessel, vehicle and equipment	408,534	22,793	85,453	15,476	(355,046)	177,210
Total Expenses	$ 22,516,029	$ 1,525,406	$ 5,239,570	$ 1,238,729	$ 1,565,151	$ 32,084,885
Percent of Total						87%

Supporting Services				2023	2022
Research Facilities and Operations	Administrative and General	Fund Raising	Total	Functional Expenses	Functional Expenses
$ 1,198,756	$ 1,367,661	$ 1,586,252	$ 4,152,669	$ 18,821,063	$ 16,537,074
39,576	87,177	178,493	305,246	4,503,660	3,768,040
555,991	1,822,097	-	2,378,088	2,604,536	2,499,729
715,425	87,899	9,430	812,754	2,373,476	1,903,454
15,100	25,817	299,331	340,248	1,209,385	946,675
43,925	153	-	44,078	2,282,566	1,610,588
-	-	1,439	1,439	71,838	35,947
17,177	141,465	91,564	250,206	1,021,651	893,318
485,283	-	-	485,283	1,007,717	873,108
357,956	242,803	202	600,961	726,776	614,010
13,723	39,984	3,024	56,731	124,544	109,269
-	1,172	151,168	152,340	529,439	494,497
82	14,116	-	14,198	32,576	30,280
10,176	2,926	89,896	102,998	166,829	151,181
573	-	-	573	225,622	144,843
90,820	1,180	-	92,000	182,573	252,417
642	203,559	-	204,201	204,201	207,150
-	62,358	2,564	64,922	109,768	217,523
43,529	28,201	48,992	120,722	228,553	110,495
-	-	-	-	65,261	55,063
29,595	64,018	16,785	110,398	285,515	220,261
-	-	-	-	79,524	70,181
-	-	-	-	24,128	17,872
3,618,329	4,192,586	2,479,140	10,290,055	36,881,201	31,762,975
(2,462,829)	(2,853,700)	-	(5,316,529)	-	-
(138,339)	(42,477)	3,606	(177,210)	-	-
$ 1,017,161	$ 1,296,409	$ 2,482,746	$ 4,796,316	$ 36,881,201	$ 31,762,975
3%	3%	7%		100%	

Mote Marine Laboratory, Inc.

Statement of Functional Expenses
Year Ended September 30, 2022
(With Summarized Totals for 2023)

	Program Services					
	Research	Education	Aquarium	Protect our Reefs License Plate	Other	Total
Salaries and benefits	$ 8,483,348	$ 767,754	$ 2,908,473	$ 321,972	$ 282,252	$ 12,763,799
Contracted services	2,960,830	221,352	101,029	113,367	60,260	3,456,838
Depreciation	-	-	186,757	36,446	5,078	228,281
Repairs and maintenance	471,310	559	543,157	195,695	96,935	1,307,656
Travel, meals and seminars	458,105	36,395	30,541	10,022	88,478	623,541
Research supplies	1,518,051	19,507	4,407	42,370	2,592	1,586,927
Merchandise	1,585	3,398	27,809	395	-	33,187
Office expense	143,531	32,626	420,039	23,834	106,280	726,310
Electricity	54,754	-	187,590	81,573	94,534	418,451
Insurance	32,118	-	51,743	11,191	17,593	112,645
Telephone	27,458	5,369	11,097	14,412	4,796	63,132
Promotion and advertising	174,808	52,758	61,709	12,485	38,601	340,361
Expendable supplies	5,850	8,918	15,463	-	-	30,231
Printing and publication	12,057	3,778	22,000	4,377	6,537	48,749
Vessel	109,459	-	-	25	35,359	144,843
Vehicle	48,311	500	10,340	5,258	113,277	177,686
Interest	-	-	-	-	26,195	26,195
Accounting and legal	1,078	337	1,168	-	135,876	138,459
Equipment rental	8,489	-	2,876	8,278	15,684	35,327
Library	-	-	-	-	55,063	55,063
Licenses and fees	75,856	2,942	20,737	4,009	10,976	114,520
Rent	46,082	15,099	-	-	9,000	70,181
Miscellaneous	-	-	-	-	17,872	17,872
	14,633,080	1,171,292	4,606,935	885,709	1,223,238	22,520,254
Overhead allocation	4,787,790	13,713	312	70,632	-	4,872,447
Rental use charges allocation:						
Vessel, vehicle and equipment	272,527	36,412	71,801	13,777	(278,554)	115,963
Total Expenses	$ 19,693,397	$ 1,221,417	$ 4,679,048	$ 970,118	$ 944,684	$ 27,508,664
Percent of Total						87%

Supporting Services				2022	2023
Research Facilities and Operations	Administrative and General	Fund Raising	Total	Functional Expenses	Functional Expenses
$ 1,049,108	$ 1,290,222	$ 1,433,945	$ 3,773,275	$ 16,537,074	$ 18,821,063
9,465	113,725	188,012	311,202	3,768,040	4,503,660
335,819	1,935,629	-	2,271,448	2,499,729	2,604,536
490,624	98,384	6,790	595,798	1,903,454	2,373,476
37,883	35,793	249,458	323,134	946,675	1,209,385
10,802	11,984	875	23,661	1,610,588	2,282,566
-	2,644	116	2,760	35,947	71,838
22,983	80,756	63,269	167,008	893,318	1,021,651
454,657	-	-	454,657	873,108	1,007,717
205,072	296,293	-	501,365	614,010	726,776
15,902	27,840	2,395	46,137	109,269	124,544
390	9,172	144,574	154,136	494,497	529,439
-	49	-	49	30,280	32,576
2,325	3,104	97,003	102,432	151,181	166,829
-	-	-	-	144,843	225,622
74,731	-	-	74,731	252,417	182,573
1,188	179,767	-	180,955	207,150	204,201
-	78,121	943	79,064	217,523	109,768
11,143	26,200	37,825	75,168	110,495	228,553
-	-	-	-	55,063	65,261
31,168	62,733	11,840	105,741	220,261	285,515
-	-	-	-	70,181	79,524
-	-	-	-	17,872	24,128
2,753,260	4,252,416	2,237,045	9,242,721	31,762,975	36,881,201
(1,914,892)	(2,957,555)	-	(4,872,447)	-	-
(50,288)	(70,566)	4,891	(115,963)	-	-
$ 788,080	$ 1,224,295	$ 2,241,936	$ 4,254,311	$ 31,762,975	$ 36,881,201
2%	4%	7%		100%	

1. Organization

Mote Marine Laboratory, Inc. (Laboratory), a nonprofit corporation, operates and maintains a marine and environmental sciences laboratory for the encouragement and development of the study of marine sciences and the advancement of the general knowledge of kindred subjects through education, training, scientific research, exchange of scientific information and dissemination of information to the public. The Laboratory began operations in 1955.

2. Summary of Significant Accounting Policies

Financial Statements

The financial statements and notes are representations of the Laboratory's management who is responsible for their integrity and objectivity. The accounting policies conform to accounting principles generally accepted in the United States of America and have been consistently applied in the preparation of the financial statements.

Basis of Accounting

The Laboratory prepares its financial statements on the accrual basis of accounting in accordance with accounting principles generally accepted in the United States of America.

Use of Estimates and Assumptions

The preparation of financial statements in conformity with accounting principles generally accepted in the United States of America requires management to make estimates and assumptions that affect certain reported amounts of assets and liabilities and disclosure of contingent assets and liabilities at the date of the financial statements and the reported amounts of revenues and expenses during the reporting period. Accordingly, actual results could differ from those estimates and assumptions.

Accounts Receivable

Accounts receivable consist primarily of amounts due from program fees and grants receivable. A significant portion of grants receivable are research grants.

Substantially all research grants are cost reimbursement grants. Research grants receivable consists of billed and unbilled costs incurred on research contracts. Due to the nature of the grants, management considers them to be collectible and no allowance has been established. These amounts are included in accounts receivable on the statements of financial position.

Based on the Laboratory's collection history, management believes no allowance for uncollectible amounts is necessary.

Bequest Receivable

Bequests are recorded as support when the amount to be received can be reasonably estimated as provided by the executor of the estate.

Promises to Give

Promises to give are recorded as support when the donor's commitment has been received. Promises to give due in more than one year are reflected at the present value of estimated future cash flows using an appropriate discount rate in the year promised.

2. Summary of Significant Accounting Policies (Continued)

Property and Equipment

Property and equipment are stated at cost, if purchased, or fair market value at the date of gift, if donated.

Depreciation is provided over the estimated useful lives of the assets using the straight-line half-year method. Estimated useful lives are as follows:

	Years
Vehicles	3
Vessels	5
Buildings and improvements	5 - 40
Furniture, fixtures and exhibits	5 - 10
Laboratory equipment	5 - 20
Trailers	5 - 10

The Laboratory capitalizes all fixed asset purchases or donations with an estimated useful life of greater than one year and a cost or fair market value of $5,000 or greater.

Revenue Recognition

Revenue associated with research grants or contracts is generally recognized as related costs are incurred. Membership revenue is recognized ratably throughout the membership year.

All contributions are considered to be available for use without donor restriction unless specifically restricted by the donor. Contributions which are designated by the donor to be used in future periods, or for specific purposes, are recorded as net assets with donor restrictions. When the purpose of the restriction is accomplished, or passage of time has occurred, net assets with donor restrictions are reclassified to net assets without donor restrictions and reported in the statements of activities as net assets released from restrictions.

Gifts of cash restricted for the purpose of acquiring or constructing long-lived assets are recorded as net assets with donor restrictions until the long-lived assets are acquired or constructed at which time the net assets are released from the restriction and reclassified as net assets without donor restrictions. Any conditional gifts for which the conditions are not met at year-end are recorded as refundable advances.

Patents

Patents are stated at the cost to acquire. Amortization is provided for using the straight-line method over the estimated useful life of ten years.

Contributed Services and Nonfinancial Assets

A substantial number of volunteers have made significant contributions of their time to the operations of the Laboratory. The amount of volunteer hours contributed to the Laboratory during the years ended September 30, 2023 and 2022 were 159,796 and 152,911 hours, respectively. The estimated value of these donated services has not been recorded in the accompanying financial statements because it does not meet the criteria for recognition under generally accepted accounting principles.

However, management estimates the fair value of these services contributed to the Laboratory during the years ended September 30, 2023 and 2022 amounted to $5,081,514 and $4,579,692, respectively. These estimates are based on an article published in the Nonprofit Times that estimates volunteer time to be worth $31.80 and $29.95 per hour in 2023 and 2022, respectively, according to the Independent Sector, a Washington D.C. based coalition of nonprofits and foundations.

2. Summary of Significant Accounting Policies (Continued)
Contributed Services and Nonfinancial Assets (Continued)
Contributed nonfinancial assets are recognized at their estimated fair value when they create or enhance nonfinancial assets, they require specialized skills that would need to be purchased if they were not donated, or they are nonfinancial assets which are directed by the Laboratory for its benefit and have been provided at no cost. Amounts are recorded at their estimated fair value at the date of donation using published rates and prices. Contributed nonfinancial assets for the years ended September 30, 2023 and 2022 totaled $48,879 and $0, respectively, and is included in construction in progress on the statements of financial position.

Donated property and vessels, which are not classified by management for use by the Laboratory, are recorded as assets held for sale. The carrying value of such assets is adjusted to the lower of fair market value or the recorded value at the date of gift in order to more closely reflect the net realizable value.

Advertising and Promotion
Advertising and promotion costs are expensed as incurred. Advertising and promotion expense for the years ended September 30, 2023 and 2022 totaled $523,869 and $494,497, respectively.

Income Tax Status
The Laboratory is exempt from income taxes under Section 501(c)(3) of the Internal Revenue Code.

Under the Income Taxes topic of the FASB Accounting Standards Codification, the Laboratory has reviewed and evaluated the relevant technical merits of each of its tax positions in accordance with accounting principles generally accepted in the United States of America for accounting for uncertainty in income taxes, and determined that there are no uncertain tax positions that would have a material impact on the financial statements of the Laboratory.

The Laboratory files income tax returns in the U.S. federal jurisdiction and the State of Florida. The tax periods open to examination by the major taxing jurisdictions to which the Laboratory is subject include fiscal years ended September 30, 2020 through September 30, 2023.

Financial Instruments Not Measured at Fair Value
Certain of the Laboratory's financial instruments are not measured at fair value on a recurring basis but nevertheless certain financial instruments are recorded at amounts that approximate fair value due to their liquid or short-term nature. Such financial assets and financial liabilities include cash and cash equivalents, accounts receivable, due from Mote Marine Foundation, Inc., prepaid expenses and other assets, accounts payable, accrued payroll, memberships relating to future periods, funds advanced on research programs, deferred revenue and deferred compensation payable.

Overhead Allocation
Overhead is allocated to research programs at a rate established with the cognizant federal agency, The Department of Commerce and National Oceanic and Atmospheric Administration. Certain research contracts limit the amount of reimbursement for overhead expenses to a rate specified in the individual contracts.

2. Summary of Significant Accounting Policies (Continued)

Functional Allocation of Expenses

The costs of providing the various programs and other activities have been summarized on a functional basis in the statement of activities. Accordingly, certain costs have been allocated among the programs and supporting services that benefited. The expenses that are allocated include salaries, benefits, payroll taxes, depreciation, and other expenses for services which are allocated on the basis of estimated time and effort.

Cash and Cash Equivalents

Cash on hand and highly liquid investments with a maturity of three months or less at date of acquisition are considered to be cash and cash equivalents. Cash restricted for endowment and included as cash and cash equivalents in the financial statements amounted to $584,650 and $573,290 as of September 30, 2023 and 2022, respectively.

Beneficial Interest in the Net Assets of Mote Marine Foundation, Inc.

The Laboratory follows the *Not-for-Profit Entities* Topic of the FASB Accounting Standards Codification. The *Not-for-Profit Entities* Topic establishes standards for transactions in which a donor makes a contribution to a not-for-profit organization (the recipient) that agrees to transfer those assets to another entity (the beneficiary). The statement requires that, if the specified beneficiary is financially interrelated to the recipient organization, the beneficiary must recognize its interest in the net assets of the recipient organization. As presented in the financial statements, the Laboratory is financially interrelated to Mote Marine Foundation, Inc. and therefore, is required to report its beneficial interest in the net assets of Mote Marine Foundation, Inc.

Deferred Revenue

The Laboratory recognizes as deferred revenue payments received in advance for Laboratory obligations which have not yet been performed. Revenue is recognized as the Laboratory performs those obligations.

Reclassifications

To facilitate comparison of financial data, certain amounts in the 2022 financial statements have been reclassified to conform to the 2023 reporting presentation. Such reclassifications had no effect on the change in net assets previously reported.

Adoption of New Accounting Pronouncement

In February 2016, the FASB issued ASC Topic 842, *Leases*, to increase transparency and comparability among organizations related to their leasing arrangements. The Laboratory adopted Topic 842 on October 1, 2022, using the optional transition method to the modified retrospective approach, which eliminates the requirements to restate the prior-period financial statements. The Laboratory made an accounting policy election under Topic 842 not to recognize right-of-use assets and liabilities for leases with a term of 12 months or less. Topic 842 did not have an impact on the Laboratory's financial statements.

3. Liquidity and Availability

Financial assets available within one year of the statement of financial position date for general expenditures are as follows:

	2023	2022
Cash and cash equivalents	$ 12,541,540	$ 15,353,772
Accounts receivable	4,967,920	4,919,837
Promises to give, net – current portion	4,399,927	3,994,892
Due from Mote Marine Foundation, Inc.	449,892	470,049
Beneficial interest in the net assets of Mote Marine Foundation, Inc.	18,589,544	16,481,634
Total financial assets available	40,948,823	41,220,184
Less: Amounts unavailable for general expenditures within one year due to:		
Restricted by donors with purpose and time restrictions	(18,145,227)	(20,664,511)
Restricted by donors in perpetuity	(10,049,097)	(10,047,490)
Total amounts unavailable for general expenditures within one year	(28,194,324)	(30,712,001)
Less: Amounts unavailable to management without Board approval:		
Board designated for Mote SEA project	(390,818)	(390,818)
Total financial assets available to management for general expenditure within one year	$ 12,363,681	$ 10,117,365

The Laboratory manages its liquid assets in accordance with regular budgeting processes developed through the coordinated efforts of management and the Board of Trustees. Monthly reporting by management to those charged with governance ensures the results from operating activities are monitored closely.

The Board of Trustees has designated $390,818 as of September 30, 2023 and 2022, respectively, for the construction of the Mote Science Education Aquarium (Mote SEA). Although the Laboratory does not intend to spend from board designated funds, these amounts could be made available if necessary.

4. Promises to Give

At September 30, 2023 and 2022, the Laboratory held written unconditional promises to give in the amounts of $8,111,846 and $10,146,661, respectively. The promises to give have been restricted by the donors for future projects. Management considers all promises to give to be fully collectible as of September 30, 2023 and 2022, therefore no allowance for uncollectible promises to give has been established.

Promises to give consist of the following as of September 30:

	2023	2022
Promises to give	$ 8,111,846	$ 10,146,661
Less: discount to net present value (rate of 5%)	(530,527)	(592,611)
Promises to give, net	7,581,319	9,554,050
Less amount due in less than one year	4,399,927	3,994,892
Amount collectible in one to five years	$ 3,181,392	$ 5,559,158

5. Accounts Receivable

Accounts receivable consists of the following at September 30:

	2023	2022
Costs billed on research grants and other contracts	$ 1,331,562	$ 1,074,397
Unbilled costs incurred on research grants	3,623,258	3,832,799
Accounts receivable - other	13,100	12,641
	$ 4,967,920	$ 4,919,837

During the years ended September 30, 2023 and 2022, the Laboratory had no write-offs of uncollectible accounts receivable.

6. Investments

The Laboratory has a certificate of deposit that earns interest of 3.45% and matures October 24, 2023. As of September 30, 2023, the certificates of deposit totaled $119,840 and are stated at fair value. As of September 30, 2022, the certificates of deposit totaled $119,193 and are stated at fair value. Of these amounts, $118,258 and $93,787 is restricted for endowments as of September 30, 2023 and 2022, respectively. There were no unrealized gains on the certificates of deposit for the years ended September 30, 2023 and 2022, respectively.

The Laboratory had realized gains of $4,447 and realized losses of $14,393 on the sales of investments for the years ended September 30, 2023 and 2022, respectively.

Additionally, assets held at a community foundation during the years ended September 30, 2023 and 2022 incurred unrealized gains of $3,185 and unrealized losses of $121,052, respectively.

7. Property and Equipment

Property and equipment consists of the following as of September 30:

	2023	2022
Vehicles	$ 811,885	$ 678,209
Vessels	1,937,404	1,838,971
Buildings and improvements	43,420,330	43,017,919
Furniture, fixtures and exhibits	5,525,686	5,305,515
Laboratory equipment	11,992,101	10,183,910
Trailers	148,222	118,663
	63,835,628	61,143,187
Less accumulated depreciation	49,564,664	47,079,084
	$ 14,270,964	$ 14,064,103

Depreciation expense was $2,606,173 and $2,499,729 for the years ended September 30, 2023 and 2022, respectively.

Construction in progress consists of the following at September 30:

	2023	2022
Mote Science Education Aquarium construction	$ 70,624,802	$ 30,280,619
Aquarium and Laboratory improvements	239,704	58,839
	$ 70,864,506	$ 30,339,458

7. Property and Equipment (Continued)

In accordance with contract provisions, the Laboratory has segregated and identified property and equipment that has been purchased or improved with funds received from government agencies. Title to these assets acquired with government agency funds vests with the Laboratory as long as the Laboratory has a contract with the agency, unless contract terms specify otherwise. Upon contract termination, title to these assets reverts to the agencies. At September 30, 2023 and 2022, property and equipment purchased or improved with funds received from government agencies, net of accumulated depreciation, totaled $334,393 and $209,542, respectively.

8. Patents

During the years ended September 30, 2023 and 2022, the Laboratory incurred costs to maintain certain patents. The costs capitalized and the related amortization provided for is as follows:

	2023	2022
Patents	$ 226,166	$ 206,363
Less: accumulated amortization	146,243	127,077
	$ 79,923	$ 79,286

No significant residual value is estimated for these patents. Amortization expense for the years ended September 30, 2023 and 2022 totaled $19,166 and $17,872, respectively.

The following table represents the total estimated amortization of patents for the five succeeding years and thereafter ending September 30:

2024	$ 18,202
2025	16,501
2026	15,538
2027	8,018
2028	8,000
Thereafter	13,664
	$ 79,923

9. Long-Term Debt

Notes Payable

Notes payable consists of the following as of September 30:

	2023	2022
Note payable in 180 monthly installments of $17,579 plus interest based on overnight SOFR plus 2.18%, maturing on August 5, 2028 and secured with personal property and promises to give and guaranteed by Mote Marine Foundation, Inc. with a $1,500,000 limitation. Interest rate at September 30, 2023 was 7.58%.	$ 1,459,063	$ 1,670,012
Note payable in 60 monthly installments of $427, interest at 4.44% due 2024, secured by vehicle.	4,234	9,048
Note payable in 60 monthly installments of $695, interest at 3.99% due 2024, secured by vehicle.	4,112	12,109

9. Long-Term Debt (Continued)
Notes Payable (Continued)

	2023	2022
Note payable in 119 monthly installments of $13,668 plus 4.2% interest, with final payment of $1,348,395 due on October 1, 2028, secured by mortgage on real property located in Sarasota County.	1,823,983	1,908,383
Note payable annually at $200,000. A final balloon payment is due July 11, 2027. Secured by mortgage on real property located in Monroe County.	1,440,000	1,640,000
Note payable for insurance premiums financed by a third party. The note is payable in 22 installments of $63,845, which include principal and interest at 3.99%, due in 2023. Note was paid in full during the year ended September 30, 2023.	-	226,816
	4,731,392	5,466,368
Less current portion	508,402	737,698
Non-current portion	$ 4,222,990	$ 4,728,670

Interest expense incurred under these notes payable totaled $185,113 and $172,685 for the years ended September 30, 2023 and 2022, respectively.

Lines of Credit
Pursuant to loan agreements with two banks, the Laboratory has a revolving line of credit of $1,500,000 with each bank.

The first bank's revolving line of credit had a due date of November 11, 2022 and was paid in full during the year ended September 30, 2023. Interest is charged at the bank's prime rate less a margin of 1.25% with a 0% floor and is payable monthly. At September 30, 2023 and 2022, borrowings outstanding under this line of credit, secured by promises to give and accounts receivable of the Laboratory, amounted to $0 and $1,212,647, respectively. This line of credit was not renewed and is no longer open.

The second bank's revolving line of credit was renewed on April 26, 2023 and is due on demand. Interest is charged at SOFR plus a margin of 2.50%, payable monthly, and is guaranteed by Mote Marine Foundation, Inc. There were no borrowings outstanding at September 30, 2023 and 2022.

The Laboratory also has a line of credit of $185,000 from Sarasota-Manatee Airport Authority. The loan represents advanced funding for the improvements to the Airport Aquarium and has no expiration date or interest rate and will be repaid with any funds raised associated with the Airport Aquarium. At September 30, 2023 and 2022, borrowings outstanding totaled $185,000.

During the year ended September 30, 2023, the Laboratory obtained an additional line of credit with a maturity date of December 31, 2027. Interest is 0% for the first 24 months, from the date of the first disbursement of funds. Commencing on the 25th month, the outstanding balance will bear interest at 8%, which increases to 16% on the first day of the 40th month. Upon completion of Mote SEA, $125,000 of principal will be due monthly, or $1,500,000 annually, until maturity, at which point all principal and interest are due. At September 30, 2023 and 2022, borrowings outstanding under this line of credit amounted to $16,041,314 and $0, respectively.

9. Long-Term Debt (Continued)

Lines of Credit (Continued)

The multiple lines of credit outstanding at September 30, 2023 and 2022 totaled $16,226,314 and $1,397,647, respectively.

Interest expense incurred under these lines of credit totaled $19,088 and $34,465 for the years ended September 30, 2023 and 2022, respectively.

Certain loan agreements described above require that the Laboratory meet certain debt covenant compliance requirements. As of September 30, 2023, the Laboratory was in full compliance with all requirements.

Future Maturities of Long-Term Debt

Aggregate maturities of long-term debt at September 30, are as follows:

2024	$ 508,402
2025	1,503,873
2026	2,007,851
2027	14,053,315
2028	516,327
Thereafter	2,367,938
Total	$ 20,957,706

10. Net Assets with Donor Restrictions

Net assets with donor restrictions are available for the following purposes as of September 30:

	2023	2022
Subject to expenditure for specific purpose:		
Future projects	$ 4,077,773	$ 428,448
Education	191,910	-
Construction	5,442,689	13,702,459
Library expenses	-	28,087
Beneficial interest in net assets of Mote Marine Foundation, Inc.	8,432,855	6,505,517
Total purpose restrictions	18,145,227	20,664,511
Perpetual in nature:		
Cultural endowment	600,000	600,000
Keys endowment	12,050	12,050
Beneficial interest in the net assets of Mote Marine Foundation, Inc.	9,437,047	9,435,440
Total perpetual in nature restrictions	10,049,097	10,047,490
Total net assets with donor restrictions	$ 28,194,324	$ 30,712,001

11. Net Assets Released from Restrictions

Net assets released from donor restriction by incurring expenses satisfying the restricted purposes as of September 30:

	2023	2022
Aquarium expenses	$ 37,081	$ 32,926
Research expenses	303,639	310,412
Other	96,267	94,258
Library	28,087	-
Education	7,865	-
Construction	25,601,198	15,243,805
	$ 26,074,137	$ 15,681,401

12. Retirement Plan

The Laboratory provides a 403(b) retirement plan. The Laboratory matches employee contributions based on an employee's length of service and gross salary. Retirement plan expense was $708,216 and $531,442 for the years ended September 30, 2023 and 2022, respectively.

13. Matching Requirements on Governmental Grants

The Laboratory is awarded grants from federal agencies which require matching contributions by the Laboratory. The matching requirements were met or exceeded on completed federal grants during 2023 and 2022.

14. Rental Use Charges

Periodically, certain programs require utilization of vessels, vehicles and equipment provided by the Laboratory. Each program is charged rent, based on use, at a pre-established rental fee that reflects the cost of operating the asset.

15. Financial Instruments with Off-Balance Sheet Risk

The Laboratory maintains its cash in bank deposit accounts which, at times, may exceed federally insured limits. Accounts are guaranteed by the Federal Deposit Insurance Corporation (FDIC) up to certain limits. At any given time, the Laboratory may have cash and investment balances exceeding the insured amount. The Laboratory has not experienced any losses in such accounts and does not believe it is exposed to any significant credit risk on cash and investments.

16. Related Party Transactions

The Mote Marine Foundation, Inc. (Foundation), a financially interrelated organization, provides support to the Laboratory in the form of grants. For the years ended September 30, 2023 and 2022, the Laboratory received grants from the Foundation in the amount of $361,842 and $465,741, respectively.

Mote Marine Foundation, Inc. is dependent on Laboratory personnel for administration and certain aspects of fund raising.

From time to time, the Laboratory will provide grants, receive donations and pay certain expenses on behalf of the Foundation. As of September 30, 2023 and 2022, the Foundation owed the Laboratory $449,892 and $470,049, respectively.

Certain trustee members are affiliated with organizations that transact with the Laboratory. Trustee members are required to complete conflict of interest disclosure statements and abstain from voting on related issues.

16. Related Party Transactions (Continued)

From time to time, the trustees make promises to give and contributions to the Laboratory.

17. Leased Facility

The Laboratory has a leasehold agreement with a municipality for real property on which the Laboratory has constructed its facilities. The agreement requires the Laboratory to pay the municipality one dollar per year until the agreement expires in the year 2050. The fair market value of the leasehold agreement is not determinable and therefore has not been recorded in the accompanying financial statements.

18. Endowments

The Laboratory's endowment consists of funds established for several purposes. Its endowment includes donor-restricted endowment funds. As required by accounting principles generally accepted in the United States of America, net assets associated with endowment funds are classified and reported based on the existence or absence of donor-imposed restrictions. It is typical to establish all endowment funds in Mote Marine Foundation, Inc.

Interpretation of Relevant Law

The Board of Trustees of the endowment has interpreted the Florida Uniform Prudent Management of Institutional Funds Act (FUPMIFA) as requiring the preservation of the fair value of the original gift as of the gift date of the donor-restricted endowment funds absent explicit donor stipulations to the contrary. As a result of this interpretation, the Laboratory classifies as net assets with donor restrictions in perpetuity (a) the original value of gifts donated to the perpetual endowment and (b) the original value of subsequent gifts to the perpetual endowment.

Endowment Net Asset Composition

As of September 30, 2023, endowment net assets consisted of the following:

	With Donor Restrictions
Donor-restricted endowment funds:	
Endowment balance	$ 612,050
Total donor-restricted endowment funds	$ 612,050

As of September 30, 2022, endowment net assets consisted of the following:

	With Donor Restrictions
Donor-restricted endowment funds:	
Endowment balance	$ 612,050
Total donor-restricted endowment funds	$ 612,050

18. Endowments (Continued)

Changes in Endowment Net Assets

Changes in endowment net assets for the year ended September 30, 2023 are as follows:

	With Donor Restrictions
Endowment net assets, October 1, 2022	$ 612,050
Endowment investment return:	
Investment income	154
Realized and unrealized gains	684
Total endowment investment return	838
Appropriation of endowment for expenditures	(838)
Endowment net assets, September 30, 2023	$ 612,050

Changes in endowment net assets for the year ended September 30, 2022 are as follows:

	With Donor Restrictions
Endowment net assets, October 1, 2021	$ 626,331
Endowment investment return:	
Investment income	1,522
Realized and unrealized losses	(2,297)
Total endowment investment loss	(775)
Appropriation of endowment for expenditures	(13,506)
Endowment net assets, September 30, 2022	$ 612,050

Funds with Deficiencies

From time to time, the fair value of assets associated with individual donor restricted endowment funds may fall below the level classified as net assets with donor restrictions that are perpetual in nature. These deficiencies result from unfavorable market fluctuations that occurred shortly after the investment of new contributions of net assets with donor restrictions that are perpetual in nature and continued appropriation for certain programs that was deemed prudent by the Board of Trustees. There were no deficiencies of this nature reported in net assets without donor restrictions as of September 30, 2023 and 2022.

Return Objectives and Risk Parameters

The Laboratory has adopted investment policies and spending polices for endowment assets that attempt to provide a predictable stream of funding to programs supported by its endowment while seeking to maintain the purchasing power of the endowment assets. Endowment assets include those assets of donor-restricted funds that the Laboratory must hold in perpetuity or for donor-specified periods. Under this policy, as approved by the Board of Trustees, the endowment assets are invested in a manner that is intended to produce a long-term rate of return on assets of to match or exceed the rate of return determined from the sum of the annual distribution percentage, inflation measured by the CPI, and real growth of 1%.

The Cultural Endowment Program has a primary investment constraint to preserve principal along with restrictions on investment instruments, so the Laboratory uses an alternative approved investment policy for this program.

18. Endowments (Continued)

Strategies Employed for Achieving Objectives

To satisfy its long-term rate-of-return objectives, the Laboratory relies on a total return strategy in which investment returns are achieved through both capital appreciation (realized and unrealized) and current yield (interest and dividends). The Laboratory targets a diversified asset allocation that places a greater emphasis on equity-based investments to achieve its long-term return objectives within prudent risk constraints.

Spending Policy and How the Investment Objectives Relate to Spending Policy

The Laboratory has a policy of appropriating for distribution each year 5% percent of its endowment funds average fair value over the period of 12 quarters through the calendar year end preceding the fiscal year in which the distribution is planned. In establishing this policy, the Laboratory considered the long-term expected return on its endowment. Accordingly, over the long term, the Laboratory expects the current spending policy to allow its endowment to grow at an average of 1% percent annually. This is consistent with the Laboratory's objective to maintain the purchasing power of the endowment assets held in perpetuity or for a specified term as well as to provide additional real growth through new gifts and investment return. The established policy for the Cultural Endowment Program distributes 100% of current income for use in operating costs for cultural activities expecting no further growth in this endowment.

19. Fair Value of Financial Assets and Liabilities

The Laboratory adopted the Fair *Value Measurements and Disclosures* Topic of the FASB Accounting Standards Codification which provides enhanced guidance for using fair value to measure assets and liabilities and clarifies the principle that fair value should be based on the assumptions market participants would use when pricing the assets or liabilities and establishes a hierarchy that prioritizes the information used to develop those assumptions. The Laboratory has adopted Accounting Standards Update No. 2010-06, *Improving Disclosures about Fair Value Measurements*, which requires the Laboratory to present fair value measurements separately for each class of assets and liabilities held as of September 30, 2023 and 2022.

The following tables present information about the Laboratory's assets and liabilities that are measured at fair value on a recurring and non-recurring basis as of September 30, 2023 and 2022, and indicate the fair value hierarchy of the valuation techniques used to determine such fair value. The three levels for measuring fair value are based on the reliability of inputs and are as follows:

Level 1 - quoted market prices in active markets for identical assets or liabilities, such as publicly traded equity securities. This level includes common and preferred stock, cash and money market funds, mutual funds, corporate bonds and bond funds, and government obligations.

Level 2 - inputs, other than quoted prices included in Level 1 that are observable, either directly or indirectly. Such inputs may include quoted prices for similar assets, observable inputs other than quoted prices (interest rates, yield curves, etc.), or inputs derived principally from or corroborated by observable market data by correlation or other means.

Level 3 - inputs are unobservable data points for the asset or liability, and include situations where there is little, if any, market activity for the asset or liability. The inputs reflect the Laboratory's assumptions based on the best information available in the circumstance.

19. Fair Value of Financial Assets and Liabilities (Continued)

The following sets forth the fair value hierarchy by level for the Laboratory's assets measured at fair value on a recurring basis as of September 30, 2023:

Description	Total	Level 1	Level 2	Level 3	NAV*
Beneficial interest in the net assets of Mote Marine Foundation, Inc.	$ 18,779,976	$ 16,003,676	$ 2,776,300	$ -	$ -

The following sets forth the fair value hierarchy by level for the Laboratory's assets measured at fair value on a non-recurring basis as of September 30, 2023:

Description	Total	Level 1	Level 2	Level 3	NAV*
Beneficial interest in the net assets of Mote Marine Foundation, Inc.	$ 16,181	$ -	$ -	$ 16,181	$ -
Promises to give	7,581,319	-	-	7,581,319	-
Ending balance	$ 7,597,500	$ -	$ -	$ 7,597,500	$ -

The following sets forth the fair value hierarchy by level for the Laboratory's assets measured at fair value on a recurring basis as of September 30, 2022:

Description	Total	Level 1	Level 2	Level 3	NAV*
Beneficial interest in the net assets of Mote Marine Foundation, Inc.	$ 16,602,252	$ 14,143,604	$ 2,457,981	$ -	$ 667

The following sets forth the fair value hierarchy by level for the Laboratory's assets measured at fair value on a non-recurring basis as of September 30, 2022:

Description	Total	Level 1	Level 2	Level 3	NAV*
Beneficial interest in the net assets of Mote Marine Foundation, Inc.	$ 16,181	$ -	$ -	$ 16,181	$ -
Promises to give	9,554,050	-	-	9,554,050	-
Ending balance	$ 9,570,231	$ -	$ -	$ 9,570,231	$ -

(*) Certain investments of Mote Marine Foundation, Inc. that are measured at fair value using the net asset value (NAV) per share (or its equivalent) practical expedient have not been categorized in the fair value hierarchy. The fair value amounts presented in the tables above are intended to permit reconciliation of the fair value hierarchy to the amounts presented in the statements of financial position.

20. Commitments

At September 30, 2023, the Laboratory had commitments of approximately $70,416,473 for construction and acquisition of property and equipment, all of which is related to the Mote SEA project.

21. Subsequent Events

The Laboratory has evaluated all events subsequent to the statement of financial position date of September 30, 2023 and through the date these financial statements were available to be issued, February 22, 2024, and have determined that there are no subsequent events that require disclosure.

Supplemental Information

Mote Marine Laboratory, Inc.
Schedule of Expenditures of Federal Awards and
State Financial Assistance
Year Ended September 30, 2023

Grantor	Assistance Listing # or CSFA#	Pass-through Entity Identification or Grant Number	Total Expenditures		Transfer to Subrecipients
Federal Contracts and Grants					
RESEARCH AND DEVELOPMENT CLUSTER					
Department of Agriculture					
Agricultural Research Service					
Agricultural Research Basic and Applied Research					
Passed through Florida Atlantic University	10.001	59-6034-9-007	$ 13,118	$ 13,118	$ -
Grants for Agricultural Research, Special Research Grants	10.200	2023-70007-40205	16,436	16,436	-
Agriculture and Food Research Initiative (AFRI)	10.310	2021-67017-33829	114,838	114,838	-
Department of Commerce					
National Oceanic and Atmospheric Administration (NOAA)					
Ocean Exploration	11.011	NA18OAR0110291	1,057	1,057	-
Integrated Ocean Observing System (IOOS)					
Passed through Southeast Coastal Ocean Observing Regional Association	11.012	NA23NOS0120081	748		-
Passed through University of Louisiana at Lafayette	11.012	NA21NOS0120092	9,861		-
Passed through Texas A&M University	11.012	NA21NOS0120092	121,100		-
Passed through Southeast Coastal Ocean Observing Regional Association	11.012	NA21NOS0120097	11,685		-
Passed through University of South Carolina	11.012	NA21NOS0120097	9,550	152,944	-
Ocean Acidification Program (OAP)	11.017	NA22OAR0170209	7,108	7,108	-
NOAA Small Business Innovation Research (SBIR) Program					
Passed through SC Sea Grant Consortium	11.021	NA22OAR4170114	7,200		-
	11.021	NA22OAR4170091	20,385		-
Passed through University of Central Florida	11.021	NA21OAR0210492	1,692		-
	11.021	NA21OAR0210492	89	29,366	-
Fisheries Development and Utilization Research and					
Development Grants and Cooperative Agreements Program	11.427	NA20NMF4270199	95,937		-
	11.427	NA22NMF4270150	80,908	176,845	25,300
Marine Fisheries Initiative	11.433	NA15NMF4330152	9,715	9,715	-
Marine Mammal Data Program	11.439	NA22NMF4390284	24,952		-
	11.439	NA18NMF4390064	2,355		-
	11.439	NA19NMF4390178	4,589		-
	11.439	NA20NMF4390106	13,643		-
	11.439	NA21NMF4390403	18,024	63,563	-
Unallied Management Projects	11.454	NA21NMF4540281	115,113	115,113	-
Habitat Conservation	11.463	NA19NMF4630259	611,056		-
Passed through National Marine Sanctuary Foundation	11.463	NA20NMF4630328	35,434		-
Passed through College of the Florida Keys	11.463	NA20NMF4630328	209	646,699	-
Congressionally Identified Awards and Projects	11.469	NA23NMF4690433	6,757	6,757	-
Unallied Science Program					
Passed through National Fish and Wildlife Foundation	11.472	NA22NMF4720362	10,012		-
	11.472	NA20NMF4720265	13,580		-
	11.472	NA21NMF4720530	189,499		43,917
	11.472	NA21NMF4720532	133,780		-
Passed through Florida Fish & Wildlife Conservation Commission	11.472	NA15NMF4720018	54,625	401,496	-
Office for Coastal Management					
Passed through National Fish and Wildlife Foundation	11.473	NA18NOS4730204	137,057		-
Passed through National Marine Sanctuary Foundation	11.473	NA20NOS4730027	779,790	916,847	-
Center for Sponsored Coastal Ocean Research Coastal Ocean Program					
Passed through University of Maryland Center Environmental Science	11.478	NA22NOS4780172	166,447		-
	11.478	NA19NOS4780183	1,052,647		826,329
Passed through Woods Hole Oceanographic Institution	11.478	NA21NOS4780156	227,848	1,446,942	-
Coral Reef Conservation Program					
Passed through University of Southern California	11.482	NA21NMF820300	28,632	28,632	-
Environmental Protection Agency					
Geographic Programs - South Florida Geographic Initiatives Program					
	66.484	02D20722	58,972		-
	66.484	02D42723	16,447	75,419	-

Mote Marine Laboratory, Inc.
Schedule of Expenditures of Federal Awards and
State Financial Assistance (Continued)
Year Ended September 30, 2023

Grantor	Assistance Listing # or CSFA#	Pass-through Entity Identification or Grant Number	Total Expenditures		Transfer to Subrecipients
Federal Contracts and Grants (Continued)					
RESEARCH AND DEVELOPMENT CLUSTER (Continued)					
National Science Foundation					
Geosciences	47.050	1923926	211,113		-
	47.050	2050892	134,365		-
Passed through Florida Atlantic University	47.050	2143655	40,830		-
	47.050	2309081	55,830		-
	47.050	2325316	1,325	443,463	-
Biological Sciences	47.074	2222273	36,679	36,679	-
STEM Education (formerly Education and Human Resources)	47.076	1922351	244,707	244,707	2,679
U.S. Department of Defense					
Defense Advanced Research Projects Agency (DARPA)					
Research and Technology Development					
Passed through Florida Atlantic University	12.910	AWD - 001612	100,872	100,872	-
Department of the Interior					
U.S. Fish and Wildlife Service					
Prescott Marine Mammal Rescue Assistance	15.683	F22AP03071-00	96,600	96,600	-
National Park Service					
National Park Service Conservation, Protection, Outreach, and Education	15.954	P19AC01005	5,533	5,533	-
Department of Treasury					
Resources and Ecosystems Sustainability, Tourist Opportunities, and Revived Economies of the Gulf Coast States					
Passed through The Nature Conservancy	21.015	RDCGR170068	5,407		-
Passed through the Florida Institute of Oceanography	21.015	8-RCEGR020005-01-02	121,024	126,431	-
Department of State					
General Department of State Assistance	19.700	SIS-70017G33038	188,531	188,531	101,384
TOTAL RESEARCH AND DEVELOPMENT CLUSTER				$ 5,465,711	$ 999,609
Total Federal Contracts and Grants				$ 5,465,711	$ 999,609
State Contracts and Grants					
State of Florida					
Florida Fish & Wildlife Conservation Commission					
Cooperative Red Tide Research Program - Reduction of Harmful Impacts from Red Tide - Red Tide Mitigation and Technology Development Initiative	77.010	15003	11,117		-
	77.010	19153	3,422,278		874,235
	77.010	20034	1,016,197		-
	77.010	22122	124,948	4,574,540	-
Marine Fisheries Assessment	77.023	20317	285,967	285,967	-
Mote Marine Laboratory Coral Reef Restoration Program	77.036	21069	979,836	979,836	-
Monitoring and Support Coral Restoration	77.044	21354	38,554	38,554	-
Department of Highway Safety & Motor Vehicles					
Protect Our Reefs License Plate Project	76.069	POR	1,569,863	1,569,863	55,752
Sea Turtle License Plate Project	76.070	22-003R	2,585	2,585	-
Department of Environmental Protection					
Coral Reef Protection and Restoration Grant	37.107	C2002	938,409	938,409	695,028
Department of Education and Commissioner of Education					
K-15--FCO Facility--Repairs Maintenance and Construction	48.152	417-96520-3D001	5,000,000	5,000,000	-
Total State Contracts and Grants				$ 13,389,754	$ 1,625,015
Total Federal and State Contracts and Grants				$ 18,855,465	$ 2,624,624

1. Basis of Presentation

The accompanying schedule of expenditures of federal awards (the Schedule) includes the federal award and state financial assistance activity of Mote Marine Laboratory, Inc. under programs of the federal government and State of Florida for the year ended September 30, 2023. The information in this Schedule is presented in accordance with the requirements of Title 2 U.S. Code of Federal Regulations Part 200, *Uniform Administrative Requirements, Cost Principles, and Audit Requirements for Federal Awards* (Uniform Guidance) and Chapter 10.650, *Rules of the Auditor General* of the State of Florida. Because the Schedule presents only a selected portion of the operations of Mote Marine Laboratory, Inc., it is not intended to and does not present the financial position, changes in net assets, or cash flows of Mote Marine Laboratory, Inc.

2. Summary of Significant Accounting Policies

Expenditures reported on the Schedule are reported on the accrual basis of accounting. Such expenditures are recognized following the cost principles contained in the Uniform Guidance, wherein certain types of expenditures are not allowable or are limited as to reimbursement.

3. Indirect Cost Election

Mote Marine Laboratory, Inc. has not elected to use the 10% de minimis cost rate as allowed under the Uniform Guidance, and has a federally negotiated rate with its cognizant agency.

Contract Compliance

Report on Internal Control Over Financial Reporting and on Compliance and Other Matters Based on an Audit of Financial Statements Performed in Accordance With *Government Auditing Standards*

Independent Auditor's Report

The Board of Trustees
Mote Marine Laboratory, Inc.
Sarasota, Florida

We have audited, in accordance with the auditing standards generally accepted in the United States of America and the standards applicable to financial audits contained in *Government Auditing Standards*, issued by the Comptroller General of the United States, the financial statements of Mote Marine Laboratory Inc. (Laboratory), which comprise the statement of financial position as of September 30, 2023, the related statement of activities, functional expenses, and cash flows for the year then ended, and the related notes to the financial statements, and have issued our report thereon dated February 22, 2024.

Report on Internal Control over Financial Reporting
In planning and performing our audit of the financial statements, we considered the Laboratory's internal control over financial reporting (internal control) as a basis for designing audit procedures that are appropriate in the circumstances for the purpose of expressing our opinion on the financial statements, but not for the purpose of expressing an opinion on the effectiveness of the Laboratory's internal control. Accordingly, we do not express an opinion on the effectiveness of the Laboratory's internal control.

A *deficiency in internal control* exists when the design or operation of a control does not allow management or employees, in the normal course of performing their assigned functions, to prevent, or detect and correct, misstatements on a timely basis. A *material weakness* is a deficiency, or a combination of deficiencies, in internal control, such that there is a reasonable possibility that a material misstatement of the entity's financial statements will not be prevented, or detected and corrected, on a timely basis. A *significant deficiency* is a deficiency, or a combination of deficiencies, in internal control that is less severe than a material weakness, yet important enough to merit attention by those charged with governance.

Our consideration of internal control was for the limited purpose described in the first paragraph of this section and was not designed to identify all deficiencies in internal control that might be material weaknesses or significant deficiencies. Given these limitations, during our audit we did not identify any deficiencies in internal control that we consider to be material weaknesses. However, material weaknesses may exist that have not been identified.

Report on Compliance and Other Matters

As part of obtaining reasonable assurance about whether the Laboratory's financial statements are free from material misstatement, we performed tests of its compliance with certain provisions of laws, regulations, contracts and grant agreements, noncompliance with which could have a direct and material effect on the financial statements. However, providing an opinion on compliance with those provisions was not an objective of our audit, and accordingly, we do not express such an opinion. The results of our tests disclosed no instances of noncompliance or other matters that are required to be reported under *Government Auditing Standards.*

Purpose of this Report

The purpose of this report is solely to describe the scope of our testing of internal control and compliance and the results of that testing, and not to provide an opinion on the effectiveness of the entity's internal control or on compliance. This report is an integral part of an audit performed in accordance with *Government Auditing Standards* in considering the entity's internal control and compliance. Accordingly, this communication is not suitable for any other purpose.

Kerkering Barberio & Co.

Sarasota, Florida
February 22, 2024

KERKERING BARBERIO

Kerkering, Barberio & Co.
Certified Public Accountants

Report on Compliance for Each Major Federal Program and State Project; and Report on Internal Control over Compliance Required by the Uniform Guidance and Chapter 10.650, *Rules of the Auditor General* of the State of Florida

Independent Auditor's Report

The Board of Trustees
Mote Marine Laboratory, Inc.
Sarasota, Florida

Report on Compliance for Each Major Federal Program and State Financial Assistance Project

Opinion on Each Major Federal Program and State Financial Assistance Project

We have audited Mote Marine Laboratory, Inc.'s (Laboratory) compliance with the types of compliance requirements identified as subject to audit in the *OMB Compliance Supplement* and the requirements described in the State of Florida Department of Financial Services *State Projects Compliance Supplement* that could have a direct and material effect on each of the Laboratory's major federal programs and state financial assistance projects for the year ended September 30, 2023. The Laboratory's major federal programs and state financial assistance projects are identified in the summary of auditor's results section of the accompanying schedule of findings and questioned costs.

In our opinion, the Laboratory complied, in all material respects, with the types of compliance requirements referred to above that could have a direct and material effect on each of its major federal programs and state financial assistance projects for the year ended September 30, 2023.

Basis for Opinion on Each Major Federal Program and State Financial Assistance Project

We conducted our audit of compliance in accordance with auditing standards generally accepted in the United States of America (GAAS); the standards applicable to financial audits contained in *Government Auditing Standards* issued by the Comptroller General of the United States (*Government Auditing Standards*); the audit requirements of Title 2 U.S. *Code of Federal Regulations Part 200, Uniform Administrative Requirements, Cost Principles, and Audit Requirements for Federal Awards* (Uniform Guidance); and Chapter 10.650, *Rules of the Auditor General* of the State of Florida. Our responsibilities under those standards and the Uniform Guidance are further described in the Auditor's Responsibilities for the Audit of Compliance section of our report.

We are required to be independent of the Laboratory and to meet our other ethical responsibilities, in accordance with relevant ethical requirements relating to our audit. We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our opinion on compliance for each major federal program and state financial assistance project. Our audit does not provide a legal determination of the Laboratory's compliance with the compliance requirements referred to above.

Responsibilities of Management for Compliance

Management is responsible for compliance with the requirements referred to above and for the design, implementation, and maintenance of effective internal control over compliance with the requirements of laws, statutes, regulations, rules and provisions of contracts or grant agreements applicable to the Laboratory's federal programs and state financial assistance projects.

Auditor's Responsibilities for the Audit of Compliance

Our objectives are to obtain reasonable assurance about whether material noncompliance with the compliance requirements referred to above occurred, whether due to fraud or error, and express an opinion on the Laboratory's compliance based on our audit. Reasonable assurance is a high level of assurance but is not absolute assurance and therefore is not a guarantee that an audit conducted in accordance with GAAS, *Government Auditing Standards*, the Uniform Guidance, and Chapter 10.650 *Rules of the Auditor General* of the State of Florida, will always detect material noncompliance when it exists. The risk of not detecting material noncompliance resulting from fraud is higher than for that resulting from error, as fraud may involve collusion, forgery, intentional omissions, misrepresentations, or the override of internal control. Noncompliance with the compliance requirements referred to above is considered material, if there is a substantial likelihood that, individually or in the aggregate, it would influence the judgment made by a reasonable user of the report on compliance about the Laboratory's compliance with the requirements of each major federal program and state financial assistance project as a whole.

In performing an audit in accordance with GAAS, *Government Auditing Standards*, the Uniform Guidance, and Chapter 10.650 *Rules of the Auditor General* of the State of Florida we:

- Exercise professional judgment and maintain professional skepticism throughout the audit.

- Identify and assess the risks of material noncompliance, whether due to fraud or error, and design and perform audit procedures responsive to those risks. Such procedures include examining, on a test basis, evidence regarding the Laboratory's compliance with the compliance requirements referred to above and performing such other procedures as we considered necessary in the circumstances.

- Obtain an understanding of the Laboratory's internal control over compliance relevant to the audit in order to design audit procedures that are appropriate in the circumstances and to test and report on internal control over compliance in accordance with the Uniform Guidance, but not for the purpose of expressing an opinion on the effectiveness of the Laboratory's internal control over compliance. Accordingly, no such opinion is expressed.

We are required to communicate with those charged with governance regarding, among other matters, the planned scope and timing of the audit and any significant deficiencies and material weaknesses in internal control over compliance that we identified during the audit.

Report on Internal Control over Compliance

A *deficiency in internal control over compliance* exists when the design or operation of a control over compliance does not allow management or employees, in the normal course of performing their assigned functions, to prevent, or detect and correct, noncompliance with a type of compliance requirement of a federal program or state financial assistance project on a timely basis. A *material weakness in internal control over compliance* is a deficiency, or a combination of deficiencies, in internal control over compliance, such that there is a reasonable possibility that material noncompliance with a type of compliance requirement of a federal program or state project will not be prevented, or detected and corrected, on a timely basis. A *significant deficiency in internal control over compliance* is a deficiency, or a combination of deficiencies, in internal control over compliance with a type of compliance requirement of a federal program or state financial assistance project that is less severe than a material weakness in internal control over compliance, yet important enough to merit attention by those charged with governance.

Report on Internal Control over Compliance (Continued)

Our consideration of internal control over compliance was for the limited purpose described in the Auditor's Responsibilities for the Audit of Compliance section above and was not designed to identify all deficiencies in internal control over compliance that might be material weaknesses or significant deficiencies in internal control over compliance. Given these limitations, during our audit we did not identify any deficiencies in internal control over compliance that we consider to be material weaknesses, as defined above. However, material weaknesses or significant deficiencies in internal control over compliance may exist that were not identified.

Our audit was not designed for the purpose of expressing an opinion on the effectiveness of internal control over compliance. Accordingly, no such opinion is expressed.

The purpose of this report on internal control over compliance is solely to describe the scope of our testing of internal control over compliance and the results of that testing based on the requirements of the Uniform Guidance and the Chapter 10.650, *Rules of the Auditor General* of the State of Florida. Accordingly, this report is not suitable for any other purpose.

Kerkering, Barberio & Co.

Sarasota, Florida
February 22, 2024

Section I - Summary of Auditor's Results

Financial Statements

Type of auditor's report issued on whether the financial statements audited were prepared in accordance with GAAP:	Unmodified
Internal control over financial reporting:	
• Material weakness(es) identified?	______yes___x___ no
• Significant deficiency(ies) identified?	______yes___x___ none reported
Noncompliance material to financial statements noted?	______yes___x___ no

Federal and State Awards

Internal control over major programs and projects:	
• Material weakness(es) identified?	______yes___x___ no
• Significant deficiency(ies) identified?	______yes___x___ none reported
Type of auditor's report issued on compliance for major programs and projects:	Unmodified
Any audit findings disclosed that are required to be reported in accordance with section 2 CFR 200.516(a) and the provisions of the Florida Single Audit Act in accordance with Chapter 10.650 of the Rules of the Auditor General	______ yes___x___ no

Section I - Summary of Auditor's Results (Continued)

Identification of major programs and projects:

CFDA Numbers	*Name of Federal Program or Cluster*
	Research and Development Cluster:
10.001	Agricultural Research Basic and Applied Research
10.200	Agricultural Research, Special Research Grants
10.310	USDA/NIFA – USDA National Institute of Food and Agriculture
11.011	Ocean Exploration
11.012	Integrated Ocean Observing System (IOOS)
11.017	Ocean Acidification Toolkits for Educators
11.021	Small Business Innovation Research
11.427	Fisheries Development and Utilization Research and Development Grants and Cooperative Agreements Program
11.433	Marine Fisheries Initiative
11.439	Marine Mammal Data Program
11.454	Unallied Management Projects
11.463	Habitat Conservation
11.469	Congressionally Identified Awards and Projects
11.472	Unallied Science Program
11.473	Office for Coastal Management
11.478	Center for Sponsored Coastal Ocean Research Coastal Ocean Program
11.482	Coral Reef Conservation Program and Restoration Center
66.484	Surveys, Studies, Investigations, Demonstrations, and Training Grants and Cooperative Agreements – Section 104(b)(3) of the Clean Water Act
47.050	Geosciences
47.074	Biological Sciences
47.076	Education and Human Resources
12.910	Research and Technology Development
15.683	Prescott Marine Mammal Rescue Assistance
15.954	National Park Service Conservation, Protection, Outreach, and Education
21.015	Resources and Ecosystems Sustainability, Tourist Opportunities, and Revived Economies of the Gulf Coast States
19.700	General Department of State Assistance

Mote Marine Laboratory, Inc.

Schedule of Findings and Questioned Costs (Continued)
Year Ended September 30, 2023

Section I - Summary of Auditor's Results (Continued)

CSFA Numbers	***Name of State Projects***
77.010	Cooperative Red Tide Research Program-Reduction of Harmful Impact from Red Tide
37.107	Coral Reef Protection and Restoration Grant
48.152	K-15--FCO Facility--Repairs Maintenance and Construction

Dollar threshold used to distinguish between type A and type B Federal programs: $ 750,000
Dollar threshold used to distinguish between type A and type B State projects: $ 750,000

Auditee qualified as low-risk auditee? __x__ yes______ no

Section II - Financial Statement Findings

None

Section III - Federal and State Award Findings and Questioned Costs

None

Section IV - Summary Schedule of Prior Audit Findings and Questioned Costs

No prior audit findings or questioned costs to be addressed

Section V - Other

No management letter is required because there were no findings to be reported in a management letter as required by Section 215.97 (9)(f) and 215.97 (10)(d) of the Florida Statutes, Auditor General Rule 10.654 (1)(e) or 10.656 (3)(e).

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KERKERING BARBERIO

Kerkering, Barberio & Co.
Certified Public Accountants

Independent Auditor's Report

The Board of Trustees
Mote Marine Laboratory, Inc.
Sarasota, Florida

Opinion

We have audited the accompanying financial statements of Mote Marine Laboratory, Inc. (Laboratory), a nonprofit organization, which comprise the statements of financial position as of September 30, 2022 and 2021, and the related statements of activities, cash flows, and functional expenses for the years then ended, and the related notes to the financial statements.

In our opinion, the accompanying financial statements present fairly, in all material respects, the financial position of the Laboratory as of September 30, 2022 and 2021, and the changes in its net assets and its cash flows for the years then ended in accordance with accounting principles generally accepted in the United States of America.

Basis for Opinion

We conducted our audit in accordance with auditing standards generally accepted in the United States of America (GAAS) and the standards applicable to financial audits contained in *Government Auditing Standards,* issued by the Comptroller General of the United States (*Government Auditing Standards*). Our responsibilities under those standards are further described in the Auditor's Responsibilities for the Audit of the Financial Statements section of our report. We are required to be independent of the Laboratory and to meet our other ethical responsibilities, in accordance with the relevant ethical requirements relating to our audits. We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our audit opinion.

Responsibilities of Management for the Financial Statements

Management is responsible for the preparation and fair presentation of the financial statements in accordance with accounting principles generally accepted in the United States of America, and for the design, implementation, and maintenance of internal control relevant to the preparation and fair presentation of financial statements that are free from material misstatement, whether due to fraud or error.

In preparing the financial statements, management is required to evaluate whether there are conditions or events, considered in the aggregate, that raise substantial doubt about the Laboratory's ability to continue as a going concern within one year after the date that the financial statements are available to be issued.

Auditor's Responsibilities for the Audit of the Financial Statements

Our objectives are to obtain reasonable assurance about whether the financial statements as a whole are free from material misstatement, whether due to fraud or error, and to issue an auditor's report that includes our opinion. Reasonable assurance is a high level of assurance but is not absolute assurance and therefore is not a guarantee that an audit conducted in accordance with GAAS and *Government Auditing Standards* will always detect a material misstatement when it exists. The risk of not detecting a material misstatement resulting from fraud is higher than for one resulting from error, as fraud may involve collusion, forgery, intentional omissions, misrepresentations, or the override of internal control. Misstatements are considered material if there is a substantial likelihood that, individually or in the aggregate, they would influence the judgment made by a reasonable user based on the financial statements.

In performing an audit in accordance with GAAS and *Government Auditing Standards*, we:

- Exercise professional judgment and maintain professional skepticism throughout the audit.
- Identify and assess the risks of material misstatement of the financial statements, whether due to fraud or error, and design and perform audit procedures responsive to those risks. Such procedures include examining, on a test basis, evidence regarding the amounts and disclosures in the financial statements.
- Obtain an understanding of internal control relevant to the audit in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of the Laboratory's internal control. Accordingly, no such opinion is expressed.
- Evaluate the appropriateness of accounting policies used and the reasonableness of significant accounting estimates made by management, as well as evaluate the overall presentation of the financial statements.
- Conclude whether, in our judgment, there are conditions or events, considered in the aggregate, that raise substantial doubt about the Laboratory's ability to continue as a going concern for a reasonable period of time.

We are required to communicate with those charged with governance regarding, among other matters, the planned scope and timing of the audit, significant audit findings, and certain internal control-related matters that we identified during the audit.

Other Matters

Our audit was conducted for the purpose of forming an opinion on the financial statements as a whole. The accompanying Schedule of Expenditures of Federal Awards and State Financial Assistance, as required by Title 2 U.S. *Code of Federal Regulations (CFR)* Part 200, *Uniform Administrative Requirements, Cost Principles, and Audit Requirements for Federal Awards* and Chapter 10.650, *Rules of the Auditor General* is presented for purposes of additional analysis and is not a required part of the financial statements. Such information is the responsibility of management and was derived from and relates directly to the underlying accounting and other records used to prepare the financial statements. The information has been subjected to the auditing procedures applied in the audit of the financial statements and certain additional procedures, including comparing and reconciling such information directly to the underlying accounting and other records used to prepare the financial statements or to the financial statements themselves, and other additional procedures in accordance with GAAS. In our opinion, the information is fairly stated, in all material respects, in relation to the financial statements as a whole.

Other Reporting Required by *Government Auditing Standards*

In accordance with *Government Auditing Standards*, we have also issued our report dated February 21, 2023, on our consideration of the Laboratory's internal control over financial reporting and on our tests of its compliance with certain provisions of laws, regulations, contracts, and grant agreements and other matters. The purpose of that report is solely to describe the scope of our testing of internal control over financial reporting and compliance and the results of that testing, and not to provide an opinion on the effectiveness of the Laboratory's internal control over financial reporting or on compliance. That report is an integral part of an audit performed in accordance with *Government Auditing Standards* in considering the Laboratory's internal control over financial reporting and compliance.

Kerkering Barberio & Co.

Sarasota, Florida
February 21, 2023

Mote Marine Laboratory, Inc.

Statements of Financial Position

September 30, 2022 and 2021

	2022	2021
Assets		
Cash and cash equivalents	$ 15,353,772	$ 16,351,517
Accounts receivable	4,919,837	4,295,917
Pledges receivable, net	9,554,050	7,847,579
Due from Mote Marine Foundation, Inc.	470,049	529,282
Prepaid expenses and other assets	179,710	126,016
Investments - certificates of deposit	119,193	392,197
Patents, net	79,286	88,139
Intangibles, net	334,750	-
Investment in deferred compensation plan	611,078	595,355
Land	7,519,082	7,498,190
Property and equipment, net	14,064,103	14,999,685
Construction in progress	30,004,708	15,972,540
Beneficial interest in the net assets of Mote Marine Foundation, Inc.	16,481,634	20,678,361
Total Assets	$ 99,691,252	$ 89,374,778
Liabilities and Net Assets		
Liabilities:		
Accounts payable	$ 2,680,699	$ 3,543,776
Accrued payroll	1,058,914	931,701
Memberships relating to future periods	546,511	639,825
Funds advanced on research programs	5,154,051	4,840,451
Deferred compensation payable	611,078	595,355
Lines of credit	1,397,647	1,402,101
Notes payable	5,466,368	6,715,042
Total liabilities	16,915,268	18,668,251
Net Assets:		
Without donor restrictions:		
Undesignated	51,673,165	35,585,348
Board designated	390,818	390,818
Total net assets without donor restrictions	52,063,983	35,976,166
With donor restrictions:		
Purpose and time restrictions	20,664,511	24,684,247
Perpetual in nature	10,047,490	10,046,114
Total net assets with donor restrictions	30,712,001	34,730,361
Total net assets	82,775,984	70,706,527
Total Liabilities and Net Assets	$ 99,691,252	$ 89,374,778

See accompanying notes to the financial statements.

Mote Marine Laboratory, Inc.

Statement of Activities
Year Ended September 30, 2022
(With Summarized Totals for 2021)

	Without Donor Restrictions	With Donor Restrictions	Total	2021 Total
Support, Revenue and Reclassifications:				
Program revenue:				
Research revenue:				
Federal	$ 5,677,236	$ -	$ 5,677,236	$ 4,697,906
State	6,814,217	-	6,814,217	5,242,015
Other	5,023,170	99,186	5,122,356	7,535,946
Aquarium:				
Admission fees	6,230,784	-	6,230,784	5,485,931
Gift shop	644,078	-	644,078	556,749
Other	699,109	-	699,109	371,717
Memberships	1,118,070	-	1,118,070	604,506
Education	617,845	-	617,845	472,256
Protect Our Reefs-License Plate	1,350,873	-	1,350,873	875,077
Other programs	358,684	1,807,218	2,165,902	3,917,393
Contributions:				
Construction	-	13,556,039	13,556,039	7,833,755
Education	470,808	25,000	495,808	-
Aquarium	94,826	44,892	139,718	100,685
Other programs	2,859,602	25,250	2,884,852	2,733,482
Paycheck Protection Program loan forgiveness	-	-	-	2,318,259
Non-cash contributions	99,328	16,204	115,532	690,081
Grants from Mote Marine Foundation, Inc.	465,741	-	465,741	524,748
Investment income	16,144	51,899	68,043	27,735
Unrealized loss on investments, net	(8,318)	(112,734)	(121,052)	(8,612)
Realized gain (loss) on investments, net	5,152	(19,545)	(14,393)	2,689
Realized loss on disposal of assets	(1,599)	-	(1,599)	(949)
Change in beneficial interest in the net assets of Mote Marine Foundation, Inc.	(366,359)	(3,830,368)	(4,196,727)	3,536,913
Net assets released from restrictions	15,681,401	(15,681,401)	-	-
Total support, revenue and reclassifications	47,850,792	(4,018,360)	43,832,432	47,518,282
Expenses:				
Program services:				
Research	19,693,397	-	19,693,397	16,842,052
Education	1,221,417	-	1,221,417	980,292
Aquarium	4,679,048	-	4,679,048	4,232,382
Protect Our Reefs-License Plate	970,118	-	970,118	505,156
MAP facility operations	628,510	-	628,510	639,506
Other	1,191,368	-	1,191,368	692,048
Supporting services:				
Administrative and general	1,137,181	-	1,137,181	1,437,163
Fundraising	2,241,936	-	2,241,936	2,022,659
Total expenses	31,762,975	-	31,762,975	27,351,258
Change in net assets	16,087,817	(4,018,360)	12,069,457	20,167,024
Net assets at beginning of year	35,976,166	34,730,361	70,706,527	50,539,503
Net assets at end of year	$ 52,063,983	$ 30,712,001	$ 82,775,984	$ 70,706,527

See accompanying notes to the financial statements.

Mote Marine Laboratory, Inc.
Statement of Activities
Year Ended September 30, 2021
(With Summarized Totals for 2022)

	Without Donor Restrictions	With Donor Restrictions	Total	2022 Total
Support, Revenue and Reclassifications:				
Program revenue:				
Research revenue:				
Federal	$ 4,697,906	$ -	$ 4,697,906	$ 5,677,236
State	5,242,015	-	5,242,015	6,814,217
Other	7,004,272	531,674	7,535,946	5,122,356
Aquarium:				
Admission fees	5,485,931	-	5,485,931	6,230,784
Gift shop	556,749	-	556,749	644,078
Other	371,717	-	371,717	699,109
Memberships	604,506	-	604,506	1,118,070
Education	472,256	-	472,256	617,845
Protect Our Reefs-License Plate	875,077	-	875,077	1,350,873
Other programs	517,396	3,399,997	3,917,393	2,165,902
Contributions:				
Construction	-	7,833,755	7,833,755	13,556,039
Education	-	-	-	495,808
Aquarium	92,085	8,600	100,685	139,718
Other programs	2,702,482	31,000	2,733,482	2,884,852
Paycheck Protection Program loan forgiveness	2,318,259	-	2,318,259	-
Non-cash contributions	84,381	605,700	690,081	115,532
Grants from Mote Marine Foundation, Inc.	524,748	-	524,748	465,741
Investment income	22,025	5,710	27,735	68,043
Unrealized loss on investments, net	(2,939)	(5,673)	(8,612)	(121,052)
Realized gain (loss) on investments, net	2,689	-	2,689	(14,393)
Realized loss on disposal of assets	(653)	(296)	(949)	(1,599)
Change in beneficial interest in the net assets of Mote Marine Foundation, Inc.	369,390	3,167,523	3,536,913	(4,196,727)
Net assets released from restrictions	9,951,357	(9,951,357)	-	-
Total support, revenue and reclassifications	41,891,649	5,626,633	47,518,282	43,832,432
Expenses:				
Program services:				
Research	16,842,052	-	16,842,052	19,693,397
Education	980,292	-	980,292	1,221,417
Aquarium	4,232,382	-	4,232,382	4,679,048
Protect Our Reefs-License Plate	505,156	-	505,156	970,118
MAP facility operations	639,506	-	639,506	628,510
Other	692,048	-	692,048	1,191,368
Supporting services:				
Administrative and general	1,437,163	-	1,437,163	1,137,181
Fundraising	2,022,659	-	2,022,659	2,241,936
Total expenses	27,351,258	-	27,351,258	31,762,975
Change in net assets	14,540,391	5,626,633	20,167,024	12,069,457
Net assets at beginning of year	21,435,775	29,103,728	50,539,503	70,706,527
Net assets at end of year	$ 35,976,166	$ 34,730,361	$ 70,706,527	$ 82,775,984

See accompanying notes to the financial statements.

Mote Marine Laboratory, Inc.
Statements of Cash Flows
Years Ended September 30, 2022 and 2021

	2022	2021
Cash Flows from Operating Activities:		
Change in net assets	$ 12,069,457	$ 20,167,024
Adjustments to reconcile change in net assets to net cash provided by operating activities:		
Depreciation and amortization	2,517,601	2,879,804
Realized loss on disposal of assets	1,599	949
Unrealized / realized loss on investments, net	135,445	5,923
Change in beneficial interest in the net assets of Mote Marine Foundation, Inc.	4,196,727	(3,536,913)
Non-cash contributions	(115,532)	(690,081)
Proceeds from donated assets held for sale	-	83,209
Paycheck Protection Program loan forgiveness	-	(2,318,259)
Change in operating assets:		
Accounts receivable	(623,920)	605,620
Pledges receivable, net	(1,706,471)	(95,525)
Due from Mote Marine Foundation, Inc.	59,233	190,356
Prepaid expenses and other assets	(388,444)	(58,719)
Change in operating liabilities:		
Accounts payable	(149,636)	(12,974)
Accrued payroll	127,213	110,755
Memberships relating to future periods	(93,314)	263,912
Funds advanced on research programs	313,600	(4,200,564)
Total adjustments	4,274,101	(6,772,507)
Net cash provided by operating activities	16,343,558	13,394,517
Cash Flows from Investing Activities:		
Purchases of property and equipment	(16,335,447)	(7,685,923)
Proceeds from sale of property and equipment	3,200	-
Proceeds from maturity of certificate of deposit	253,091	235,432
Patent costs	(9,019)	(9,467)
Net cash used in investing activities	(16,088,175)	(7,459,958)
Cash Flows from Financing Activities:		
Net change in lines of credit	(4,454)	-
Repayments of notes payable	(1,248,674)	(862,159)
Net cash used in financing activities	(1,253,128)	(862,159)
Net change in cash and cash equivalents	(997,745)	5,072,400
Cash and cash equivalents, beginning of year	16,351,517	11,279,117
Cash and cash equivalents, end of year	$ 15,353,772	$ 16,351,517
Cash and cash equivalents, end of year, consist of the following:		
Cash	14,780,482	15,799,009
Restricted cash	573,290	552,508
	$ 15,353,772	$ 16,351,517
Supplemental Disclosure of Non-Cash:		
Operating, Investing, and Financing Activity:		
Cash paid for interest	$ 207,150	$ 161,922
Construction in progress included in accounts payable	$ 1,757,588	$ 2,471,029
Construction in progress purchased through financing	$ -	$ 1,500,418
Construction in progress non-cash contribution	$ -	$ 600,000
Forgiveness of Paycheck Protection Program Loan	$ -	$ 2,318,259

See accompanying notes to the financial statements.

Mote Marine Laboratory, Inc.
Statement of Functional Expenses
Year Ended September 30, 2022
(With Summarized Totals for 2021)

	Program Services				
	Research	Education	Aquarium	Protect our Reefs License Plate	MAP Facility Operations
Salaries and benefits	$ 8,483,348	$ 767,754	$ 2,908,473	$ 321,972	$ 61,054
Contracted services	2,960,830	221,352	101,029	113,367	826
Depreciation	-	-	186,757	36,446	316,997
Repairs and maintenance	471,310	559	543,157	195,695	64,150
Travel, meals and seminars	458,105	36,395	30,541	10,022	-
Research supplies	1,518,051	19,507	4,407	42,370	544
Merchandise	1,585	3,398	27,809	395	-
Office expense	143,531	32,626	420,039	23,834	726
Electricity	54,754	-	187,590	81,573	111,090
Insurance	32,118	-	51,743	11,191	44,460
Telephone	27,458	5,369	11,097	14,412	3,716
Promotion and advertising	174,808	52,758	61,709	12,485	-
Expendable supplies	5,850	8,918	15,463	-	-
Printing and publication	12,057	3,778	22,000	4,377	-
Vessel	109,459	-	-	25	-
Vehicle	48,311	500	10,340	5,258	6,130
Interest	-	-	-	-	-
Accounting and legal	1,078	337	1,168	-	-
Equipment rental	8,489	-	2,876	8,278	(2,141)
Library	-	-	-	-	-
Licenses and fees	75,856	2,942	20,737	4,009	20,958
Rent	46,082	15,099	-	-	-
Miscellaneous	-	-	-	-	-
	14,633,080	1,171,292	4,606,935	885,709	628,510
Overhead allocation	4,787,790	13,713	312	70,632	-
Rental use charges allocation:					
Vessel, vehicle and equipment	272,527	36,412	71,801	13,777	-
Total Expenses	$ 19,693,397	$ 1,221,417	$ 4,679,048	$ 970,118	$ 628,510
Percent of Total					

		Supporting Services			2022	2021
Other	Total	Administrative and General	Fund Raising	Total	Functional Expenses	Functional Expenses
$ 357,788	$ 12,900,389	$ 2,202,740	$ 1,433,945	$ 3,636,685	$ 16,537,074	$ 14,935,763
60,648	3,458,052	121,976	188,012	309,988	3,768,040	2,667,251
23,900	564,100	1,935,629	-	1,935,629	2,499,729	2,862,696
163,552	1,438,423	458,241	6,790	465,031	1,903,454	1,626,830
125,070	660,133	37,084	249,458	286,542	946,675	388,784
4,236	1,589,115	20,598	875	21,473	1,610,588	1,387,312
-	33,187	2,644	116	2,760	35,947	23,554
114,221	734,977	95,072	63,269	158,341	893,318	755,047
117,710	552,717	320,391	-	320,391	873,108	682,836
17,593	157,105	456,905	-	456,905	614,010	510,661
6,425	68,477	38,397	2,395	40,792	109,269	101,372
38,601	340,361	9,562	144,574	154,136	494,497	345,836
-	30,231	49	-	49	30,280	17,285
8,862	51,074	3,104	97,003	100,107	151,181	92,500
35,359	144,843	-	-	-	144,843	152,322
113,321	183,860	68,557	-	68,557	252,417	44,277
26,195	26,195	180,955	-	180,955	207,150	161,922
135,876	138,459	78,121	943	79,064	217,523	180,132
19,185	36,687	35,983	37,825	73,808	110,495	105,679
55,063	55,063	-	-	-	55,063	40,525
11,034	135,536	72,885	11,840	84,725	220,261	204,260
9,000	70,181	-	-	-	70,181	47,306
17,872	17,872	-	-	-	17,872	17,108
1,461,511	23,387,037	6,138,893	2,237,045	8,375,938	31,762,975	27,351,258
-	4,872,447	(4,872,447)	-	(4,872,447)	-	-
(270,143)	124,374	(129,265)	4,891	(124,374)	-	-
$ 1,191,368	$ 28,383,858	$ 1,137,181	$ 2,241,936	$ 3,379,117	$ 31,762,975	$ 27,351,258
	89%	4%	7%		100%	

Mote Marine Laboratory, Inc.
Statement of Functional Expenses
Year Ended September 30, 2021
(With Summarized Totals for 2022)

	Program Services				
	Research	Education	Aquarium	Protect our Reefs License Plate	MAP Facility Operations
Salaries and benefits	$ 7,756,169	$ 616,372	$ 2,586,002	$ 175,997	$ 74,126
Contracted services	1,972,978	214,158	130,951	61,981	2,863
Depreciation	-	-	230,583	-	320,971
Repairs and maintenance	409,849	1,121	508,227	123,970	72,257
Travel, meals and seminars	236,841	8,819	11,484	5,170	-
Research supplies	1,325,336	15,090	2,647	22,805	57
Merchandise	-	250	23,304	-	-
Office expense	128,654	27,872	358,019	5,858	2,210
Electricity	45,210	21	164,357	51,285	82,547
Insurance	21,912	-	46,768	10,304	37,989
Telephone	23,950	5,596	10,198	12,953	3,855
Promotion and advertising	135,047	38,520	36,830	9,062	-
Expendable supplies	697	4,625	11,963	-	-
Printing and publication	6,439	1,967	10,312	307	-
Vessel	44,262	-	7,966	(105)	2,408
Vehicle	-	-	2,123	2,239	-
Interest	-	-	-	-	-
Accounting and legal	5,074	1,586	1,586	-	-
Equipment rental	23,171	8	3,043	1,292	19,966
Library	-	-	-	-	-
Licenses and fees	69,233	2,547	25,595	2,202	20,257
Rent	25,501	21,705	-	-	-
Miscellaneous	-	-	-	-	-
	12,230,323	960,257	4,171,958	485,320	639,506
Overhead allocation	4,320,607	8,965	-	16,185	-
Rental use charges allocation:					
Vessel, vehicle and equipment	291,122	11,070	60,424	3,651	-
Total Expenses	$ 16,842,052	$ 980,292	$ 4,232,382	$ 505,156	$ 639,506
Percent of Total					

		Supporting Services			2021 Total Functional Expenses	2022 Total Functional Expenses
Other	Total	Administrative and General	Fund Raising	Total		
$ 243,444	$ 11,452,110	$ 2,018,456	$ 1,465,197	$ 3,483,653	$ 14,935,763	$ 16,537,074
12,866	2,395,797	129,863	141,591	271,454	2,667,251	3,768,040
-	551,554	2,311,142	-	2,311,142	2,862,696	2,499,729
180,206	1,295,630	322,639	8,561	331,200	1,626,830	1,903,454
18,032	280,346	10,730	97,708	108,438	388,784	946,675
4,148	1,370,083	17,229	-	17,229	1,387,312	1,610,588
-	23,554	-	-	-	23,554	35,947
47,592	570,205	85,470	99,372	184,842	755,047	893,318
62,815	406,235	276,601	-	276,601	682,836	873,108
31,447	148,420	362,241	-	362,241	510,661	614,010
4,437	60,989	38,284	2,099	40,383	101,372	109,269
9,468	228,927	6,864	110,045	116,909	345,836	494,497
-	17,285	-	-	-	17,285	30,280
155	19,180	640	72,680	73,320	92,500	151,181
97,559	152,090	232	-	232	152,322	144,843
76	4,438	39,839	-	39,839	44,277	252,417
5,573	5,573	156,349	-	156,349	161,922	207,150
107,509	115,755	59,937	4,440	64,377	180,132	217,523
10,537	58,017	46,987	675	47,662	105,679	110,495
40,525	40,525	-	-	-	40,525	55,063
26,571	146,405	44,502	13,353	57,855	204,260	220,261
100	47,306	-	-	-	47,306	70,181
17,108	17,108	-	-	-	17,108	17,872
920,168	19,407,532	5,928,005	2,015,721	7,943,726	27,351,258	31,762,975
3,786	4,349,543	(4,349,543)	-	(4,349,543)	-	-
(231,906)	134,361	(141,299)	6,938	(134,361)	-	-
$ 692,048	$ 23,891,436	$ 1,437,163	$ 2,022,659	$ 3,459,822	$ 27,351,258	$ 31,762,975
	87%	6%	7%		100%	

1. Organization

Mote Marine Laboratory, Inc. (Laboratory), a nonprofit corporation, operates and maintains a marine and environmental sciences laboratory for the encouragement and development of the study of marine sciences and the advancement of the general knowledge of kindred subjects through education, training, scientific research, exchange of scientific information and dissemination of information to the public. The Laboratory began operations in 1955.

2. Summary of Significant Accounting Policies

Financial Statements

The financial statements and notes are representations of the Laboratory's management who is responsible for their integrity and objectivity. The accounting policies conform to accounting principles generally accepted in the United States of America and have been consistently applied in the preparation of the financial statements.

Basis of Accounting

The Laboratory prepares its financial statements on the accrual basis of accounting in accordance with accounting principles generally accepted in the United States of America.

Use of Estimates and Assumptions

The preparation of financial statements in conformity with accounting principles generally accepted in the United States of America requires management to make estimates and assumptions that affect certain reported amounts of assets and liabilities and disclosure of contingent assets and liabilities at the date of the financial statements and the reported amounts of revenues and expenses during the reporting period. Accordingly, actual results could differ from those estimates and assumptions.

Accounts Receivable

Accounts receivable consist primarily of amounts due from program fees and grants receivable. A significant portion of grants receivable are research grants.

Substantially all research grants are cost reimbursement grants. Research grants receivable consists of billed and unbilled costs incurred on research contracts. Due to the nature of the grants, management considers them to be collectible and no allowance has been established. These amounts are included in accounts receivable on the statements of financial position.

Based on the Laboratory's collection history, management believes no allowance for uncollectible amounts is necessary.

Bequest Receivable

Bequests are recorded as support when the amount to be received can be reasonably estimated as provided by the executor of the estate.

Pledges Receivable

Pledges are recorded as support when the donor's commitment has been received. Pledges receivable due in more than one year are reflected at the present value of estimated future cash flows using an appropriate discount rate in the year pledged.

2. Summary of Significant Accounting Policies (Continued)

Property and Equipment

Property and equipment are stated at cost, if purchased, or fair market value at the date of gift, if donated.

Depreciation is provided over the estimated useful lives of the assets using the straight-line half-year method. Estimated useful lives are as follows:

	Years
Vehicles	3
Vessels	5
Buildings and improvements	5 - 40
Furniture, fixtures and exhibits	5 - 10
Laboratory equipment	5 - 20
Trailers	5 - 10

The Laboratory capitalizes all fixed asset purchases or donations with an estimated useful life of greater than one year and a cost or fair market value of $5,000 or greater.

Revenue Recognition

Revenue associated with research grants or contracts is generally recognized as related costs are incurred. Membership revenue is recognized ratably throughout the membership year.

All contributions are considered to be available for use without donor restriction unless specifically restricted by the donor. Contributions which are designated by the donor to be used in future periods, or for specific purposes, are recorded as net assets with donor restrictions. When the purpose of the restriction is accomplished, or passage of time has occurred, net assets with donor restrictions are reclassified to net assets without donor restrictions and reported in the statements of activities as net assets released from restrictions.

Gifts of cash restricted for the purpose of acquiring or constructing long-lived assets are recorded as net assets with donor restrictions until the long-lived assets are acquired or constructed at which time the net assets are released from the restriction and reclassified as net assets without donor restrictions. Any conditional gifts for which the conditions are not met at year-end are recorded as refundable advances.

Patents

Patents are stated at the cost to acquire. Amortization is provided for using the straight-line method over the estimated useful life of ten years.

Contributed Services and Nonfinancial Assets

A substantial number of volunteers have made significant contributions of their time to the operations of the Laboratory. The amount of volunteer hours contributed to the Laboratory during the years ended September 30, 2022 and 2021 were 152,911 and 160,208 hours, respectively. The estimated value of these donated services has not been recorded in the accompanying financial statements because it does not meet the criteria for recognition under generally accepted accounting principles.

However, management estimates the fair value of these services contributed to the Laboratory during the years ended September 30, 2022 and 2021 amounted to $4,579,692 and $4,572,324, respectively. These estimates are based on an article published in the Nonprofit Times that estimates volunteer time to be worth $29.95 and $28.54 per hour in 2022 and 2021, respectively, according to the Independent Sector, a Washington D.C. based coalition of nonprofits and foundations.

2. Summary of Significant Accounting Policies (Continued)
Contributed Services and Nonfinancial Assets (Continued)
Contributed nonfinancial assets are recognized at their estimated fair value when they create or enhance nonfinancial assets, they require specialized skills that would need to be purchased if they were not donated, or they are nonfinancial assets which are directed by the Laboratory for its benefit and have been provided at no cost. Amounts are recorded at their estimated fair value at the date of donation using published rates and prices. Contributed nonfinancial assets for the years ended September 30, 2022 and 2021 totaled $0 and $600,000, respectively, and is included in construction in progress on the statements of financial position.

Donated property and vessels, which are not classified by management for use by the Laboratory, are recorded as assets held for sale. The carrying value of such assets is adjusted to the lower of fair market value or the recorded value at the date of gift in order to more closely reflect the net realizable value.

Advertising and Promotion
Advertising and promotion costs are expensed as incurred. Advertising and promotion expense for the years ended September 30, 2022 and 2021 totaled $494,497 and $345,836, respectively.

Income Tax Status
The Laboratory is exempt from income taxes under Section 501(c)(3) of the Internal Revenue Code.

Under the Income Taxes topic of the FASB Accounting Standards Codification, the Laboratory has reviewed and evaluated the relevant technical merits of each of its tax positions in accordance with accounting principles generally accepted in the United States of America for accounting for uncertainty in income taxes, and determined that there are no uncertain tax positions that would have a material impact on the financial statements of the Laboratory.

The Laboratory files income tax returns in the U.S. federal jurisdiction and the State of Florida. The tax periods open to examination by the major taxing jurisdictions to which the Laboratory is subject include fiscal years ended September 30, 2019 through September 30, 2022.

Financial Instruments Not Measured at Fair Value
Certain of the Laboratory's financial instruments are not measured at fair value on a recurring basis but nevertheless certain financial instruments are recorded at amounts that approximate fair value due to their liquid or short-term nature. Such financial assets and financial liabilities include cash and cash equivalents, accounts receivable, due from Mote Marine Foundation, Inc., prepaid expenses and other assets, accounts payable, accrued payroll, memberships relating to future periods, funds advanced on research programs and deferred compensation payable.

Overhead Allocation
Overhead is allocated to research programs at a rate established with the cognizant federal agency, The Department of Commerce and National Oceanic and Atmospheric Administration. Certain research contracts limit the amount of reimbursement for overhead expenses to a rate specified in the individual contracts.

2. Summary of Significant Accounting Policies (Continued)

Functional Allocation of Expenses

The costs of providing the various programs and other activities have been summarized on a functional basis in the statement of activities. Accordingly, certain costs have been allocated among the programs and supporting services that benefited. The expenses that are allocated include salaries, benefits, payroll taxes, depreciation, and other expenses for services which are allocated on the basis of estimated time and effort.

Cash and Cash Equivalents

Cash on hand and highly liquid investments with a maturity of three months or less at date of acquisition are considered to be cash and cash equivalents. Cash restricted for the endowment and included as cash and cash equivalents in the financial statements amounted to $573,290 and $552,508 as of September 30, 2022 and 2021, respectively.

Beneficial Interest in the Net Assets of Mote Marine Foundation, Inc.

The Laboratory follows the *Not-for-Profit Entities* Topic of the FASB Accounting Standards Codification. The *Not-for-Profit Entities* Topic establishes standards for transactions in which a donor makes a contribution to a not-for-profit organization (the recipient) that agrees to transfer those assets to another entity (the beneficiary). The statement requires that, if the specified beneficiary is financially interrelated to the recipient organization, the beneficiary must recognize its interest in the net assets of the recipient organization. As presented in the financial statements, the Laboratory is financially interrelated to Mote Marine Foundation, Inc. and therefore, is required to report its beneficial interest in the net assets of Mote Marine Foundation, Inc.

Reclassifications

To facilitate comparison of financial data, certain amounts in the 2021 financial statements have been reclassified to conform to the 2022 reporting presentation. Such reclassifications had no effect on the change in net assets previously reported.

3. Liquidity and Availability

Financial assets available within one year of the statement of financial position date for general expenditures are as follows:

	2022	2021
Cash and cash equivalents	$ 15,353,772	$ 16,351,517
Accounts receivable	4,919,837	4,295,917
Pledges receivable, net – current portion	3,994,892	3,739,647
Due from Mote Marine Foundation, Inc.	470,049	529,282
Beneficial interest in the net assets of Mote Marine Foundation, Inc.	16,481,634	20,678,361
Total financial assets available	41,220,184	45,594,724
Less: Amounts unavailable for general expenditures within one year due to:		
Restricted by donors with purpose and time restrictions	(20,664,511)	(24,684,247)
Restricted by donors in perpetuity	(10,047,490)	(10,046,114)
Total amounts unavailable for general expenditures within one year	(30,712,001)	(34,730,361)
Less: Amounts unavailable to management without Board approval:		
Board designated for Mote SEA project	(390,818)	(390,818)
Total financial assets available to management for general expenditure within one year	$ 10,117,365	$ 10,473,545

3. Liquidity and Availability (Continued)

The Laboratory manages its liquid assets in accordance with regular budgeting processes developed through the coordinated efforts of management and the Board of Trustees. Monthly reporting by management to those charged with governance ensures the results from operating activities are monitored closely.

The Board of Trustees has designated $390,818 as of September 30, 2022 and 2021, respectively, for the construction of the Mote Science Education Aquarium (Mote SEA). Although the Laboratory does not intend to spend from board designated funds, these amounts could be made available if necessary.

4. Pledges Receivable

At September 30, 2022 and 2021, the Laboratory held written unconditional pledges receivable in the amounts of $10,146,661 and $7,942,514, respectively. The pledges have been restricted by the donors for future projects. Management considers all pledges receivable to be fully collectible as of September 30, 2022 and 2021, therefore no allowance for uncollectible pledges has been established.

Pledges receivable consist of the following as of September 30:

	2022	2021
Pledges receivable	$ 10,146,661	$ 7,942,514
Less: discount to net present value (rates of 1% and .40%)	(592,611)	(94,935)
Pledges receivable, net	9,554,050	7,847,579
Less amount due in less than one year	3,994,892	3,739,647
Amount collectible in one to five years	$ 5,559,158	$ 4,107,932

5. Accounts Receivable

Accounts receivable consists of the following at September 30:

	2022	2021
Costs billed on research grants and other contracts	$ 1,074,397	$ 1,442,217
Unbilled costs incurred on research grants	3,832,799	2,844,855
Accounts receivable - other	12,641	8,845
	$ 4,919,837	$ 4,295,917

During the years ended September 30, 2022 and 2021, the Laboratory had no write-offs of uncollectible accounts receivable.

6. Investments

The Laboratory has a certificate of deposit that earns interest of 3.45% and matures October 24, 2023. As of September 30, 2022, the certificates of deposit totaled $119,193 and are stated at fair value. As of September 30, 2021, the certificates of deposit totaled $392,197 and are stated at fair value. Of these amounts, $69,631 and $127,576 is restricted for endowments as of September 30, 2022 and 2021, respectively. There were no unrealized gains on the certificates of deposit for the years ended September 30, 2022 and 2021, respectively.

The Laboratory had realized losses of $14,393 and realized gains of $2,689 on the sales of investments in for the years ended September 30, 2022 and 2021, respectively.

Additionally, assets held at a community foundation during the years ended September 30, 2022 and 2021 incurred unrealized losses of $121,052 and unrealized gains of $8,612, respectively.

7. Property and Equipment

Property and equipment consists of the following as of September 30:

	2022	2021
Vehicles	$ 678,209	$ 591,237
Vessels	1,838,971	1,544,500
Buildings and improvements	43,017,919	42,570,072
Furniture, fixtures and exhibits	5,305,515	5,199,638
Laboratory equipment	10,183,910	9,583,282
Trailers	118,663	109,131
	61,143,187	59,597,860
Less accumulated depreciation	47,079,084	44,598,175
	$ 14,064,103	$ 14,999,685

Depreciation expense was $2,499,729 and $2,862,696 for the years ended September 30, 2022 and 2021, respectively.

Construction in progress consists of the following at September 30:

	2022	2021
Mote Science Education Aquarium construction	$ 29,945,869	$ 15,905,034
Aquarium and Laboratory improvements	58,839	67,506
	$ 30,004,708	$ 15,972,540

In accordance with contract provisions, the Laboratory has segregated and identified property and equipment that has been purchased or improved with funds received from government agencies. Title to these assets acquired with government agency funds vests with the Laboratory as long as the Laboratory has a contract with the agency, unless contract terms specify otherwise. Upon contract termination, title to these assets reverts to the agencies. At September 30, 2022 and 2021, property and equipment purchased or improved with funds received from government agencies, net of accumulated depreciation, totaled $209,542 and $756,662, respectively.

8. Patents

During the years ended September 30, 2022 and 2021, the Laboratory incurred costs to maintain certain patents. The costs capitalized and the related amortization provided for is as follows:

	2022	2021
Patents	$ 206,363	$ 197,344
Less: accumulated amortization	127,077	109,205
	$ 79,286	$ 88,139

No significant residual value is estimated for these patents. Amortization expense for the years ended September 30, 2022 and 2021 totaled $17,872 and $17,108, respectively.

8. Patents (Continued)

The following table represents the total estimated amortization of patents for the five succeeding years and thereafter ending September 30:

2023	$	17,186
2024		16,222
2025		14,521
2026		13,789
2027		6,038
Thereafter		11,530
	$	79,286

9. Long-Term Debt

Notes Payable

Notes payable consists of the following as of September 30:

	2022	2021
Note payable in 180 monthly installments of $17,579 plus interest based on overnight LIBOR plus 2.18%, maturing on August 5, 2028 and secured with personal property and pledges and guaranteed by Mote Marine Foundation, Inc. with a $1,500,000 limitation. Interest rate at September 30, 2022 was 5.25%.	$ 1,670,012	$ 1,880,960
Note payable in 60 monthly installments of $624, interest at 2.39% due 2021, secured by vehicle. Note was paid in full during the year ended September 30, 2022.	-	622
Note payable in 48 monthly installments of $348, interest at 3.64% due 2022, secured by vehicle. Note was paid in full during the year ended September 30, 2022.	-	1,381
Note payable in 60 monthly installments of $665, interest at 2.39% due 2021, secured by vehicle. Note was paid in full during the year ended September 30, 2022.	-	663
Note payable in 48 monthly installments of $382, interest at 3.64% due 2022, secured by vehicle. Note was paid in full during the year ended September 30, 2022.	-	1,516
Note payable in 60 monthly installments of $413, interest at 2.39% due 2021, secured by vehicle. Note was paid in full during the year ended September 30, 2022.	-	411
Note payable in 60 monthly installments of $427, interest at 4.44% due 2024, secured by vehicle.	9,048	13,654

9. Long-Term Debt (Continued)
Notes Payable (Continued)

	2022	2021
Note payable in 60 monthly installments of $695, interest at 3.99% due 2024, secured by vehicle.	12,109	19,794
Note payable in 119 monthly installments of $13,668 plus 4.2% interest, with final payment of $1,348,395 due on October 1, 2028, secured by mortgage on real property located in Sarasota County.	1,908,383	1,989,276
Note payable annually at $200,000. A final balloon payment is due July 11, 2027.	1,640,000	1,840,000
Note payable for insurance premiums financed by a third party. The note is payable in 22 installments of $63,845, which include principal and interest at 3.99%, due in 2023.	226,816	966,765
	5,466,368	6,715,042
Less current portion	737,698	1,250,216
Non-current portion	$ 4,728,670	$ 5,464,826

Interest expense incurred under these notes payable totaled $172,685 and $140,352 for the years ended September 30, 2022 and 2021, respectively.

Lines of Credit

Pursuant to loan agreements with two banks, the Laboratory has a revolving line of credit of $1,500,000 with each bank. One loan agreement has a due date of November 11, 2022 and the other is open-ended subject to renewal provisions. Interest on one line of credit is charged at the bank's prime rate less a margin of 1.25% with a 0% floor and is payable monthly. At September 30, 2022 and 2021, borrowings outstanding under this line of credit and secured by pledges and accounts receivable of the Laboratory amounted to $1,212,647 and $1,217,101, respectively.

Interest on the second revolving line of credit is charged at one month LIBOR plus 1.90% per annum, payable monthly. There were no borrowings outstanding at September 30, 2022 and 2021. This line of credit is secured by assets of Mote Marine Foundation, Inc.

The Laboratory also has a line of credit of $185,000 from Sarasota-Manatee Airport Authority. The loan represents advanced funding for the improvements to the Airport Aquarium and has no expiration date or interest rate and will be repaid with any funds raised associated with the Airport Aquarium. At September 30, 2022 and 2021, borrowings outstanding totaled $185,000.

During the year ended September 30, 2022, the Laboratory obtained an additional line of credit with a maturity date of December 31, 2027. Various interest rates are charged based on the number of days that the principal is outstanding, ranging from 0% to 16%. No funds were borrowed on this line of credit during the year ended September 30, 2022.

The multiple lines of credit outstanding at September 30, 2022 and 2021 totaled $1,397,647 and $1,402,101, respectively.

Interest expense incurred under these lines of credit totaled $34,465 and $21,570 for the years ended September 30, 2022 and 2021, respectively.

9. Long-Term Debt (Continued)

Lines of Credit (Continued)

Certain loan agreements described above require that the Laboratory meet certain debt covenant compliance requirements. As of September 30, 2022, the Laboratory was in full compliance with all requirements.

Paycheck Protection Program Forgivable Loan

On April 16, 2020, the Laboratory qualified for and received a loan pursuant to the Paycheck Protection Program, a program implemented by the U.S. Small Business Administration (the SBA) under the Coronavirus Aid, Relief, and Economic Security Act for an aggregate principal amount of $2,318,259 (the PPP Loan). The Laboratory applied for forgiveness of the PPP Loan in September 2020. On April 30, 2021, the Laboratory received notice of forgiveness from the SBA of the entire principal of $2,318,259 and the 1% calculated accrued interest of $24,072. The Laboratory has recorded $2,318,259 as Paycheck Protection Program loan forgiveness in the statement of activities for the year ended September 30, 2021. The Laboratory did not accrue interest on the PPP Loan.

Future Maturities of Long-Term Debt

Aggregate maturities of long-term debt at September 30, are as follows:

2023	$	737,698
2024		508,484
2025		503,993
2026		507,977
2027		512,131
Thereafter		2,696,085
Total	$	5,466,368

10. Net Assets with Donor Restrictions

Net assets with donor restrictions are available for the following purposes as of September 30:

		2022		2021
Subject to expenditure for specific purpose:				
Future projects	$	428,448	$	659,700
Construction		13,702,459		13,660,702
Library expenses		28,087		26,587
Beneficial interest in net assets of Mote Marine Foundation, Inc.		6,505,517		10,337,258
Total purpose restrictions		20,664,511		24,684,247
Perpetual in nature:				
Cultural endowment		600,000		600,000
Keys endowment		12,050		12,050
Beneficial interest in the net assets of Mote Marine Foundation, Inc.		9,435,440		9,434,064
Total perpetual in nature restrictions		10,047,490		10,046,114
Total net assets with donor restrictions	$	30,712,001	$	34,730,361

11. Net Assets Released from Restrictions

Net assets released from donor restriction by incurring expenses satisfying the restricted purposes as of September 30:

	2022	2021
Aquarium expenses	$ 32,926	$ 32,883
Research expenses	310,412	-
Other	94,258	-
Library	-	2,000
Construction	15,243,805	9,916,474
	$ 15,681,401	$ 9,951,357

12. Retirement Plan

The Laboratory provides a 403(b) retirement plan. The Laboratory matches employee contributions based on an employee's length of service and gross salary. Retirement plan expense was $531,442 and $578,363 for the years ended September 30, 2022 and 2021, respectively.

13. Matching Requirements on Governmental Grants

The Laboratory is awarded grants from federal agencies which require matching contributions by the Laboratory. The matching requirements were met or exceeded on completed federal grants during 2022 and 2021.

14. Rental Use Charges

Periodically, certain programs require utilization of vessels, vehicles and equipment provided by the Laboratory. Each program is charged rent, based on use, at a pre-established rental fee that reflects the cost of operating the asset.

15. Financial Instruments with Off-Balance Sheet Risk

The Laboratory maintains its cash in bank deposit accounts which, at times, may exceed federally insured limits. Accounts are guaranteed by the Federal Deposit Insurance Corporation (FDIC) up to certain limits. At any given time, the Laboratory may have cash and investment balances exceeding the insured amount. The Laboratory has not experienced any losses in such accounts and does not believe it is exposed to any significant credit risk on cash and investments.

16. Related Party Transactions

The Mote Marine Foundation, Inc. (Foundation), a financially interrelated organization, provides support to the Laboratory in the form of grants. For the years ended September 30, 2022 and 2021, the Laboratory received grants from the Foundation in the amount of $465,741 and $524,748, respectively.

Mote Marine Foundation, Inc. is dependent on Laboratory personnel for administration and certain aspects of fund raising.

From time to time, the Laboratory will provide grants, receive donations and pay certain expenses on behalf of the Foundation. As of September 30, 2022 and 2021, the Foundation owed the Laboratory $470,049 and $529,282, respectively.

Certain trustee members are affiliated with organizations that transact with the Laboratory. Trustee members are required to complete conflict of interest disclosure statements and abstain from voting on related issues.

16. Related Party Transactions (Continued)

During the year ended September 30, 2021, a trustee donated the use of an aircraft for travel accommodations for employees and trustees. The value of this donation for the year ended September 30, 2021, is estimated at $2,603.

From time to time, the trustees make pledges and contributions to the Laboratory.

17. Leased Facility

The Laboratory has a leasehold agreement with a municipality for real property on which the Laboratory has constructed its facilities. The agreement requires the Laboratory to pay the municipality one dollar per year until the agreement expires in the year 2050. The fair market value of the leasehold agreement is not determinable and therefore has not been recorded in the accompanying financial statements.

18. Endowments

The Laboratory's endowment consists of funds established for several purposes. Its endowment includes donor-restricted endowment funds. As required by accounting principles generally accepted in the United States of America, net assets associated with endowment funds are classified and reported based on the existence or absence of donor-imposed restrictions. It is typical to establish all endowment funds in Mote Marine Foundation, Inc.

Interpretation of Relevant Law

The Board of Trustees of the endowment has interpreted the Florida Uniform Prudent Management of Institutional Funds Act (FUPMIFA) as requiring the preservation of the fair value of the original gift as of the gift date of the donor-restricted endowment funds absent explicit donor stipulations to the contrary. As a result of this interpretation, the Laboratory classifies as net assets with donor restrictions in perpetuity (a) the original value of gifts donated to the perpetual endowment and (b) the original value of subsequent gifts to the perpetual endowment.

Endowment Net Asset Composition

As of September 30, 2022, endowment net assets consisted of the following:

	With Donor Restrictions
Donor-restricted endowment funds:	
Endowment balance	$ 612,050
Total donor-restricted endowment funds	$ 612,050

As of September 30, 2021, endowment net assets consisted of the following:

	With Donor Restrictions
Donor-restricted endowment funds:	
Endowment balance	$ 612,050
Un-appropriated income with purpose restrictions	14,281
Total donor-restricted endowment funds	$ 626,331

18. Endowments (Continued)

Changes in Endowment Net Assets

Changes in endowment net assets for the year ended September 30, 2022 are as follows:

		With Donor Restrictions
Endowment net assets, October 1, 2021	$	626,331
Endowment investment return:		
Investment income		1,522
Realized and unrealized losses		(2,297)
Total endowment investment loss		(775)
Appropriation of endowment for expenditures		(13,506)
Endowment net assets, September 30, 2022	$	612,050

Changes in endowment net assets for the year ended September 30, 2021 are as follows:

		With Donor Restrictions
Endowment net assets, October 1, 2020	$	622,859
Endowment investment return:		
Investment income		205
Realized and unrealized gains		3,267
Total endowment investment return		3,472
Appropriation of endowment for expenditures		-
Endowment net assets, September 30, 2021	$	626,331

Funds with Deficiencies

From time to time, the fair value of assets associated with individual donor restricted endowment funds may fall below the level classified as net assets with donor restrictions that are perpetual in nature. These deficiencies result from unfavorable market fluctuations that occurred shortly after the investment of new contributions of net assets with donor restrictions that are perpetual in nature and continued appropriation for certain programs that was deemed prudent by the Board of Trustees. There were no deficiencies of this nature reported in net assets without donor restrictions as of September 30, 2022 and 2021.

Return Objectives and Risk Parameters

The Laboratory has adopted investment policies and spending polices for endowment assets that attempt to provide a predictable stream of funding to programs supported by its endowment while seeking to maintain the purchasing power of the endowment assets. Endowment assets include those assets of donor-restricted funds that the Laboratory must hold in perpetuity or for donor-specified periods. Under this policy, as approved by the Board of Trustees, the endowment assets are invested in a manner that is intended to produce a long-term rate of return on assets of to match or exceed the rate of return determined from the sum of the annual distribution percentage, inflation measured by the CPI, and real growth of 1%.

The Cultural Endowment Program has a primary investment constraint to preserve principal along with restrictions on investment instruments, so the Laboratory uses an alternative approved investment policy for this program.

18. Endowments (Continued)

Strategies Employed for Achieving Objectives

To satisfy its long-term rate-of-return objectives, the Laboratory relies on a total return strategy in which investment returns are achieved through both capital appreciation (realized and unrealized) and current yield (interest and dividends). The Laboratory targets a diversified asset allocation that places a greater emphasis on equity-based investments to achieve its long-term return objectives within prudent risk constraints.

Spending Policy and How the Investment Objectives Relate to Spending Policy

The Laboratory has a policy of appropriating for distribution each year 5% percent of its endowment funds average fair value over the period of 12 quarters through the calendar year end preceding the fiscal year in which the distribution is planned. In establishing this policy, the Laboratory considered the long-term expected return on its endowment. Accordingly, over the long term, the Laboratory expects the current spending policy to allow its endowment to grow at an average of 1% percent annually. This is consistent with the Laboratory's objective to maintain the purchasing power of the endowment assets held in perpetuity or for a specified term as well as to provide additional real growth through new gifts and investment return. The established policy for the Cultural Endowment Program distributes 100% of current income for use in operating costs for cultural activities expecting no further growth in this endowment.

19. Fair Value of Financial Assets and Liabilities

The Laboratory adopted the Fair *Value Measurements and Disclosures* Topic of the FASB Accounting Standards Codification which provides enhanced guidance for using fair value to measure assets and liabilities and clarifies the principle that fair value should be based on the assumptions market participants would use when pricing the assets or liabilities and establishes a hierarchy that prioritizes the information used to develop those assumptions. The Laboratory has adopted Accounting Standards Update No. 2010-06, *Improving Disclosures about Fair Value Measurements*, which requires the Laboratory to present fair value measurements separately for each class of assets and liabilities held as of September 30, 2022 and 2021.

The following tables present information about the Laboratory's assets and liabilities that are measured at fair value on a recurring and non-recurring basis as of September 30, 2022 and 2021, and indicate the fair value hierarchy of the valuation techniques used to determine such fair value. The three levels for measuring fair value are based on the reliability of inputs and are as follows:

Level 1 - quoted market prices in active markets for identical assets or liabilities, such as publicly traded equity securities. This level includes common and preferred stock, cash and money market funds, mutual funds, corporate bonds and bond funds, and government obligations.

Level 2 - inputs, other than quoted prices included in Level 1 that are observable, either directly or indirectly. Such inputs may include quoted prices for similar assets, observable inputs other than quoted prices (interest rates, yield curves, etc.), or inputs derived principally from or corroborated by observable market data by correlation or other means.

Level 3 - inputs are unobservable data points for the asset or liability, and include situations where there is little, if any, market activity for the asset or liability. The inputs reflect the Laboratory's assumptions based on the best information available in the circumstance.

19. Fair Value of Financial Assets and Liabilities (Continued)

The following sets forth the fair value hierarchy by level for the Laboratory's assets measured at fair value on a recurring basis as of September 30, 2022:

Description	Total	Level 1	Level 2	Level 3	NAV*
Beneficial interest in the net assets of Mote Marine Foundation, Inc.	$ 16,602,252	$ 14,143,604	$ 2,457,981	$ -	$ 667

The following sets forth the fair value hierarchy by level for the Laboratory's assets measured at fair value on a non-recurring basis as of September 30, 2022:

Description	Total	Level 1	Level 2	Level 3	NAV*
Beneficial interest in the net assets of Mote Marine Foundation, Inc.	$ 16,181	$ -	$ -	$ 16,181	$ -
Pledges receivable	9,554,050	-	-	9,554,050	-
Ending balance	$ 9,570,231	$ -	$ -	$ 9,570,231	$ -

The following sets forth the fair value hierarchy by level for the Laboratory's assets measured at fair value on a recurring basis as of September 30, 2021:

Description	Total	Level 1	Level 2	Level 3	NAV*
Beneficial interest in the net assets of Mote Marine Foundation, Inc.	$ 20,894,243	$ 18,136,475	$ 2,736,253	$ -	$ 21,515

The following sets forth the fair value hierarchy by level for the Laboratory's assets measured at fair value on a non-recurring basis as of September 30, 2021:

Description	Total	Level 1	Level 2	Level 3	NAV*
Beneficial interest in the net assets of Mote Marine Foundation, Inc.	$ 16,181	$ -	$ -	$ 16,181	$ -
Pledges receivable	7,847,579	-	-	7,847,579	-
Ending balance	$ 7,863,760	$ -	$ -	$ 7,863,760	$ -

(*)Certain investments of Mote Marine Foundation, Inc. that are measured at fair value using the net asset value (NAV) per share (or its equivalent) practical expedient have not been categorized in the fair value hierarchy. The fair value amounts presented in the tables above are intended to permit reconciliation of the fair value hierarchy to the amounts presented in the statements of financial position.

20. Commitments

At September 30, 2022, the Laboratory had commitments of approximately $109,240,000 for construction and acquisition of property and equipment, all of which is related to the Mote SEA project. Also, in connection with the Mote SEA project, the Laboratory has received contributions restricted for construction of $13,556,039 and $7,833,755 for the years ended September 30, 2022 and 2021, respectively.

21. Subsequent Events

The Laboratory has evaluated all events subsequent to the statement of financial position date of September 30, 2022 and through the date these financial statements were available to be issued, February 21, 2023, and have determined that, there are no subsequent events that require disclosure.

Supplemental Information

Grantor	Assistance Listing # or CSFA#	Pass-through Entity Identification or Grant Number	Total Expenditures		Transfer to Subrecipients
Federal Contracts and Grants					
RESEARCH AND DEVELOPMENT CLUSTER					
Department of Agriculture					
Agricultural Research Service					
Agricultural Research Basic and Applied Research					
Passed through Florida Atlantic University	10.001	59-6034-9-007	$ 77,884	$ 77,884	$ -
Agriculture and Food Research Initiative (AFRI)	10.310	2021-67017-33829	15,000	15,000	-
Department of Commerce					
National Oceanic and Atmospheric Administration (NOAA)					
Ocean Exploration	11.011	NA180AR0110291	36,569	36,569	-
Integrated Ocean Observing System (IOOS)					
Passed through Texas A&M University	11.012	NA16NOS0120018	134,566		9,614
Passed through Southeast Coastal Ocean Observing Regional Association	11.012	NA16NOS0120028	106,222		-
Passed through Texas A&M University	11.012	NA21NOS0120092	28,900		844
Passed through Southeast Coastal Ocean Observing Regional Association	11.012	NA21NOS0120097	8,546		-
Passed through University of South Carolina	11.012	NA21NOS0120097	7,023	285,257	-
Ocean Acididifcation Program (OAP)	11.017	NA22OAR0170209	500	500	-
NOAA Small Business Inovation Research (SBIR) Program					
Passed through Live Advantage Bait, LLC	11.021	NA21OAR0210492	28,144	28,144	-
Sea Grant Support					
Passed through University of Florida	11.417	NA18OAR4170085	101,014		79,149
Passed through University of Miami	11.417	NA19OAR4170414	7,725		-
Passed through Southeast Coastal Ocean Observing Regional Association	11.417	NA22OAR4170114	58	108,797	-
Fisheries Development and Utilization Research and Development Grants and Cooperative Agreements Program	11.427	NA20NMF4270199	54,420	54,420	-
National Oceanic and Atmospheric Administration (NOAA) Cooperative Institutes					
Passed through Research Foundation CUNY	11.432	16126-Z7813001	5,628	5,628	-
Marine Fisheries Initiative	11.433	NA15NMF4330152	36,743	36,743	-
Marine Mammal Data Program	11.439	NA17NMF4390089	6,314		-
	11.439	NA18NMF4390064	4,883		-
	11.439	NA19NMF4390178	9,456		-
	11.439	NA20NMF4390106	31,061		-
	11.439	NA21NMF4390403	23,574	75,288	-
Unallied Management Projects					
Passed through National Fish and Wildlife Foundation	11.454	NA20NMF4540082	29,237		9,000
	11.454	NA21NMF4540281	65,119	94,356	4,419
Habitat Conservation	11.463	NA19NMF4630259	712,806	-	-
Passed through National Marine Sanctuary Foundation	11.463	NA20NMF4630328	370,538		
Passed through College of the Florida Keys	11.463	NA20NMF4630328	10,791	1,094,135	-
Unallied Science Program					
Passed through National Fish and Wildlife Foundation	11.472	NA19NMF4720290	253,480		17,242
	11.472	NA20NMF4720265	62,494		3,797
	11.472	NA21NMF4720530	29,495		-
	11.472	NA21NMF4720532	55,215		-
Passed through Florida Fish & Wildlife Conservation Commission	11.472	NA15NMF4720018	14,911	415,595	4,518
Office for Coastal Management					
Passed through National Fish and Wildlife Foundation	11.473	NA18NOS4730204	532,447		-
	11.473	NA20NOS4730027	454,868	987,315	-
Center for Sponsored Coastal Ocean Research Coastal Ocean Program					
Passed through Florida International University	11.478	NA18NOS4780171	62,966		-
	11.478	NA19NOS4780183	929,556		576,636
Passed through Woods Hole Oceanographic Institution	11.478	NA21NOS4780156	26,482	1,019,004	-
Coral Reef Conservation Program	11.482	NA21NMF820300	40,956	40,956	-
Environmental Protection Agency					
Geographic Programs - South Florida Geographic Initiatives Program	66.484	02D20722	29,883	29,883	-

Mote Marine Laboratory, Inc.
Schedule of Expenditures of Federal Awards and
State Financial Assistance (Continued)
Year Ended September 30, 2022

Grantor	Assistance Listing # or CSFA#	Pass-through Entity Identification or Grant Number	Total Expenditures		Transfer to Subrecipients
Federal Contracts and Grants (Continued)					
RESEARCH AND DEVELOPMENT CLUSTER (Continued)					
National Science Foundation					
Geosciences	47.050	1923926	89,428		-
	47.050	1923926	33,744		-
	47.050	2050892	133,960		-
Passed through Florida Atlantic University	47.050	2143665	26,209		-
	47.050	OCE - 1757419	7,529	290,870	-
STEM Education (formerly Education and Human Resources)	47.076	1922351	398,212	398,212	17,576
U.S. Department of Defense					
Defense Advanced Research Projects Agency (DARPA)					
Research and Technology Development					
Passed through Florida Atlantic University	12.910	AWD - 001612	69,357	69,357	5,700
Department of the Interior					
U.S. Fish and Wildlife Service					
State Wildlife Grants	15.634	FL-T-F18AF00492	30,327	30,327	-
Department of Treasury					
Resources and Ecosystems Sustainability, Tourist Opportunities, and Revived Economies of the Gulf Coast States					
Passed through The Nature Conservancy	21.015	RDCGR170068	127,197		
Passed through the Florida Institute of Oceanography	21.015	8-RCEGR020005-01-02	110,342	237,539	62,382
Department of State					
General Department of State Assistance	19.700	SIS-70017G33038	75,462	75,462	-
TOTAL RESEARCH AND DEVELOPMENT CLUSTER				$ 5,507,241	$ 790,877
Total Federal Contracts and Grants				**$ 5,507,241**	**$ 790,877**
State Contracts and Grants					
State of Florida					
Florida Fish & Wildlife Conservation Commission					
Cooperative Red Tide Research Program - Reduction of Harmful Impacts from Red Tide - Red Tide Mitigation and Technology Development Initiative	77.010	15003	15,688		-
	77.010	19153	3,604,561		960,854
	77.010	20034	1,070,885	4,691,134	14,109
Marine Fisheries Assessment	77.023	20317	237,932	237,932	-
Mote Marine Laboratory Coral Reef Restoration Program	77.036	20151	800,000		-
	77.036	21069	1,298,736	2,098,736	-
Keys Marine Laboratory Infrastructure Expansion to Support Coral Restoration	77.044	21354	17,223	17,223	-
Department of Highway Safety & Motor Vehicles					
Protect Wild Dolphins License Plate Project	76.011	1600	8,340	8,340	-
Protect Our Reefs License Plate Project	76.069	POR	1,058,171	1,058,171	93,398
Sea Turtle License Plate Project	76.070	21-033C	2,412		
	76.070	22-003R	12,532	14,944	-
Department of Environmental Protection					
Coral Reef Protection and Restoration Grant	37.107	C2002	323,544	323,544	162,513
Total State Contracts and Grants				**$ 8,450,024**	**$ 1,230,874**
Total Federal and State Contracts and Grants				**$ 13,957,265**	**$ 2,021,751**

1. Basis of Presentation

The accompanying schedule of expenditures of federal awards (the Schedule) includes the federal award and state financial assistance activity of Mote Marine Laboratory, Inc. under programs of the federal government and State of Florida for the year ended September 30, 2022. The information in this Schedule is presented in accordance with the requirements of Title 2 U.S. Code of Federal Regulations Part 200, *Uniform Administrative Requirements, Cost Principles, and Audit Requirements for Federal Awards* (Uniform Guidance) and Chapter 10.650, Rules of the Auditor General. Because the Schedule presents only a selected portion of the operations of Mote Marine Laboratory, Inc., it is not intended to and does not present the financial position, changes in net assets, or cash flows of Mote Marine Laboratory, Inc.

2. Summary of Significant Accounting Policies

Expenditures reported on the Schedule are reported on the accrual basis of accounting. Such expenditures are recognized following the cost principles contained in the Uniform Guidance, wherein certain types of expenditures are not allowable or are limited as to reimbursement.

3. Indirect Cost Election

Mote Marine Laboratory, Inc. has not elected to use the 10% de minimis cost rate as allowed under the Uniform Guidance, and has a federally negotiated rate with its cognizant agency.

Contract Compliance

Report on Internal Control Over Financial Reporting and on Compliance and Other Matters Based on an Audit of Financial Statements Performed in Accordance With *Government Auditing Standards*

Independent Auditor's Report

The Board of Trustees
Mote Marine Laboratory, Inc.
Sarasota, Florida

We have audited, in accordance with the auditing standards generally accepted in the United States of America and the standards applicable to financial audits contained in *Government Auditing Standards*, issued by the Comptroller General of the United States and Chapter 10.650, *Rules of the Auditor General*, the financial statements of Mote Marine Laboratory Inc. (Laboratory), which comprise the statement of financial position as of September 30, 2022, and the related statement of activities, functional expenses, and cash flows for the year then ended, and the related notes to the financial statements, and have issued our report thereon dated February 21, 2023.

Report on Internal Control over Financial Reporting

In planning and performing our audit of the financial statements, we considered the Laboratory's internal control over financial reporting (internal control) as a basis for designing audit procedures that are appropriate in the circumstances for the purpose of expressing our opinion on the financial statements, but not for the purpose of expressing an opinion on the effectiveness of the Laboratory's internal control. Accordingly, we do not express an opinion on the effectiveness of the Laboratory's internal control.

A *deficiency in internal control* exists when the design or operation of a control does not allow management or employees, in the normal course of performing their assigned functions, to prevent, or detect and correct, misstatements on a timely basis. A *material weakness* is a deficiency, or a combination of deficiencies, in internal control, such that there is a reasonable possibility that a material misstatement of the entity's financial statements will not be prevented, or detected and corrected, on a timely basis. A *significant deficiency* is a deficiency, or a combination of deficiencies, in internal control that is less severe than a material weakness, yet important enough to merit attention by those charged with governance.

Our consideration of internal control was for the limited purpose described in the first paragraph of this section and was not designed to identify all deficiencies in internal control that might be material weaknesses or significant deficiencies. Given these limitations, during our audit we did not identify any deficiencies in internal control that we consider to be material weaknesses. However, material weaknesses may exist that have not been identified.

Report on Compliance and Other Matters
As part of obtaining reasonable assurance about whether the Laboratory's financial statements are free from material misstatement, we performed tests of its compliance with certain provisions of laws, regulations, contracts and grant agreements, noncompliance with which could have a direct and material effect on the financial statements. However, providing an opinion on compliance with those provisions was not an objective of our audit, and accordingly, we do not express such an opinion. The results of our tests disclosed no instances of noncompliance or other matters that are required to be reported under *Government Auditing Standards.*

Purpose of this Report
The purpose of this report is solely to describe the scope of our testing of internal control and compliance and the results of that testing, and not to provide an opinion on the effectiveness of the entity's internal control or on compliance. This report is an integral part of an audit performed in accordance with *Government Auditing Standards* in considering the entity's internal control and compliance. Accordingly, this communication is not suitable for any other purpose.

Kerkering, Barberio & Co.

Sarasota, Florida
February 21, 2023

Report on Compliance for Each Major Federal Program and State Project; and Report on Internal Control over Compliance Required by the Uniform Guidance and Chapter 10.650, *Rules of the Auditor General* of the State of Florida

Independent Auditor's Report

The Board of Trustees
Mote Marine Laboratory, Inc.
Sarasota, Florida

Report on Compliance for Each Major Federal Program and State Financial Assistance Project

Opinion on Each Major Federal Program and State Financial Assistance Project

We have audited Mote Marine Laboratory, Inc.'s (Laboratory) compliance with the types of compliance requirements identified as subject to audit in the *OMB Compliance Supplement* and the requirements described in the State of Florida Department of Financial Services Statements Projects Compliance Supplement that could have a direct and material effect on each of the Laboratory's major federal programs and state financial assistance projects for the year ended September 30, 2022. The Laboratory's major federal programs and state financial assistance projects are identified in the summary of auditor's results section of the accompanying schedule of findings and questioned costs.

In our opinion, the Laboratory complied, in all material respects, with the types of compliance requirements referred to above that could have a direct and material effect on each of its major federal programs and state financial assistance projects for the year ended September 30, 2022.

Basis for Opinion on Each Major Federal Program and State Financial Assistance Project

We conducted our audit of compliance in accordance with auditing standards generally accepted in the United States of America (GAAS); the standards applicable to financial audits contained in *Government Auditing Standards* issued by the Comptroller General of the United States (*Government Auditing Standards*); the audit requirements of Title 2 U.S. *Code of Federal Regulations* Part 200, *Uniform Administrative Requirements, Cost Principles, and Audit Requirements for Federal Awards* (Uniform Guidance); and Chapter 10.650, *Rules of the Auditor General*. Our responsibilities under those standards and the Uniform Guidance are further described in the Auditor's Responsibilities for the Audit of Compliance section of our report.

We are required to be independent of the Laboratory and to meet our other ethical responsibilities, in accordance with relevant ethical requirements relating to our audit. We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our opinion on compliance for each major federal program and state financial assistance project. Our audit does not provide a legal determination of the Laboratory's compliance with the compliance requirements referred to above.

Responsibilities of Management for Compliance

Management is responsible for compliance with the requirements referred to above and for the design, implementation, and maintenance of effective internal control over compliance with the requirements of laws, statutes, regulations, rules and provisions of contracts or grant agreements applicable to the Laboratory's federal programs and state financial assistance projects.

Auditor's Responsibilities for the Audit of Compliance

Our objectives are to obtain reasonable assurance about whether material noncompliance with the compliance requirements referred to above occurred, whether due to fraud or error, and express an opinion on the Laboratory's compliance based on our audit. Reasonable assurance is a high level of assurance but is not absolute assurance and therefore is not a guarantee that an audit conducted in accordance with GAAS, *Government Auditing Standards*, and the Uniform Guidance will always detect material noncompliance when it exists. The risk of not detecting material noncompliance resulting from fraud is higher than for that resulting from error, as fraud may involve collusion, forgery, intentional omissions, misrepresentations, or the override of internal control. Noncompliance with the compliance requirements referred to above is considered material, if there is a substantial likelihood that, individually or in the aggregate, it would influence the judgment made by a reasonable user of the report on compliance about the Laboratory's compliance with the requirements of each major federal program and state financial assistance project as a whole.

In performing an audit in accordance with GAAS, *Government Auditing Standards*, and the Uniform Guidance, we:

- Exercise professional judgment and maintain professional skepticism throughout the audit.

- Identify and assess the risks of material noncompliance, whether due to fraud or error, and design and perform audit procedures responsive to those risks. Such procedures include examining, on a test basis, evidence regarding the Laboratory's compliance with the compliance requirements referred to above and performing such other procedures as we considered necessary in the circumstances.

- Obtain an understanding of the Laboratory's internal control over compliance relevant to the audit in order to design audit procedures that are appropriate in the circumstances and to test and report on internal control over compliance in accordance with the Uniform Guidance, but not for the purpose of expressing an opinion on the effectiveness of the Laboratory's internal control over compliance. Accordingly, no such opinion is expressed.

We are required to communicate with those charged with governance regarding, among other matters, the planned scope and timing of the audit and any significant deficiencies and material weaknesses in internal control over compliance that we identified during the audit.

Report on Internal Control over Compliance

A *deficiency in internal control over compliance* exists when the design or operation of a control over compliance does not allow management or employees, in the normal course of performing their assigned functions, to prevent, or detect and correct, noncompliance with a type of compliance requirement of a federal program or state financial assistance project on a timely basis. A *material weakness in internal control over compliance* is a deficiency, or a combination of deficiencies, in internal control over compliance, such that there is a reasonable possibility that material noncompliance with a type of compliance requirement of a federal program or state project will not be prevented, or detected and corrected, on a timely basis. A *significant deficiency in internal control over compliance* is a deficiency, or a combination of deficiencies, in internal control over compliance with a type of compliance requirement of a federal program or state financial assistance project that is less severe than a material weakness in internal control over compliance, yet important enough to merit attention by those charged with governance.

Our consideration of internal control over compliance was for the limited purpose described in the Auditor's Responsibilities for the Audit of Compliance section above and was not designed to identify all deficiencies in internal control over compliance that might be material weaknesses or significant deficiencies in internal control over compliance. Given these limitations, during our audit we did not identify any deficiencies in internal control over compliance that we consider to be material weaknesses, as defined above. However, material weaknesses or significant deficiencies in internal control over compliance may exist that were not identified.

Report on Internal Control over Compliance (Continued)

Our audit was not designed for the purpose of expressing an opinion on the effectiveness of internal control over compliance. Accordingly, no such opinion is expressed.

The purpose of this report on internal control over compliance is solely to describe the scope of our testing of internal control over compliance and the results of that testing based on the requirements of the Uniform Guidance and the Chapter 10.650, *Rules of the Auditor General*. Accordingly, this report is not suitable for any other purpose.

Kerkering, Barberio & Co.

Sarasota, Florida
February 21, 2023

Mote Marine Laboratory, Inc.
Schedule of Findings and Questioned Costs
Year Ended September 30, 2022

Section I - Summary of Auditor's Results

Financial Statements

Type of auditor's report issued: Unmodified

Internal control over financial reporting:

- Material weakness(es) identified?_____ yes___x__ no
- Significant deficiency(ies) identified?_____ yes___x__ none reported

Noncompliance material to financial statements
noted? _____ yes___x__ no

Federal and State Awards

Internal control over major programs and projects:

- Material weakness(es) identified?_____ yes___x__ no
- Significant deficiency(ies) identified?_____ yes___x__ none reported

Type of auditor's report issued on compliance for major programs and projects: Unmodified

Any audit findings disclosed that are required to
be reported in accordance with section 2 CFR
200.516(a) and the provisions of the Florida Single
Audit Act in accordance with Chapter 10.650 of
the Rules of the Auditor General_____ yes___x__ no

Section I - Summary of Auditor's Results (Continued)

Identification of major programs and projects:

CFDA Numbers	*Name of Federal Program or Cluster*
	Research and Development Cluster:
10.001	Agricultural Research Basic and Applied Research
10.310	USDA/NIFA – USDA National Institute of Food and Agriculture
11.011	Ocean Exploration
11.012	Integrated Ocean Observing System (IOOS)
11.017	Ocean Acidification Toolkits for Educators
11.021	Small Business Innovation Research
11.417	Sea Grant Support
11.427	Fisheries Development and Utilization Research and Development Grants and Cooperative Agreements Program
11.432	National Oceanic and Atmospheric Administration (NOAA) Cooperative Institutes
11.433	Marine Fisheries Initiative
11.439	Marine Mammal Data Program
11.454	Unallied Management Projects
11.463	Habitat Conservation
11.472	Unallied Science Program
11.473	Office for Coastal Management
11.478	Center for Sponsored Coastal Ocean Research Coastal Ocean Program
11.482	Coral Reef Conservation Program and Restoration Center
66.484	Surveys, Studies, Investigations, Demonstrations, and Training Grants and Cooperative Agreements – Section 104(b)(3) of the Clean Water Act
47.050	Geosciences
47.076	Education and Human Resources
12.910	Research and Technology Development
15.634	State Wildlife Grants
21.015	Resources and Ecosystems Sustainability, Tourist Opportunities, and Revived Economies of the Gulf Coast States
19.700	General Department of State Assistance

Section I - Summary of Auditor's Results (Continued)

CSFA Numbers	*Name of State Projects*
77.010	Cooperative Red Tide Research Program-Reduction of Harmful Impact from Red Tide
77.036	Coral Reef Restoration Program

Dollar threshold used to distinguish between type A and type B Federal programs: $ 750,000
Dollar threshold used to distinguish between type A and type B State projects: $ 750,000

Auditee qualified as low-risk auditee? __x__ yes______ no

Section II - Financial Statement Findings

None

Section III - Federal and State Award Findings and Questioned Costs

None

Section IV - Summary Schedule of Prior Audit Findings and Questioned Costs

No prior audit findings or questioned costs to be addressed

Section V - Other

No management letter is required because there were no findings to be reported in a management letter as required by Section 215.97 (9)(f) and 215.97 (10)(d) of the Florida Statutes, Auditor General Rule 10.654 (1)(e) or 10.656 (3)(e).

ANTI-KICKBACK AFFIDAVIT

STATE OF FLORIDA)

: SS

COUNTY OF MANATEE)

I, the undersigned hereby duly sworn, depose and say that no portion of the sum herein bid will be paid to any employees of the City of Key West as a commission, kickback, reward or gift, directly or indirectly by me or any member of my firm or by an officer of the corporation.

By: MICHAEL P. CROSBY________________________

Sworn and subscribed before me this 16th__ day of ______APRIL____________2025_.

____

NOTARY PUBLIC, State of Florida at Large

DEBRA HOLMES
Notary Public - State of Florida
Commission # HH 422046
My Comm. Expires Jul 16, 2027

My Commission Expires: 07-16-27

SWORN STATEMENT UNDER SECTION 287.133(3)(A)
FLORIDA STATUTES, ON PUBLIC ENTITY CRIMES

THIS FORM MUST BE SIGNED IN THE PRESENCE OF A NOTARY PUBLIC OR OTHER OFFICER AUTHORIZED TO ADMINISTER OATHS.

1. This sworn statement is submitted with Bid or Proposal for

   City of Key West RFP No. 25-004 Water Quality Monitoring Program

2. This sworn statement is submitted by Mote Marine Laboratory, Inc.,
   Elizabeth Moore Center for Coral Reef Research and Restoration________________
   (name of entity submitting sworn statement)
   whose business address is 24244 Overseas Highway, Summerland Key, FL 33042____

   and (if applicable) its Federal Employer Identification Number (FEIN) is 59-0756643

   (If the entity has no FEIN, include the Social Security Number of the individual

   signing this sworn statement n/a

3. My name is Michael P. Crosby
   (please print name of individual signing)

   and my relationship to the entity named above is President & CEO

4. I understand that a "public entity crime" as defined in Paragraph 287.133(1)(g), Florida Statutes, means a violation of any state or federal law by a person with respect to and directly related to the transaction of business with any public entity or with an agency or political subdivision of any other state or with the United States, including but not limited to, any bid or contract for goods or services to be provided to any public or an agency or political subdivision of any other state or of the United States and involving antitrust, fraud, theft, bribery, collusion, racketeering, conspiracy, material misrepresentation.

5. I understand that "convicted" or "conviction" as defined in Paragraph 287.133(1)(b), Florida Statutes, means a finding of guilt or a conviction of a public entity crime, with or without an adjudication guilt, in any federal or state trial court of record relating to charges brought by indictment information after July 1, 1989, as a result of a jury verdict, nonjury trial, or entry of a plea of guilty or nolo contendere.

6. I understand that an "affiliate" as defined in Paragraph 287.133(1)(a), Florida Statutes, means

1. A predecessor or successor of a person convicted of a public entity crime; or

2. An entity under the control of any natural person who is active in the management of the entity and who has been convicted of a public entity crime. The term "affiliate" includes those officers, directors, executives, partners, shareholders, employees, members, and agents who are active in the management of an affiliate. The ownership by one person of shares constituting controlling interest in another person, or a pooling of equipment or income among persons when not for fair market value under an arm's length agreement, shall be a prima facie case that one person controls another person. A person who knowingly enters into a joint venture with a person who has been convicted of a public entity crime in Florida during the preceding 36 months shall be considered an affiliate.

7. I understand that a "person" as defined in Paragraph 287.133(1)(8), Florida Statutes, means any natural person or entity organized under the laws of any state or of the United States with the legal power to enter into a binding contract and which bids or applies to bid on contracts for the provision of goods or services let by a public entity, or which otherwise transacts or applies to transact business with public entity. The term "person" includes those officers, directors, executives, partners, shareholders, employees, members, and agents who are active in management of an entity.

8. Based on information and belief, the statement which I have marked below is true in relation to the entity submitting this sworn statement. (Please indicate which statement applies).

X Neither the entity submitting this sworn statement, nor any officers, directors, executives, partners, shareholders, employees, members, or agents who are active in management of the entity, nor any affiliate of the entity have been charged with and convicted of a public entity crime subsequent to July 1, 1989, AND (Please indicate which additional statement applies.)

NA There has been a proceeding concerning the conviction before a hearing of the State of Florida, Division of Administrative Hearings. The final order entered by the hearing officer did not place the person or affiliate on the convicted vendor list. (Please attach a copy of the final order.)

NA The person or affiliate was placed on the convicted vendor list. There has been a subsequent proceeding before a hearing officer of the State of Florida, Division of Administrative Hearings. The final order entered by the hearing officer determined that it was in the public interest to remove the person or affiliate from the convicted vendor list. (Please attach a copy of the final order.)

NA The person or affiliate has not been put on the convicted vendor list. (Please describe any action taken by or pending with the Department of General Services.)

(signature)

04/16/25

(date)

STATE OF_FLORIDA__

COUNTY OF_MANATEE__

PERSONALLY APPEARED BEFORE ME, the undersigned authority,

MICHAEL P. CROSBY who, after first being sworn by me, affixed his/her
(name of individual signing)

signature in the space provided above on this ______16th___day of APRIL , 2025___.

My commission expires:
07-16-27

NOTARY PUBLIC

DEBRA HOLMES
Notary Public - State of Florida
Commission # HH 422046
My Comm. Expires Jul 16, 2027

CITY OF KEY WEST INDEMNIFICATION FORM

To the fullest extent permitted by law, the Consultant expressly agrees to indemnify and hold harmless the City of Key West, their officers, directors, agents and employees *(herein called the "indemnitees") from liabilities, damages, losses and costs, including but not limited to, reasonable attorney's fees and court costs, such legal expenses to include costs incurred in establishing the indemnification and other rights agreed to in this Paragraph, to persons or property, to the extent caused by the negligence, recklessness, or intentional wrongful misconduct of the Consultant, its Subcontractors or persons employed or utilized by them in the performance of the Contract. Claims by indemnitees for indemnification shall be limited to the amount of Consultant's insurance or $1 million per occurrence, whichever is greater. The parties acknowledge that the amount of the indemnity required hereunder bears a reasonable commercial relationship to the Contract and it is part of the project specifications or the bid documents, if any.

The indemnification obligations under the Contract shall not be restricted in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for the Consultant under Workers' Compensation acts, disability benefits acts, or other employee benefits acts, and shall extend to and include any actions brought by or in the name of any employee of the Consultant or of any third party to whom Consultant may subcontract a part or all of the Work. This indemnification shall continue beyond the date of completion of the work.

CONSULTANT: MOTE MARINE LABORATORY, INC. SEAL:

Address

Signature

MICHAEL P. CROSBY, PhD

Print Name

PRESIDENT & CEO

Title

DATE: APRIL 16, 2025

DEBRA HOLMES
Notary Public - State of Florida
Commission # HH 422046
My Comm. Expires Jul 16, 2027

Debra Holmes

EQUAL BENEFITS FOR DOMESTIC PARTNERS AFFIDAVIT

STATE OF FLORIDA)

: SS

COUNTY OF MANATEE)

I, the undersigned hereby duly sworn, depose and say that the firm of MOTE MARINE LABORATORY, INC. provides benefits to domestic partners of its employees on the same basis as it provides benefits to employees' spouses, per City of Key West Code of Ordinances Sec. 2-799.

By: ______________________

Sworn and subscribed before me this 16th day of APRIL 2025 ____.

Debra Holmes

NOTARY PUBLIC, State of Florida at Large

My Commission Expires: 07-16-27

DEBRA HOLMES
Notary Public - State of Florida
Commission # HH 422046
My Comm. Expires Jul 16, 2027

CONE OF SILENCE AFFIDAVIT

STATE OF FLORIDA)

: SS

COUNTY OF MANATEE)

I, the undersigned hereby duly sworn, depose and say that all owner(s), partners, officers, directors, employees and agents representing the firm of MOTE MARINE LABORATORY, INC. have read and understand the limitations and procedures regarding communications concerning City of Key West Code of Ordinances Sec. 2-773 Cone of Silence.

By: ______________________________

Sworn and subscribed before me this

16th day of APRIL 2025.

Debra Holmes
____

NOTARY PUBLIC, State of FLORIDA at Large

My Commission Expires: 07-16-27

DEBRA HOLMES
Notary Public - State of Florida
Commission # HH 422046
My Comm. Expires Jul 16, 2027

NON-COLLUSION AFFIDAVIT

STATE OF FLORIDA)

:

SS COUNTY OF MONROE)

I, the undersigned hereby declares that the only persons or parties interested in this Proposal are those named herein, that this proposal is, in all respects, fair and without fraud, that it is made without collusion with any official of the Owner, and that the Proposal is made without any connection or collusion with any person submitting another Proposal on this Contract.

By: ______________________

Sworn and subscribed before me this

16th day of APRIL, 2025.

Debra Holmes

NOTARY PUBLIC, State of Florida at Large

My Commission Expires: 07-16-27

DEBRA HOLMES
Notary Public - State of Florida
Commission # HH 422046
My Comm. Expires Jul 16, 2027

LOCAL VENDOR CERTIFICATION
PURSUANT TO CITY OF KEY WEST CODE OF ORDINANCES SECTION 2-798

The undersigned, as a duly authorized representative of the vendor listed herein, certifies to the best of his/her knowledge and belief, that the vendor meets the definition of a "Local Business." For purposes of this section, "local business" shall mean a business which:

a. **Principle address as registered with the FL Department of State located within 30 miles of the boundaries of the city, listed with the chief licensing official as having a business tax receipt with its principle address within 30 miles of the boundaries of the city for at least one year immediately prior to the issuance of the solicitation.**

b. **Maintains a workforce of at least 50 percent of its employees from the city or within 30 miles of its boundaries.**

c. **Having paid all current license taxes and any other fees due the city at least 24 hours prior to the publication of the call for bids or request for proposals.**
   - Not a local vendor pursuant to Code od Ordinances Section 2-798
   - Qualifies as a local vendor pursuant to Code od Ordinances Section 2-798

If you qualify, please complete the following in support of the self-certification & submit copies of your County and City business licenses. Failure to provide the information requested will result in denial of certification as a local business.

Business Name: Mote Marine Laboratory, Inc. Phone: 305.745.2729
Elizabeth Moore Center for Coral Reef Research and Restoration Fax:
Current Local Address: 24244 Overseas Highway, Summerland Key, FL 33042
(P.O Box numbers may not be used to establish status)
Length of time at this address: >20 yrs

[signature] April 16, 2025
Signature of Authorized Representative Date

STATE OF FLORIDA
COUNTY OF MANATEE
The foregoing instrument was acknowledged before me this 16th day of APRIL, 2025.
By MICHAEL P. CROSBY, President & CEO, of MOTE MARINE LABORATORY, INC
(Name of officer or agent, title of officer or agent) Name of corporation acknowledging)
or has produced FL Drivers License as identification
(type of identification)

Debra Holmes
Signature of Notary
Debra Holmes
Print, Type or Stamp Name of Notary

Return Completed form with
Supporting documents to:
City of Key West Purchasing

Title or Rank

DEBRA HOLMES
Notary Public - State of Florida
Commission # HH 422046
My Comm. Expires Jul 16, 2027

THE CITY OF KEY WEST E-VERIFY AFFIDAVIT

Beginning January 1, 2021, Florida law requires all contractors doing business with The City of Key West to register with and use the E-Verify System in order to verify the work authorization status of all newly hired employees. The City of Key West requires all vendors who are awarded contracts with the City to verify employee eligibility using the E-Verify System. As before, vendors are also required to maintain all I-9 Forms of their employees for the duration of the contract term. To enroll in the E-Verify System, vendors should visit the E-Verify Website located at www.e-verify.gov.

In accordance with Florida Statute § 448.095, **it is the responsibility of the Awarded Vendor to ensure compliance with all applicable E-Verify requirements.**

By executing this affidavit, the undersigned contractor verifies it compliance with Florida Statute § 448.095, stating affirmatively that the individual, firm, or corporation which is engaged in the performance of services on behalf of the City of Key West, has registered with, is authorized to use, and uses the U.S. Department of Homeland Security's E-Verify system.

Furthermore, the undersigned contractor agrees that it will continue to use E-Verify throughout the contract period, and should it employ or contract with any subcontractor(s) in connection with the performance of services pursuant to this Agreement with The City of Key West, contractor will secure from such subcontractor(s) similar verification of compliance with Florida Statute § 448.095, by requiring the subcontractor(s) to provide an affidavit attesting that the subcontractor does not employ, or subcontract with, an unauthorized alien. Contractor further agrees to maintain records of such compliance during the duration of the Agreement and provide a copy of each such verification to The City of Key West within five (5) business days of receipt.

Failure to comply with this provision is a material breach of the Agreement and shall result in immediate termination of the Agreement without penalty to the City of Key West. Contractor shall be liable for all costs incurred by the City of Key West to secure replacement Agreement, including but not limited to, any increased costs for the same services, and costs due to delay, and rebidding costs, if applicable.

04/16/25

Date

(Signature of Authorized Representative)

State of_FLORIDA,
County of_MANATEE,

Personally Appeared Before Me, the undersigned authority, MICHAEL P. CROSBY who ☒ being personally know or ☐ having produced his/her signature in the space provided above on this 16th day of April, 2025 Signature, Notary Public

07-16-27

Commission Expires

Stamp/Seal: DEBRA HOLMES Notary Public - State of Florida Commission # HH 422046 My Comm. Expires Jul 16, 2027

AFFIDAVIT ATTESTING TO NONCOERCIVE CONDUCT FOR LABOR OR SERVICES

Entity/Vendor Name: MOTE MARINE LABORATORY, INC.
Vendor FEIN: 59-0756643
Vendor's Authorized Representative: MICHAEL P. CROSBY, PRESIDENT & CEO
(Name and Title)
Address: 24244 Overseas Highway
City: SUMMERLAND KEY State: FLORIDA Zip: 33042
Phone Number: 305-745-2729
Email Address: research@mote.org

As a nongovernmental entity executing, renewing, or extending a contract with a government entity, Vendor is required to provide an affidavit under penalty of perjury attesting that Vendor does not use coercion for labor or services in accordance with Section 787.06, Florida Statutes.

As defined in Section 787.06(2)(a), coercion means:

1. Using or threating to use physical force against any person;
2. Restraining, isolating, or confining or threating to restrain, isolate, or confine any person without lawful authority and against her or his will;
3. Using lending or other credit methods to establish a debt by any person when labor or services are pledged as a security for the debt, if the value of the labor or services as reasonably assessed is not applied toward the liquidation of the debt, the length and nature of the labor or service are not respectively limited and defined;
4. Destroying, concealing, removing, confiscating, withholding, or possessing any actual or purported passport, visa, or other immigration document, or any other actual or purported government identification document, of any person;
5. Causing or threating to cause financial harm to any person;
6. Enticing or luring any person by fraud or deceit; or
7. Providing a controlled substance as outlined in Schedule I or Schedule II of Section 893.03 to any person for the purpose of exploitation of that person.

As a person authorized to sign on behalf of Vendor, I certify under penalties of perjury that Vendor does not use coercion for labor or services in accordance with Section 787.06. Additionally, Vendor has reviewed Section 787.06, Florida Statutes, and agrees to abide by same.

Certified By: MICHAEL P. CROSBY, PRESIDENT & CEO, who is authorized to sign on behalf of the above referenced company.

Authorized Signature: M P Crosby
Print Name: MICHAEL P. CROSBY,
Title: PRESIDENT & CEO

Debra Holmes

DEBRA HOLMES
Notary Public - State of Florida
Commission # HH 422046
My Comm. Expires Jul 16, 2027

VENDOR CERTIFICATION REGARDING SCRUTINIZED COMPANIES LISTS

Respondent Vendor Name: MOTE MARINE LABORATORY,INC

Vendor FEIN: 0756643

Vendor's Authorized Representative Name and Title: MICHAEL P. CROSBY, PRESIDENT & CEO

Address: 24244 OVERSEAS HIGHWAY

City: SUMMERLAND KEY State: FLORIDA Zip: 33042

Phone Number: 305-745-2729

Email Address: research@mote.org

Section 287.135(2)(a), Florida Statutes, prohibits a company from bidding on, submitting a proposal for, or entering into or renewing a contract for goods or services of any amount if, at the time of contracting or renewal, the company is on the Scrutinized Companies that Boycott Israel List, created pursuant to section 215.4725, Florida Statutes, or is engaged in a boycott of Israel. Section 287.135(2)(b), Florida Statutes, further prohibits a company from bidding on, submitting a proposal for, or entering into or renewing a contract for goods or services over one million dollars ($1,000,000) if, at the time of contracting or renewal, the company is on either the Scrutinized Companies with Activities in Sudan List or the Scrutinized Companies with Activities in the Iran Petroleum Energy Sector List, both created pursuant to section 215.473, Florida Statutes, or the company is engaged in business operations in Cuba or Syria.

As the person authorized to sign on behalf of Respondent, I hereby certify that the company identified above in the section entitled "Respondent Vendor Name" is not listed on either the Scrutinized Companies that Boycott Israel List, Scrutinized Companies with Activities in Sudan List or the Scrutinized Companies with Activities in the Iran Petroleum Energy Sector List I understand that pursuant to section 287.135, Florida Statutes, the submission of a false certification may subject such company to civil penalties, attorney's fees, and/or costs and termination of the contract at the option of the awarding governmental entity.

Certified By: MICHAEL P. CROSBY — PRESIDENT & CEO
Print Name — *Print Title*

who is authorized to sign on behalf of the above referenced company.

Authorized Signature: [signature].

END OF SECTION 4

DEBRA HOLMES
Notary Public - State of Florida
Commission # HH 422046
My Comm. Expires Jul 16, 2027

[signature]

10. Project Location and Local Preference

Main Office: The Elizabeth Moore Center for Coral Reef Research and Restoration, Mote Marine Laboratory, 24244 Overseas Highway Summerland Key, Florida 33042

Location of Proposed Work: City of Key West; The Elizabeth Moore Center for Coral Reef Research and Restoration, Mote Marine Laboratory, 24244 Overseas Highway Summerland Key, Florida 33042

Proposed Sample Locations: Proposed sample locations for Task 4 include 1. Smathers Beach, 3. Rest Beach, 4. Higgs Beach, 5. Fort Zachary Taylor State Park Beach, 5. South Beach, and 6. Dog Beach, and the mooring field (7 total stations). The overlapping beach stations with FDOH will be sampled at identical locations.

IDENTIFYING INFORMATION:

NAME: Crosby, Michael

POSITION TITLE: Chief Executive Officer

PRIMARY ORGANIZATION AND LOCATION: Mote Marine Laboratory, Sarasota, Florida, United States

Professional Preparation:

ORGANIZATION AND LOCATION	DEGREE (if applicable)	RECEIPT DATE	FIELD OF STUDY
University of Maryland, Baltimore, Maryland, United States	PHD	06/1986	Marine-Estuarine-Environmental Sciences
Old Dominian University, Norfolk, Virginia, United States	MS	06/1982	Marine Biology
Old Dominion University, Norfolk, Virginia, United States	BS	06/1979	Marine Biology

Appointments and Positions

2013 - present Chief Executive Officer, Mote Marine Laboratory, Sarasota, Florida, United States

2009 - 2010 Assoc. Vice President Research & Economic Development, George Mason University, Fairfax, Virginia, United States

2008 - 2010 Interim Vice Chancellor Research, University of Hawaii at Hilo, Hilo, Hawaii, United States

2003 - 2008 Executive Director, U.S. Senior Executive Service (SES), National Science Board, Arlington, Virginia, United States

2002 - 2003 The Senior International Science Policy Advisor, Office of Under Secretary, NOAA, Washington, District of Columbia, United States

Products

Products Most Closely Related to the Proposed Project

1. Crosby M, Busse A, Ribble J, Marshall K. Building a more inclusive and impactful marine STEM undergraduate research experience: The Marine Science Laboratory Alliance Center of Excellence for broadening participation. Oceanography, 36(4), 102-10. 2024.
2. Crosby M. Length-based Risk Analysis of Management Options for the southern Florida USA Multispecies Coral Reef Fish Fishery. Fisheries Research, 249, 106210. 2022.
3. Crosby M, Graham J, Hodsdon G, Busse A. BIPOC voices in ocean sciences: A qualitative exploration of factors impacting career retention. Journal of Geoscience Education. 2022.
4. Crosby M, Lausche B. Models for Implementing the Satoumi Concept via Residential Research Institute Collaborations with Citizen Scientists in the United States. Ecological Monographs. 2022.

5. Crosby M, Muller E, Koch H. Restored Corals Space Hope for Reefs Worldwide. The Scientist. 2021.

Other Significant Products, Whether or Not Related to the Proposed Project

Certification:

I certify that the information provided is current, accurate, and complete. This includes but is not limited to current, pending, and other support (both foreign and domestic) as defined in 42 U.S.C. § 6605.

I also certify that, at the time of submission, I am not a party to a malign foreign talent recruitment program.

Misrepresentations and/or omissions may be subject to prosecution and liability pursuant to, but not limited to, 18 U.S.C. §§ 287, 1001, 1031 and 31 U.S.C. §§ 3729-3733 and 3802.

Certified by Crosby, Michael in SciENcv on 2025-03-27 12:20:26

Kevin Claridge
Mote Marine Laboratory,
1600 Ken Thompson Parkway, Sarasota, FL 34236
941-702-0099

Experience

Vice President *(02/25/21 – Present)* **Associate Vice President** *(10/02/19 – 02/25/21)*
Mote Marine Laboratory and Aquarium, Sarasota, FL

Position Duties: Oversee 35 Research Units and a Sponsored Research Programs Office managing internal and external proposals, grants, contracts, agreements, reports, and intellectual property, for an annual research budget exceeding $30 million dollars with over 140 multi-disciplinary staff, including 40 PhD's, across 9 campuses; administering the Florida Red Tide Mitigation and Technology Development Initiative and Seagrass Restoration Technology Development Initiative with the State of Florida and US Harmful Algal Bloom Control Technologies Incubator in with the University of Maryland and NOAA; supervise the Beach Condition Reporting System, Marine Policy Institute, and Librarian/Archival functions; assist institutional facilities operations, education programming, and public aquarium; track and advance overall organizational goals in institutional strategic plan.

Director *(06/25/12 – 10/01/19)*
Florida Department of Environmental Protection, Office of Resilience and Coastal Protection, Tallahassee, FL

Position Duties: Supervision of approximately 200 multi-disciplinary staff in 19 office locations; executing a $35+ million annual operating budget; overseeing millions of dollars in contracts and grants; managing emergency response efforts; leading resource management and restoration of 4.9 million upland and marine acres; advising on controversial and complex scientific, political, and economic issues; multi/cross-program coordination of the Outer Continental Shelf, Coastal Zone Management, Coral Reef Conservation, Resilient Coastlines, and Clean Boating Programs, and 41 Aquatic Preserves, 3 National Estuarine Research Reserves, Florida Keys National Marine Sanctuary; developing new and ensuring adherence to State and Federal Statutes/Rules, Deepwater Horizon Restoration Program; directing resource trend analyses, metric development, and program reviews; coordinating with sister agencies, Governor's Offices, US Congress, State Legislature, local governments, Regional Ocean Partnerships, NGO's, stakeholders, and Universities; and conducting presentations and communicating to the media and general public.

Assistant and Acting District Director (*04/01/08 – 06/24/12*)
Florida Department of Environmental Protection, Southeast District, West Palm Beach, FL

Position Duties: Leading over 140 multi-disciplinary staff in 3 regional offices; managing a $9 million annual operating budget; responsible for regulatory issues in 6 counties covering 7027 square miles and a population of over 6 million; managing the Administration, Environmental Resources, Waste Management, Water Facilities, and Air Resources Programs and their adherence to Statutes/Rules/Ordinances; coordinating with related agencies, State Governor's Offices, State Legislature, local governments, stakeholders and Universities; speaking in public forums; conducting environmental education/outreach such as clean marina, green lodging and turf management recognition events; and supporting emergency response efforts.

Environmental Administrator (*03/02/04 – 03/31/08*)
Florida Department of Environmental Protection, Bureau of Mining and Mineral Regulation, Bartow, FL

Position Duties: Leading a branch office with resource management and regulatory responsibilities; integrating policy and planning with land and mineral operations oversight while coordinating interagency efforts to promote natural resources stewardship; supervising 12 staffers and a $200,000 equipment budget; assuring adherence to Statutes/Rules; reviewing statewide mining related financial responsibility; overseeing multi-million-dollar restoration contracts; managing 26 public lands and conservation easements covering over 42,000 acres; using GPS and GIS tools; assisting threatened wildlife relocation; recommending funding options to the NonMandatory Reclamation Committee; and giving expert testimony in Administrative Hearings.

Environmental Specialist I/III *(05/08/00 – 03/01/04)*
Florida Department of Environmental Protection, Bureau of Mine Reclamation, Tallahassee and Bartow, FL

Position Duties: Processing applications for disturbances to wetlands or Waters of the State; overseeing wetland mitigation efforts; regulating mine reclamation activities; supervising staff; working with and maintaining land management equipment; managing public lands and conservation easements; assisting contract management; and representing the Department in Administrative Hearings.

Education

Graduate Certificate (2002) – Public Management, University of South Florida, Tampa, FL
Master of Science (2000) – Biology, University of Memphis, Memphis, TN
Bachelor of Science (1998) – Environmental Studies, University of North Carolina, Asheville, NC
Associate of Arts (1995) – St. Petersburg College, Clearwater, FL

Additional Experiences and Training

2020 –Present

- National and SE Association of Marine Laboratories, Mote Representative
- Florida Ocean Alliance, Mote Representative
- Florida Institute of Oceanography, Mote Representative
- US Coral Reef Task Force, Restoration Work Group, Mote Representative
- Florida Sea Grant Advisory Council
- Aquatic Preserve Society, President

2011 – 2019

- Chair, Alliance Management Team, Gulf of Mexico Alliance
- Florida Representative, BOEM/Florida Intergovernmental Renewable Energy Task Force
- Gulf of Mexico Executive Committee Representative and Florida Member, Coastal States Organization
- Steering Committee, US Coral Reef Task Force
- Steering Committee Chair and Member, Governor's South Atlantic Alliance
- Co-agency representative, Florida Institute of Oceanography
- Member, Florida Keys National Marine Sanctuary Advisory Council
- Florida Sea Grant, Advisory Council
- Certified Prescribed Burn Manager Training
- Rapid Process Improvement Training, Practical Quality Services Inc.
- Member, South Florida Water Management District, Water Resource Advisory Commission
- Ex-Officio, South Florida Regional Planning Council
- Executive Committee, Lake Worth Lagoon Initiative
- Mentor, Leader Within Supervisor Training Program

2000 - 2010

- State of Florida Representative, Oil Response Branch Offices
- South Florida Representative, Green Lodging and Clean Marina Designations
- Member, Lake Worth Lagoon Selection Committee
- Water Quality Sampling and Stream Condition Indices Training
- PADI SCUBA Diving Certified
- Ex-Officio, Central Florida Regional Planning Council
- Reclamation Technical Advisory Committee, Florida Institute of Phosphate Research
- Landcover Change and Advanced GIS Training
- Gopher Tortoise Management and Mitigation Training
- Archaeological Resource Management Training
- Licensed Certified Pesticide Applicator
- Biological Invasions – 4(4): 339-347; Jan 2002, "Compensation and Plasticity in an Invasive Plant Species"

CATHERINE J. WALSH, Ph.D.
Senior Scientist, Marine Immunology Program
Mote Marine Laboratory, 1600 Ken Thompson Parkway, Sarasota, FL 34236

RELEVANT EXPERTISE

I have 34+ years of experience conducting research in immunology with marine species, including elasmobranch fish (sharks, skates, and rays), and threatened and endangered species, such as sea turtles and the Florida manatee. My research focuses on assessing health of these species through basic functional research approaches, i.e., cell culture, western blotting, cell flow cytometry, real time PCR, ELISA, enzyme assays, and electrophoretic protocols. I have also over 18 years of experience conducting research with immune system effects of the toxic dinoflagellate, *Karenia brevis*, on health of marine species, particularly manatees and sea turtles, and demonstrated a number of immune function parameters impacted by sublethal brevetoxin exposure. I have served as lab-wide Quality Assurance Officer for Mote Marine Laboratory since 2000. I have been coordinator of Mote's NSF-funded Research Experience for Undergraduates (REU) program in Ocean Sciences since 2012.

PROFESSIONAL PREPARATION

Hope College, Holland, MI	Biology	B.S.	1985
Clemson University, Clemson, SC	Nutrition	M.S.	1987
Clemson University, Clemson, SC	Nutrition/Immunology	Ph.D.	1991
Mote Marine Laboratory, Sarasota, FL	Immunology	Postdoctoral	1991-96

APPOINTMENTS

2000-Present	Quality Assurance Officer, Mote Marine Laboratory, Sarasota, FL
2006-Present	Program Manager and Senior Scientist, Marine Immunology Program, Mote Marine Laboratory, Sarasota, FL
2017-2024	Program Manager and Senior Scientist, Marine Immunology and Manatee Research Programs, Mote Marine Laboratory, Sarasota, FL
2017-2021	Associate Vice President for Research, Directorate of Marine Biology & Conservation, Mote Marine Laboratory, Sarasota, FL
2017	Courtesy Instructor, USF, Sarasota-Manatee, Principles of Immunology
2012-Present	Principal Investigator and Site Coordinator, Mote Marine Laboratory NSF-funded Research Experience for Undergraduates
2007-Present	Adjunct Assistant Professor, Animal and Veterinary Sciences, Clemson University, Clemson, SC
2002-2022	Patent Agent and IP Director, Mote Marine Laboratory, Sarasota, FL
2002-2006	Manager and Staff Scientist, Marine Immunology Program, Mote Marine Laboratory, Sarasota, FL
2003	Adjunct Instructor, Biology for Non-Majors, Manatee Community College, Bradenton, FL
1997-2006	Staff Scientist, Marine Biomedical Program, Mote Marine Laboratory, Sarasota, FL
1991-1996	Postdoctoral Scientist, Mote Marine Laboratory, Sarasota, FL
1987-1991	Graduate Research Assistant, Dairy Sci. Dept., Clemson University, Clemson, SC
1985-1987	Graduate Research Assistant, Food Sci. Dept., Clemson University, Clemson, SC
1984	Laboratory Assistant, Michigan Molecular Institute, Midland, MI
1982-1985	Laboratory Assistant, Hope College, Holland, MI

Most relevant publications

Walsh CJ, TA Sherwood, AM Tarnecki, NR Rhody, KL Main, J Restivo. 2025. Challenges in cellular agriculture: lessons from Pacific white shrimp, *Litopenaeus vannamei*. In Vitro Cellular & Developmental Biology – Animal. doi.org/10.1007/s11626-024-01011-0.

Walsh CJ, N Rhody, KL Main, J Restivo, AM Tarnecki. 2024. Advances in development of long-term embryonic stem cell-like cultures from a marine fish, *Sciaenops ocellatus*. Curr Res Food Sci. Sep 13;9:100841. doi: 10.1016/j.crfs.2024.100841. PMID: 39319109; PMCID: PMC11421352

Doupnik CA, Luer CA, **Walsh CJ**, Restivo J, Brick J. 2024. Bioactive properties of venoms isolated from whiptail stingrays and the search for molecular mechanisms and targets. Pharmaceuticals 17, 488. https://doi.org/10.3390/ph17040488

Greene W, B Chan, E Bromage, JH Grose, **C Walsh**, K Kortright, S Forrest, G Perry, L Byrd. MA Stamper. 2021. The use of bacteriophages and immunological monitoring for the treatment of a case of chronic septicemic cutaneous ulcerative disease (SCUD) in a loggerhead sea turtle (*Caretta caretta*). J Aquatic Animal Health. 33:139-154. Doi: 10.1002/aah.10130.

Lazensky R, ME Hunter, D M Amador, B Al-Khedery, F Yu, **C Walsh**, MA Gitzendanner, K Tripp, MT Walsh, ND Denslow. 2020. Investigating the gene expression profiles of rehabilitated Florida manatees (*Trichechus manatus latirostris*) following red tide exposure. PLoS One 15(7):e0234150. https://doi.org/10.1371/journal.pone.0234150

Walsh CJ, C Cocilova, J Restivo, L Flewelling, S Milton. 2019. Immune function in *Trachemys scripta* following exposure to a predominant brevetoxin congener, PbTx-3, as a model for potential health impacts for sea turtles naturally exposed to brevetoxins. Ecotoxicology 28:1085-1104.

Perrault JP, NI Stacy, CR Mott, S Hirsch, JC Gorham, AF Lehner, JP Buchweitz, MJ Bresette, **CJ Walsh**. 2017. Effects of brevetoxins and toxic elements on various health variables in Kemp's ridley (*Lepidochelys kempii*) and green (*Chelonia mydas*) sea turtles after a red tide bloom event. Science of the Total Environment 605-606:967-979.

Perrault JR, KD Bauman, TM Greenan, PC Blum, MS Henry, **CJ Walsh**. 2016. Maternal transfer and sublethal immune system effects of brevetoxin exposure in nesting loggerhead sea turtles (*Caretta caretta*) from western Florida. *Aquatic Toxicology* 180:131-140.

Walsh CJ, M Butwan, J Yordy, R Ball, L Flewelling, M de Wit, RK Bonde. 2015. Sublethal red tide toxin exposure in free-ranging manatees (*Trichechus manatus latirostris*) affects the immune system through reduced lymphocyte proliferation response, inflammation, and oxidative stress. Aquatic Toxicology 161:73-84 http://dx.doi.org/10.1016/j.aquatox.2015.01.019

Perrault JR, JR Schmid, **CJ Walsh**, JE Yordy, AD Tucker. 2014. Brevetoxin exposure, oxidative stress and plasma protein electrophoretic profiles in Kemp's ridley sea turtles (*Lepidochelys kempii*) in southwest Florida. Harmful Algae 37:194-202.

Fleming LE, B Kirkpatrick, LC Backer, **CJ Walsh**, K Nierenberg, J Clark, A Reich, J Hollenbeck, J Benson, YS Cheng, J Naar, R Pierce, AJ Bourdelais, WM Abraham, G Kirkpatrick, J Zaias, A Wanner, E Mendes, S Shalat, P Hoagland, W Stephan, S Watkins, T Clarke, DG Baden. 2011. Review of Florida Red Tide and Human Health Effects. *Harmful Algae* 10(2):224-233.**Walsh CJ**, SR Leggett, BJ Carter, C Colle. 2010. Effects of brevetoxin exposure on the immune system of loggerhead sea turtles. *Aquatic Toxicol.* 97:293-303.

Walsh CJ, SR Leggett, BJ Carter, C Colle. 2010. Effects of brevetoxin exposure on the immune system of loggerhead sea turtles. *Aquatic Toxicol* 97:293-303.

Walsh CJ, SR Leggett, MS Henry, PC Blum, S Osborn, RH Pierce. 2009. Cellular metabolism of brevetoxin (PbTx-2) by a monocyte cell line (U-937). *Toxicon* 53(1):135-145.

Walsh CJ, SR Leggett, K Strohbehn, RH Pierce, JW Sleasman. 2008. Effects of *in vitro* brevetoxin exposure on apoptosis and cellular metabolism in a leukemic T cell line (Jurkat). *Marine Drugs* 6: 291-307.

Walsh CJ, CA Luer, DR Noyes. 2005. Effects of environmental stressors on lymphocyte proliferation in the Florida manatee, *Trichechus manatus latirostris*. *Vet Immunol Immunopathol* 103(3-4):255-264.

BIOGRAPHICAL SKETCH – EMILY R. HALL, PH.D.

Senior Scientist/ Program Manager
Ocean Acidification Program
Chemical and Physical Ecology Program
Mote Marine Laboratory,
1600 Ken Thompson Parkway
Sarasota, FL 34236
emily8@mote.org

PROFESSIONAL PREPARATAION

Mercer University	B.S., Environmental Science, 1999
Mercer University	B.A., Spanish, 1999
University of Florida	M.S., Environmental Engineering Sciences, 2001
University of Florida	Ph.D., Environmental Engineering Sciences, 2004

PROFESSIONAL APPOINTMENTS

2021-present	Program Manager/Senior Scientist, Ocean Acidification Program and Chemical and Physical Ecology Program, Mote Marine Laboratory
2018-2021	Program Manager/Staff Scientist, Chemical and Physical Ecology Program, Mote Marine Laboratory
2011-2021	Program Manager/Staff Scientist, Ocean Acidification Program, Mote Marine Laboratory
2013-2018	Courtesy Professor, Biology Program, University of South Florida-Sarasota Manatee
2009-2018	Adjunct Professor, Environmental Studies Department, Ringling College of Art and Design
2007-2011	Staff Scientist, Chemical Ecology Program, Mote Marine Laboratory
2005-2007	Postdoctoral Scientist, Chemical Ecology Program, Mote Marine Laboratory
2004-2005	Postdoctoral Associate, Fisheries and Aquatic Sciences, Environmental Engineering Sciences, University of Florida
1999-2004	Research and Teaching Assistant / Graduate Student, Environmental Engineering Sciences, University of Florida

RELEVANT PUBLICATIONS

2025 Lankes JD, Page HN, Quasunella A, Torkelson JF, Lemaire C, Nowicki RJ, Blasius L and **Hall ER** (2025) Quantifying coral-algal interactions in an acidified ocean: *Sargassum* spp. exposure mitigates low pH effects on *Acropora cervicornis* health. Front. Mar. Sci. 12:1487102. doi: 10.3389/fmars.2025.1487102

2024 MacVittie, S., Cuyler, E., Rose, B.J., **Hall, E.R.** and Krediet, C.J. Holobiont-level responses to elevated temperature and reduced pH in *Aiptasia*. Bulletin of Marine Science, 100(4), pp.693-708.

2024 **Hall, E.R**., Yates, K.K., Hubbard, K.A., Garrett, M.J. and Frankle, J.D. Nutrient and carbonate chemistry patterns associated with *Karenia brevis* blooms in three West Florida Shelf estuaries 2020-2023. Frontiers in Marine Science, 11, p.1331285.

2024 Devillier, V.M., **Hall, E.R.,** Lovko, V., Pierce, R., Anderson, D.M., Lewis, K.A. Mesocosm study of PAC-modified clay effects on *Karenia brevis* cells and toxins, chemical dynamics,

and benthic invertebrate physiology. Harmful Algae, 134: 102609. https://doi.org/10.1016/j.hal.2024.10260.9

2024 Dilworth, J., Million, W.C., Ruggeri, M., **Hall, E.R.**, Dungan, A.M., Muller, E.M. and Kenkel, C.D. Synergistic response to climate stressors in coral is associated with genotypic variation in baseline expression. Proceedings of the Royal Society B, 291(2019), p.20232447.

2024 Klepac, C.N., Petrik, C.G., Karabelas, E., Owens, J., **Hall, E.R**. and Muller, E.M., Assessing acute thermal assays as a rapid screening tool for coral restoration. Scientific Reports, 14(1): 1898.

2023 **Hall, E.R.**, Dixon, L.K., Kirkpatrick, G.J., Nissanka, A. and Pederson, B.A. Phytoplankton communities of the west coast of Florida–multiyear and seasonal responses to nutrient enrichment. Harmful Algae, 130, p.102547.

2023 Klepac, C.N., Eaton, K.R., Petrik, C.G., Arick, L.N., **Hall, E.R.** and Muller, E.M. Symbiont composition and coral genotype determine massive coral species performance under end-of-century climate scenarios. Frontiers in Marine Science, 10, p.1026426.

2023 Wessel, M.R., Beck, M.W., Sherwood, E.T., Peebles, E.B., **Hall, E**. Establishing a community of practice for tidal creek research using conceptual models and open science. Florida Scientist, 86(2): 362-369.

2022 Osborne, E., Hu, X., **Hall, E.R.**, Yates, K., Vreeland-Dawson, J., Shamberger, K., Barbero, L., Hernandez-Ayon, J.M., Gomez, F.A., Hicks, T. and Xu, Y.Y. Ocean acidification in the Gulf of Mexico: Drivers, impacts, and unknowns. Progress in Oceanography, 209, p.102882.

2022 Glibert, P.M., Cai, W.J., **Hall, E.R**., Li, M., Main, K.L., Rose, K.A., Testa, J.M. and Vidyarathna, N.K. Stressing over the complexities of multiple stressors in marine and estuarine systems. Ocean-Land-Atmosphere Research, 2022, DOI:10.34133/2022/9787258

2022 Mallon, J., Cyronak, T**., Hall, E.R**., Banaszak, A.T., Exton, D.A., Bass, A.M. Light-driven dynamics between calcification and production in functionally diverse coral reef calcifiers. Limnology and Oceanography 9999:1-16. doi: 10.1002/lno.12002

2022 Burnham, K.A., Nowicki, R.J., **Hall, E.R.,** Pi, J. and Page, H.N. Effects of ocean acidification on the performance and interaction of fleshy macroalgae and a grazing sea urchin. Journal of Experimental Marine Biology and Ecology, 547, p.151662.

2021 Muller, E.M., Dungan, A.M., Million, W.C., Eaton, K.R., Petrik, C., Bartels, E., **Hall, E.R.** and Kenkel, C.D. Heritable variation and lack of tradeoffs suggest adaptive capacity in *Acropora cervicornis* despite negative synergism under climate change scenarios. Proceedings of the Royal Society B, 288(1960), p.20210923.

2021 Page, H.N., Hewett, C., Tompkins, H. and **Hall, E.R**. Ocean acidification and direct interactions affect coral, macroalga, and sponge growth in the Florida Keys. Journal of Marine Science and Engineering, 9(7), p.739.

2020 **Hall, E.R.**, Wickes, L., Burnett, L.E., Scott, G.I., Hernandez, D., Yates, K.K., Barbero, L., Reimer, J.J., Baalousha, M., Mintz, J. and Cai, W.J., 2020. Acidification in the US Southeast: Causes, potential consequences and the role of the southeast ocean and coastal acidification network. Frontiers in Marine Science, 7, p.548.

2015 **Hall, E.R.,** B. DeGroot, and M. Fine. Lesion recovery of two scleractinian corals under low pH conditions: implications for restoration efforts. Marine Pollution Bulletin, 100:321-326.

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Melissa Sante

Highly driven Chemist with experience in Pharmaceutical and Carbonate Chemistry. Certified Six Sigma trainer with proven expertise in management, leadership, and communication. Seeking an opportunity with an organization that fosters growth, innovation, and professional development.

Experience

Lab Manager/Senior Chemist – Ocean Acidification Program
Mote's International Center for Coral Reef Research & Restoration, Summerland Key, FL
2021 – Present

- Lead water quality analysis for ocean acidification studies, focusing on key carbonate chemistry parameters including total alkalinity, pH, dissolved inorganic carbon (DIC), and nutrients.
- Operate and maintain complex analytical instruments in the lab, ensuring calibration and correct functionality.
- Manage experimental designs, coordination, and daily lab operations, including sample processing, analysis, and data collection.
- Perform resiliency experimental data analysis for calcification, photosynthesis, and respiration of marine species under varying acidification conditions.
- Prepare Standard Reference Materials (SRM), maintain lab safety standards, and manage hazardous waste disposal.

Key Accomplishments:

- Trained and mentored staff and interns as Subject Matter Expert (SME) in lab instrumentation and methodologies.
- Conducted high-impact research on the effects of ocean acidification, contributing to Mote's mission of coral reef restoration.

QC Analyst – Tech IV Chemistry Laboratory
Bausch & Lomb Pharmaceuticals, Tampa, FL
September 2017 – February 2021

- Conducted pharmaceutical analysis of raw materials, components, and stability testing in compliance with GMP and compendia methods (USP, EP, JP, CP, FDA).
- Supported manufacturing by performing release testing and maintaining proper calibration of analytical equipment.
- Oversaw investigations into Out of Specification (OOS) and Out of Trend (OOT) results, initiating root cause analysis.
- Certified as a trainer and Subject Matter Expert (SME) for QC laboratory instruments and methods.

Key Accomplishments:

- Delivered high-quality results while adhering to rigorous GMP regulations and providing support for drug safety and potency assessments.

Brand Ambassador
Yuengling Brewing Co-Tampa Inc., Tampa, FL
March 2016 – December 2017

- Led brewery tours, educating customers on company history, products, and operations.
- Organized promotional events and executed on/off-premise marketing strategies to increase brand visibility.
- Managed point-of-sale (POS) transactions and inventory, ensuring customer satisfaction and product availability.

Skills and Expertise

Analytical Techniques: HPLC, Gas Chromatography (GC), UV/IR Spectroscopy, Karl Fischer, pH meters, and other analytical instruments.

Chemistry and Chemical Analysis: Wet Chemistry, TOC Datapro 900, Microtrac, Empower 3, and Tiamo Software.

Laboratory Practices: GMP, GLIMS, Lean Six-Sigma, FDA Regulations, Lab Investigations, Root Cause Analysis.

Technical Expertise: Calibration and maintenance of laboratory instruments, data verification, analytical testing, experiment design.

Software: Microsoft Office, Empower 3, Tiamo Software, GLIMS, Catsweb, NSPDW.

Certifications: Train-The-Trainer Qualified, PADI Open Water Diver, Emergency Response Team Member.

Education

BACHELOR OF SCIENCE IN CHEMISTRY WITH FOCUS IN BIOMEDICAL SCIENCES
UNIVERSITY OF SOUTH FLORIDA, TAMPA, FL | DECEMBER 2016

PHARMACY TECHNICIAN CERTIFICATION
EXPRESS TRAINING SERVICES, GAINESVILLE, FL | JULY 2014

ASSOCIATE OF SCIENCE IN PHARMACY
SANTA FE COLLEGE, GAINESVILLE, FL | DECEMBER 2011

HIGH SCHOOL DIPLOMA
CORAL SHORES HIGH SCHOOL, TAVERNIER, FL | JUNE 2009

Community Involvement

Alzheimer’s Association
Coral Restoration Foundation Education
Relay for Life: American Cancer Society
Marvelous Pet Rescue
Upper Keys Rotary Club
Key Largo Lions Club

Professional Development and Certifications

Certified Six Sigma Trainer
PADI Open Water Diver, AAUS Diver
Laboratory Instrumentation and Testing Certification

Megan E. Gannon

21920 Disturbed Pine Rd. Cudjoe Key, FL 33042 | 513-460-9480 | gannonmegan9@gmail.com

EDUCATION

Purdue University, West Lafayette, IN
Bachelor of Science in Agriculture
Majors: Wildlife and Fisheries & Aquatic Sciences *May 2019*

University of Florida, Gainesville, FL
Graduate Certificate Program
Certificate: Quantitative Fisheries Science *Anticipated December 2025*

WORK EXPERIENCE

Ocean Acidification Laboratory Technician | Mote Marine Laboratory | Summerland Key, FL
February 2024-Present

Fish and Wildlife Biological Scientist II | Florida Fish and Wildlife Conservation Commission | St. Cloud, FL (Herky Huffman/Bull Creek WMA)
October 2022-February 2024

Biological Science Technician (Fish) GS-0404-05 | U.S. Fish & Wildlife Service | Soldotna, AK (field site McGrath, AK)
July 2022-October 2022

Biological Science Technician (Aquatics) GS-0404-07 | U.S. Fish & Wildlife Service | Hurlburt Field, FL
January-July 2022

Wildlife Biologist Aide | Sierra Pacific Industries | Fortuna, CA
March-November 2021

Biological Science Technician (Fish) GS-0404-05 | U. S. Fish and Wildlife Service | Lodi, CA Delta Juvenile Fish Monitoring Program/ Enhanced Delta Smelt Monitoring Program
April 2020-March 2021

Biological Science Technician (Wildlife) GS-0404-05 | U. S. Forest Service | Flagstaff, AZ Coconino National Forest
May-September 2019

Amphibian Disease and Toxicology Research Assistant | Purdue University
August 2016-May 2019

Teaching Assistant| Mammalian Taxonomy Lab| Purdue University
January 13-March 16, 2018 & 2019

PUBLICATIONS

2021 Tornabene BJ, MF Chislock, **ME Gannon**, MS Sepulveda, and JT Hoverman. Relative acute toxicity of three per- and polyfluoroalkyl substances on nine species of larval amphibians. Integrated Environmental Assessment and Management. 17(4): 684-690.

2019 Flynn RW, MF Chislock, **ME Gannon**, S Bauer, BJ Tornabene, JT Hoverman, and MS Sepúlveda. Lethal and sublethal effects of perfluoroalkyl substance mixtures on larval American bullfrogs (Rana catesbeiana). Chemosphere.

2019 Hoverman JT, MF Chislock, ZA Compton, and **ME Gannon**. Ranavirus reservoirs: Assemblage of American Bullfrog and Green Frog tadpoles maintains ranavirus infections across multiple seasons. Herpetological Review. 50(2): 275-278.

CERTIFICATIONS

· **Wildland Firefighter Type 1**
National Wildfire Coordinating Group
· **Master Naturalist of Coastal Systems**
University of Florida
· **Open Water Diver/Nitrox**
SDI
· **Motorboat Operator**
Department of the Interior
· **Rescue/Diving First Aid for Professional Divers**
NAUI
· **Project WILD and Aquatic WILD**
Project Wild Outdoor Education
· **Wilderness First-Aid and CPR**
Sierra Rescue

ADDITIONAL SKILLS

Water Quality Monitoring · Project Management and Budgeting · ESRI software and GPS · R, Excel, SAS, SPSS, and Access statistical software · Experienced with manual transmission, 4x4 off-road vehicles, trailers, and small motorboats (<25ft) · Chainsaw and tractor operations · Firearms safety

BIOGRAPHICAL SKETCH

NAME: Kirstie Tandberg Francis

eRA COMMONS USER NAME (credential, e.g., agency login): K_FRANCIS

POSITION TITLE: Mote Postdoctoral Research Fellow, Molecular Microbiology

EDUCATION/TRAINING

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	Completion Date MM/YYYY	FIELD OF STUDY
University of Miami, Coral Gables, FL	B.S.	05/2016	Marine Science & Microbiology/Immunology
Florida Atlantic University, Boca Raton, FL	M.S.	08/2018	Biological Sciences
Florida Atlantic University, Boca Raton, FL	Ph.D.	12/2021	Integrative Biology
Mote Marine Laboratory, Sarasota, FL	Post Doc	Present	Molecular Microbiology

A. Personal Statement

I am a postdoctoral research fellow at Mote Marine Laboratory in Sarasota, FL, where I am developing a research program to identify marine microbial natural products with therapeutic or commercial potential. I completed my Ph.D. in Integrative Biology at Harbor Branch Oceanographic Institute where my research focused on identifying marine natural products which reduced the levels of an upregulated protein called survivin in cancer cells. Prior to my current position I completed a National Academies of Science fellowship at NOAA National Centers for Environmental Information where I learned skills in data management, program management, and science policy. In my current position, I am working to maintain and expand the Mote Microbial Library through sampling of unique environments, generate a library of pre-fractionated extracts, screen the library for various bioactivity in my own lab and through collaborations, and purify and elucidate the structure of active compounds. I have identified preliminary activity within my pre-fractionated extract library in antimicrobial, cancer cell cytotoxicity, and algicide assays, and am serving as lead-PI on a HAB CTI grant funded through NOAA to optimize and conduct a high throughput screening to identify natural products with algicidal activity against harmful algal bloom species.

B. Positions

RESEARCH POSITIONS

2023 – Present	**Postdoctoral Research Fellow**, Molecular Microbiology, Mote Marine Laboratory
2021 – 2022	**Gulf Research Program Science Policy Fellow**, NOAA National Centers for Environmental Information (NCEI), National Academies of Sciences, Engineering, and Medicine
2016 – 2021	**Graduate Research Assistant**, Wright Lab, Department of Marine Biomedical and Biotechnology Research, Harbor Branch Oceanographic Institute, Florida Atlantic University
2014 – 2016	**Undergraduate Researcher**, Schmale Lab, Department of Marine Biology and Ecology, University of Miami, RSMAS

C. Contributions to Science

(ii) **Marine natural products drug discovery** I have experience with high throughput screening assay design and optimization, analytical chemistry techniques—including HPLC, mass spectrometry, and NMR—and microbial and cancer cell culture. I have a first author publication in preparation which describes a series of novel cholestenone natural products and their impacts on cancer cells, which exemplifies my ability to execute a project involving cell biology, chemistry, and molecular biology. As a note, my publication history reflects my maiden name (Tandberg, K. R.). I have been publishing under my married name (Francis, K. T.) since 2022.

1. Guzmán, E. A., Pitts, T. P., **Tandberg, K. R.**, Winder, P. L., & Wright, A. E. (2021). Discovery of Survivin Inhibitors Part 1: Screening the Harbor Branch Pure Compound Library. *Marine Drugs*, 19(2), 73. https://doi.org/10.3390/md19020073
2. **Francis, K. T.** (2025). Discovery of bioactive natural products from mesophotic and deep-sea microorganisms. Florida Chapter American Society for Microbiology Conference. Fort Meyers, FL. Oral Presentation.
3. **Francis, K. T.** (2024). Establishing a Drug Discovery Program at Mote Marine Lab: Identifying Diverse Bioactivity from Marine Microorganisms. Marine Natural Products Gordon Research Conference, Ventura, CA. Poster presentation.
4. **Francis, K. T.** Peterson, T. A., Winder, P. L., Guzmán, E. A., & Wright, A. E. (2022). Discovery and Investigation of Survivin-Targeting Marine Natural Products from the Deep-Water Gorgonian *Ellisella paraplexauroides*. American Society of Pharmacognosy Conference, Charleston, SC. Poster presentation.

(ii) **Data and project management** My experience in data and project management from my NOAA NCEI science policy fellowship has given me the skills to coordinate large research projects, manage budgets and personnel, and maintain FAIR data practices.

1. Bassett, R., Herting, J., Frometa, J., Sharuga, S., Howell, J., Siceloff, L., Bourque, J., Cromwell, M., **Francis, K**., Clark, R., Demopoulos, A., David, A., Benson, K., Harter, S.L. (2023). Comprehensive Inventory of Habitat Assessment and Evaluation Datasets to Support Deepwater Horizon Mesophotic and Deep Benthic Communities. National Oceanic and Atmospheric Administration. DWH MDBC Data Report DR-23-01. Silver Spring, MD. 68 pp. https://doi.org/10.25923/kz7t-4674
2. **Francis, K.T.**, Formel, S., Ronje, E., Jackson, L., Newman, M., Cromwell, M., Larsen, K. (2022). Project Data Management Across Office and Agency Lines: DWH Oil Spill Restoration. Gulf of Mexico Conference, Baton Rouge, LA. Oral Presentation.
3. **Francis, K.T.**, Formel, S., Larsen, K. (2022) Starting down the road of data management and bioinformatics. NOAA NCEI Data Stewardship Council. Virtual. Oral Presentation.

(iii) **Toxicity of Harmful Algal Blooms** My background in researching the harmful algal blooms (HABs) impacting the Indian River Lagoon has given me experience with HAB sample collection and sample processing for toxin extraction and analysis. My current work focuses on HAB laboratory cultures: assessing the microbial communities in different strains using 16S metagenomics and identifying microbial extracts with algicidal activity through high throughput screening.

1. Guzmán, E. A., Peterson, T. A., Winder, P. L., **Francis, K. T.**, McFarland, M., Roberts, J. C., Sandle, J. & Wright, A. E. (2023). An Assessment of Potential Threats to Human Health from Algae Blooms in the Indian River Lagoon (USA) 2018–2021: Unique Patterns of Cytotoxicity Associated with Toxins. *Toxins*, 15(11), 664. https://doi.org/10.3390/toxins15110664

(iv) **Science communication and outreach** I am motivated to use my research as a platform for ocean conservation and as an instrument to improve the scientific literacy of the public. I regularly give lectures to the public to explain my research and how they can get involved as well-informed citizens.

1. **Francis, K. T.** (2024). From the seafloor to the medicine cabinet: Establishing a natural product drug discovery program at Mote Marine Lab. Coffee with a Scientist Lecture Series. Boca Grande Community Center, Boca Grande, FL. Oral Presentation.
2. **Francis, K. T.** (2024). From the seafloor to the medicine cabinet: Establishing a natural product drug discovery program at Mote Marine Lab. Motivational Mondays Special Lecture Series, Sarasota, FL. Oral Presentation.
3. **Francis, K. T.** and Xavier, R.M. (2021). Marine Natural Products: From the seafloor to the medicine cabinet. HBOI Ocean Discovery Center, Fort Pierce, FL. Oral Presentation.
4. **Francis, K. T.** (2018). Marine Natural Products as Cancer Therapies: Screening for Survivin Inhibitors. HBOI Ocean Discovery Center, Fort Pierce, FL. Oral Presentation.

Aspen Cook
4540 S. Lockwood Ridge, Sarasota, Florida 34231
Phone: 941.323.6793
E-mail: acook@mote.org

Education:
University of Phoenix (2015-2020)
Bachelor of Science
Major**:** Environmental Science
Minor**:** Psychology
Focus Study: Linguistics

Professional Experience:
Senior Environmental Specialist, BCRS Operations Supervisor
Environmental Health Research Program, Beach Conditions Reporting System Program
Mote Marine Laboratory & Aquarium
April 2022 – present

- Manage Mote's Beach Conditions Reporting System (BCRS), including volunteer training, coordination, and web/app development, maintenance, and troubleshooting.
- Oversee BCRS expansion under the Florida Red Tide Mitigation & Technology Development Initiative, FWC/FWRI Red Tide Cooperative Agreement, SECOORA & University of South Carolina How's the Beach Agreement, and City of Sarasota Smart City Initiative.
- Develop and implement public education materials, including infographics and videos on Florida red tide, water quality, and citizen science initiatives.
- Advance red tide monitoring technology in collaboration with Mote's Phytoplankton Ecology Program; recruit and train volunteers.
- Mentor interns, guiding project design, implementation, and communication.
- Lead proposal development, grant writing, and project management, including budget justifications and reports.

Staff Environmental Specialist, Outreach Specialist
Environmental Health Research Program
Mote Marine Laboratory & Aquarium
October 2020 – April 2022

- Directed volunteer recruitment and training for BCRS and the HABscope programs.
- Coordinated Living Dock installations and volunteer activities for the Boca Grande Living Docks Project.
- Created educational content, including infographics and videos, supporting red tide monitoring and mitigation research.
- Contributed to research on red tide mitigation, laboratory studies, and citizen science methodologies.

Research Technician
Environmental Health Research Program
Mote Marine Laboratory & Aquarium
January 2019 – October 2020

- Supported red tide research, including data collection and outreach.
- Trained volunteers for BCRS and the HABscope program, ensuring accurate reporting and equipment management.
- Designed methodologies and training programs for future community science projects.

Environmental Health Intern
Environmental Health Research Program
Mote Marine Laboratory & Aquarium
May 2018 - January 2019

- Conducted biofuels research focused on diatom lipid production under varying conditions.
- Supported red tide research, including sample collection, filtration, and microscopy analysis for Karenia brevis.

Publications:

- Mote Marine Laboratory, Inc. *Beach Conditions Reporting System.* Visitbeaches.org https://www.visitbeaches.org/
- Mote Marine Laboratory, Inc. (2022). *Year 2 – Annual Report FY – 2021 to 2022 FWRI-Mote Cooperative Red Tide Monitoring and Research Program.* FWC Agreement No. 20034.
- Mote Marine Laboratory, Inc. (2023). *Year 3 – Annual Report FY – 2022 to 2023 FWRI-Mote Cooperative Red Tide Monitoring and Research Program.* FWC Agreement No. 20034.
- Mote Marine Laboratory, Inc. (2024). *Year 4 – Annual Report FY – 2023 to 2024 FWRI-Mote Cooperative Red Tide Monitoring and Research Program*. FWC Agreement No. 20034.

Jon Perry, GISP

Principal Environmental Scientist

EDUCATION

Graduate Certificate, Geographic Information Systems, University of South Florida

BS, Earth Science, Norwich University

30 YEARS OF EXPERIENCE

CERTIFICATIONS/ REGISTRATIONS

Certified Geographic Information Systems Professional, #58956

FDEP Qualified Stormwater Management Inspector, #8899

SPECIALIZED EXPERIENCE

EFDC Hydrodynamic and Water Quality Models

GIS

HEC-GeoRAS

Microsoft Products

SAS

SIMPLE Model

Jon has more than 30 years of experience collecting and analyzing the physical, chemical, and biological properties of aquatic systems throughout Florida. His areas of expertise include monitoring design, watershed assessment (status and trends), pollutant loading and hydrodynamic modeling, and geographic information system technology. He has regulatory experience with developing Minimum Flows and Levels (MFLs), Total Maximum Daily Loads (TMDLs), Reasonable Assurance Plan development, and National Pollution Discharge Elimination Systems (NPDES) reporting. His principal responsibilities are focused on providing clients with technical analysis to aid decision making.

Relevant Experience

Brevard County, Indian River Lagoon (IRL) Total Maximum Daily Load (TMDL) Revision, Brevard County, FL. *Water Quality Specialist – Seagrass Target Revisions, Nutrient Loading Target Development.* As a subcontractor, ESA (formerly Janicki Environmental) assisted in the update and revision of the TMDLs for the water body segments within the IRL. The initial phase of this project included data compilation, assessment, and TMDL approach development. Using the data compiled and following the approach, the objective of the second phase was determination of targets and assimilative capacity for the IRL and development of TMDL load reductions. ESA (formerly Janicki Environmental) worked closely with stakeholders and the Florida Department of Environmental Protection in development of the approach for TMDL revision, and provided extensive evaluation of empirical relationships between loadings, water quality, and seagrass. Jon's responsibilities included developing of seagrass targets and the evaluation of empirical relationships between loadings and water quality and seagrass responses. (ATM)

Choctawhatchee Bay Estuary Program, Development of a Comprehensive Conservation and Management Plan (CCMP) for the Choctawhatchee Bay Estuary, Okaloosa County, FL. *Water Quality/Regulatory Specialist.* This project involves development of the CCMP for Choctawhatchee Bay Estuary. The watershed includes portions of Southeast Alabama as well as four Florida counties. The CCMP will provide a blueprint for the management actions to be implemented to improve water quality and protect key living resources and their habitats. Critical elements of a successful CCMP include commitments on the part of its stakeholders, public participation including education tools, and monitoring plans that can track progress toward program goals and objectives. SF330: 2022–2024; Total Project Value: $399,522; w/Firm; Client Reference: Brian Underwood, Executive Director; 1540 Miracle Strip Parkway, SE, Fort Walton Beach, FL 32548; 850-609-5382; bunderwood@myokaloosa.com DJ20232009.00

City of Cape Coral, Permitting Assistance Regarding the South Spreader Canal, Cape Coral, FL. *Water Quality Specialist.* Jon provided technical support in the development of the

Environmental Fluid Dynamics Code (EFDC) hydrodynamic model used to support the permit application for the removal of the Chiquita Lock on the city's South Spreader Canal. Jon assisted the City staff in gathering the necessary hydrologic data used in the calibration of the model. He gathered, performed the necessary quality assurance/quality control activities, and formatted the water quality, meteorological, and hydrologic data used to drive the EFDC model. He also conducted the water quality analysis, particularly as it relates to the Caloosahatchee Total Maximum Daily Load.

City of Dunedin and Pinellas County, Curlew Creek/Smith Bayou Watershed Management Plan (Pinellas County), and Stormwater Master Plan and Vulnerability Assessment (City of Dunedin), FL. *Water Quality Specialist/Modeler.* Jon was part of the team at ESA (formerly Janicki Environmental) providing water quality and modeling assistance to the development of the City of Dunedin and Curlew Creek Master Plans. He was responsible for the collection, cataloging, and analysis of the available water quality data and the implementation of the Spatially Integrated Model for Pollutant Loading Estimates (SIMPLE) model for both projects. Implementation included the development of the input data, estimation of loads, and the identification of "hotspots." The project provided both the City of Dunedin and Pinellas County with the information to make informed decisions to improve surface water quality in these areas.

City of Plant City, Water Quality Based Effluent Limitation (WQBEL) for the Plant City Water Reclamation Facility, Plant City, FL. *Water Quality Specialist.* Jon assisted in the design and implemented the water quality and quantity study plan used to gather data for the calibration of the QUAL2w model, an in-stream water quality model, developed for the study area. This effort included coordination with landowners to get access to sampling locations, conducting the sampling events, and coordinating with the analytical laboratory. He also assisted in the development of the model inputs, and preparation of the final report for submittal to the City and FDEP.

City of St. Petersburg, 2018 Water Quality Report Card and Trends, St. Petersburg, FL. *Water Quality/Regulatory Specialist.* The City requested assistance in developing the water quality report card for 2018, and providing associated information related to trend test results in water quality constituents. ESA was a subcontractor in this effort. Jon compiled, provided quality assurance/quality control, and analysis of water quality data. Portions of the City are included in the watersheds of Old Tampa Bay, Middle Tampa Bay, and Boca Ciega Bay. The results of the water quality assessment were reported in the Water Quality Report Card technical memo for each watershed, with maps of spatial variability and tables of temporal variability with associated time series graphics. The Time-series Trend Analysis tech memo provided results of temporal trend tests over the 2003–2018 period. SF330: Cost: $22,600; 2018_N/A, w/Firm (Subcontractor to ARO Engineering)

City of St. Petersburg, 2021 Water Quality Report Card, National Pollutant Discharge Elimination System Report Card, and Normalized Loads, St. Petersburg, FL. *Water Quality/Regulatory Specialist.* Jon supported the execution of this project, which ESA is completing for the City as a subcontractor. The work effort included development of pollutant loads from the City for the 2017–2021 period and included the results of non-parametric temporal trend analyses on water quality data. The 2021 Water Quality Report Card was completed, to include detailed information and relevant discussion for the City's Ambient Water Quality Monitoring Program. The report card included a color-coded grading system to categorize water quality relative to state regulatory and site-specific management thresholds. SF330: Cost: $59,000; 2023 (ongoing)_N/A, w/Firm (Subcontractor to Geosyntec)

City of West Palm Beach, West Palm Beach Baseline Water Quality Report, West Palm Beach, FL. *Water Quality Specialist.* Jon was the lead in development of the City's Source Water Quality and Hydrology Baseline Report. The City has been monitoring surface waters for a number of years and needed assistance assembling the City's water quality and quantity data into a usable format, including summary tables, maps and Time-series plots. This project included an extensive quality assurance effort, requiring several iterations to standardize data attributes collected over 7 years. Jon also developed the City's National Pollutant Discharge Elimination System Municipal Separate Storm Sewer System (MS4) Assessment Plan and prepared the first summary report for inclusion with the City's Year-2 Annual Report.

City of West Palm Beach, West Palm Beach Stormwater Master Plan, West Palm Beach, FL. *Water Quality Specialist.* As a member of the West Palm Beach Stormwater Master Plan development team, Jon compiled the City's internal water quality data along with datasets from the Florida Department of Environment Protection's (FDEP's) Impaired Waters Rule Dataset and the South Florida Water Management District's DBHYDRO database. This dataset was analyzed to determine the spatial and temporal variations within the City's waterbodies including Clear Lake, Lake Mangonia, Grassy Waters, and Lake Worth Lagoon, among others. Comparisons were also made between this ambient water quality and the loading estimates developed using the Spatially Integrated Model for Pollutant Loading Estimates (SIMPLE) model to prioritize areas in need of stormwater retrofits or other management actions. He also interacted with FDEP on the review of the most recent impairment list for the Lake Worth Lagoon Basin Group, identifying errors in FDEP's analysis that led to the removal of several impairments from the list.

***Coastal Heartland and National Estuary Partnership and Sarasota Bay Estuary Program, Development of Estuarine Numeric Nutrient Criteria (NNC) for Sarasota Bay and Charlotte Harbor, FL.** *Water Quality Specialist – Review of Methodology, Review of Criteria.* This project resulted in proposed estuarine NNC for the individual bay segments of Charlotte Harbor and Sarasota Bay. Analyses included evaluations of stressor-response relationships between loadings, water quality conditions, and seagrass extents; and selection of the most appropriate methodology for establishing water quality targets. The proposed NNC resulting from these projects were adopted by rule by Florida Department of Environmental Protection (FDEP). Jon was a member of the technical advisory committees of both estuary programs during the development of these efforts providing data, quality assurance/quality control, and technical review. Also, during this statewide effort to develop NNC, his review of the proposed stream criteria led to the correction of FDEP and United States Environmental Protection Agency nutrient regions.

Collier County, Surface Water Quality Annual Assessment and Trend Report, Collier County, FL. *Project Manager (Second and Third Iteration).* Jon was the project manager for second and third iterations, which involved the analysis of a 25-year water quality dataset to summarize existing conditions in the County's surface waters. Analyses included presentation of spatial and temporal trends in water quality. Nutrient load estimates were prepared using empirical water quality and flow data. Changes in water quality and loads were compared to land use and climatological events to determine the driver of change.

***Development of the Spatially Integrated Model for Pollutant Loading Estimates (SIMPLE), Sarasota County.** *NPDES Coordinator/Water Quality Technical Advisor.* While with Sarasota County, Jon was the NPDES coordinator and water quality technical advisor for the stormwater group. He worked with the contractors to develop the SIMPLE watershed loading model for Sarasota County, a GIS-based model that provides monthly estimates of loadings to Sarasota's receiving waters from various sources. His work prioritizing the County's Phillippi Creek Septic System Replacement Program was incorporated into the septic loading module of the model. The model was accepted by the Southwest Florida Water Management District and used in the development of four of the County's watershed management plans and in other areas throughout the state.

Florida Department of Transportation (FDOT), As-Needed Regulatory Review, FL. *Water Quality/Regulatory Specialist.* Jon was a member of a team that was called upon by FDOT to review and comment on regulatory actions by the Florida Department of Environmental Protection. Such actions include Impaired Waters Rule assessments, Total Maximum Daily Loads, Basin Management Actions Plans, and Reasonable Assurance Plans. Many of these interactions included the submission of comments on the behalf of FDOT. Since FDOT activities cover the full extent of the State, this effort involves interacting with various agencies and stakeholder groups on a wide variety of water quality issues.

Florida Department of Transportation (FDOT), Peer Review of the Loxahatchee River Reasonable Assurance Plan, FL. *Water Quality/Regulatory Specialist.* The Loxahatchee River Council, on the behalf of local stakeholders, has partnered with the Florida Department of Environmental Protection (FDEP) to lead the development of the Loxahatchee River Reasonable Assurance Plan (RAP) directed at reduction of nutrient loadings to the Loxahatchee River estuary. ESA, under an agreement with the Florida Department of Transportation, has been reviewing the effort and providing technical comments on behalf of FDOT. The focus of the review has been the identification of the water quality goals and the development of the loading model proposed for use by FDEP, the Partial Least Squares Modeling (PLSM) model, and identifying any potential difficulties that may arise. The development of the RAP is ongoing.

Indian River County, Blue Cypress Lake Water Quality Study, Indian River County, FL. *Water Quality/Regulatory Specialist/Modeler.* ESA was a member of a team contracted by Indian River County to gather and assess water quality data associated with Blue Cypress Lake, including permitted use of land application of biosolids, to identify causative factors for water quality trends in the lake. Blue Cypress Lake has been recognized as relatively pristine and used a reference lake in the development of state water quality standards, classified by FDEP as a Class 1 (potable water supply) waterbody. The lake was experiencing an upward trend in total phosphorous (TP) since 2006 which accelerated since 2014, with the lake recently experiencing Microsystis blooms, potentially introducing toxins into the drinking water supply. The primary land use in the Blue Cypress Lake watershed is agricultural, and the use of fertilizers, with the addition of biosolids since 2006, the most likely sources of phosphorus delivered to the lake. Applications of Class B biosolids at the Pressley Ranch, downstream of any tributary monitoring site, began in 2013. ¶ESA completed an analysis of tributary water quality representing the three major surface water sources to the lake, with no similar increasing trend in TP found in these waters. A phosphorus budget was developed for Blue Cypress Lake based on measured incoming TP concentrations and modeled hydrologic fluxes. This budget indicated that prior to 2013, TP inputs to the lake exceeded outputs from the lake. Since 2013, more phosphorus began leaving the lake than entering the lake, indicating an unaccounted for source of phosphorus. Beginning in 2013 the annual TP application rate downstream of the tributary water quality sampling stations on Pressley Ranch averaged approximately 200,000 pounds per year (lb/year). This application rate implies that if only 10 percent of the phosphorus in those biosolids reaches the lake, it would account for all the unaccounted-for phosphorus in the budget analysis. Class B biosolids applications in the Blue Cypress Lake watershed are based on the agronomic needs of nitrogen (not phosphorus) for hay production with the assumption based on site-specific testing, which indicated that phosphorus could generally be taken up by the crop or retained by the soils. The resulting phosphorus loading to the lake averages close to 10 times the agronomic needs. ¶The results of the study were presented to the Board of County Commissioners of Indian River County, which then extended a moratorium on the application of Class B biosolids in Indian River County. 2018

Pasco County Continuing Services, NPDES/TMDL/BMAP Support, New Port Richey, FL. *Water Quality/Regulatory Specialist.* This project included data analysis and review, document review, and meeting attendance, facilitation, and reporting. ESA worked with a group of local stakeholders, including Pasco County, Hillsborough County, Pinellas County, the City of Tampa, and FDOT in a formal challenge to a group of TMDLs proposed by FDEP and EPA, including more than 20 tidal tributaries of Tampa Bay. Efforts included working with FDEP to develop paths forward to arrive at appropriately revised TMDLs for selected waterbodies. Tony worked closely with County, FDEP, and EPA staff for this effort. SF330: Cost: $123,525, 2015_N/A, w/Firm

Sarasota Bay Estuary Program (SBEP), Sarasota Bay Water Quality Assessment and Strategy, Sarasota County, FL. *Water Quality Specialist/Modeler.* SBEP was interested in initiating efforts to address pending impairment listings for its estuarine waterbodies for nutrients and chlorophyll a. Tasks included convening a water quality consortium consisting of local stakeholders, the acquisition of existing data, estimating pollutant loads, and determining estuarine responses related to pollutant loads and estuarine water quality. Jon was responsible with the compilation of the water quality database and with updating the SBEP SIMPLE pollutant loading model to create a 20-year record of monthly loading estimates. Loadings were estimated for a variety of sources: direct runoff, baseflow, point sources, accidental releases (sewer spills), septic system, reclaimed water irrigation, and atmospheric deposition. The reclaimed water irrigation module built upon the original irrigation module, which now accounts for actual volumes and concentrations delivered to reclaimed customers. Subsequent phases of this project will lead to the development of a reasonable assurance plan for the SBEP estuaries.

Sarasota Bay Estuary Program, Southwest Florida Tidal Creeks Numeric Nutrient Study, Sarasota, FL. *Water Quality Specialist.* ESA (formerly Janicki Environmental) led an EPA-funded study to recommend management level nutrient targets and thresholds for southwest Florida tidal creeks. Responsibilities included developing a definition of a tidal creek for the study, development of a conceptual management and ecological model to formulate study hypotheses, development of a creek classification and selection process, design of a sampling scheme for a 1-year field study of 16 tidal creeks in southwest Florida, and oversight of the collection and analysis of the resulting data. The objective of the study was to better understand the dynamics between creek watershed inputs, instream processes, and biological responses in order to develop management criteria by which these creeks can be evaluated over time. The findings of the study are intended to guide management decisions to establish water quality standards for tidal creeks that will maintain and enhance fisheries production among other ecosystem services. The project included evaluation of relationships between landscape characteristics, instream processes, and biological responses as characterized by water column and benthic chlorophyll concentrations, shoreline habitats, and fish community structure in the selected creeks. Together, these data were used to provide a weight of evidence recommending protective nutrient standards related to maintaining biological integrity for southwest Florida tidal creeks and a mechanism by which these creeks can be evaluated over time to help ensure the proper stewardship of these critical estuarine resources. While with Sarasota County, Jon, in this partnership, provided expert local knowledge and logistical support. After joining ESA (formerly Janicki Environmental), he assisted in data collection activities and data quality control and analysis.

***Sarasota County, Development of Four Coastal Watershed Management Plans for Sarasota County: Sarasota Bay, Roberts Bay North, Little Sarasota Bay, and Lemon Bay, Sarasota County, FL.** *County Reviewer.* Jon served as County Reviewer for this project that developed watershed management plans for the four coastal watersheds of Sarasota County. The County was seeking an integrated management approach that aligned with the Southwest Florida Water

Management District's four areas of responsibility: natural systems, water quality, water supply, and flood control. Once status and trends were identified and the needs for retrofits were established, concept plans were developed around the four AORs and presented to the County for consideration. (2007–2012)

Sarasota County, Sarasota Bay Watershed Management Plan Best Management Practices Analysis, Sarasota County, FL. *Water Quality Specialist/Modeler.* As a member of the team developing the Sarasota Bay Watershed Management Plan, ESA (formerly Janicki Environmental) provided water quality and pollutant load modeling assistance as part of the Best Management Practices Analysis. Jon was responsible for the collection, cataloging, and analysis of the available water quality data and the implementation of the Spatially Integrated Model for Pollutant Loading Estimates (SIMPLE) pollutant loading model developed for Sarasota County. The implementation included estimating loads, establishing loading targets, and the identifying of stormwater pollutant "hotspots." The project provided Sarasota County a menu of projects that could be implemented to reduce the quantity and quality of stormwater runoff contributing to flooding and water quality impairments.

Sarasota County, Spatially Integrated Model for Pollutant Loading Estimates (SIMPLE) Model Update and 2021 Year-3 National Pollutant Discharge Elimination System (NPDES) Report, Sarasota County, FL. *Project Manager – Data Management, Model Development .* Sarasota County contracted with ESA (formerly Janicki Environmental) to update the SIMPLE model for all of Sarasota County and provide Year-3 NPDES pollutant loading reports for the City of Sarasota, City of Venice, the Sarasota County portion of the Town of Longboat Key, and unincorporated Sarasota County. The update included spatial and tabular input information including changes in land use, the location of new stormwater Best Management Practices, areas served by septic systems, and reclaimed water irrigation. The Year-3 annual report included graphical and tabular outputs and comparisons to previous loading estimates. Jon was the lead on this project based on his prior experience with SIMPLE and Sarasota County.

Southwest Florida Water Management District, Little Manatee River Minimum Flows and Levels, Brooksville, FL. *Water Quality Specialist – Floodplain Inundation Frequency Analysis, Database Management.* Jon provided technical assistance as part of an effort to develop regulatory minimum flow standards for both the freshwater and estuarine segments of the Little Manatee River (Florida). He conducted the floodplain inundation frequency analysis using HEC-GeoRAS, a collection of procedures and tools for processing HEC-RAS model output in a geospatial environment in ArcGIS. The results from this and other analyses were used to develop recommendations for establishing a proposed low flow cutoff and percent flow reduction criteria protective of the ecological integrity of the estuarine segment of the Little Manatee River as well as additional efforts to improve empirical information necessary to make informed decisions on the potential effects of future water use permits in the Little Manatee River watershed.

St. Johns River Water Management District, Minimum Flow and Level (MFL) Determination for Wekiva River System, FL. *Water Quality Specialist.* Jon was part of the ESA/Applied Technology and Management Team that assisted the District in determination of MFLs for Wekiva River, Little Wekiva River, Rock Springs, and Wekiwa Springs. The effort included evaluation of hydrological, biological, and water quality data and identification of data needs. The Team also assisted the District in identification of critical water resource value (WRV) metrics and the development of hydrologic and hydraulic models. The results of this effort were a Technical Memorandum developed by the Team and the District presenting a detailed strategy for determining and evaluating environmental criteria on the Wekiva River System.

Jon Perry, GISP (Continued)

Principal Environmental Scientist

Suwannee River Water Management District, Ecofina and Steinhatchee Minimum Flows and Levels (MFLs), FL. *Water Quality Specialist.* Jon contributed to the development of both the Ecofina River and Steinhatchee River MFLs. As a member of the team, his primary contribution was providing the description of the river and its watershed including the physical, morphological, hydrological, habitat, and water quality characteristics. This included the compilation and analysis of water quality data, a literature search, and geospatial analysis.

Suwannee River Water Management District, Econfina River Minimum Flows and Levels (MFLs), Live Oak, FL. *Water Quality Specialist – Data Management, Geospatial Analysis, Reporting.* Jon provided the description of the river and its watershed including the physical, morphological, hydrological, habitat and water quality characteristics. This included the compilation and analysis of water quality data, a literature search and geospatial analysis. He also provided technical and GIS assistance to other team members during development of the MFL.

***Tampa Bay Estuary Program, Technical Support and Data Management Services – Tampa Bay Nitrogen Management Consortium (TBNMC).** *Water Quality Specialist.* This effort included data analysis and evaluation of loadings to assist in arriving at entity-specific nitrogen load allocations as part of the effort by local stakeholders in Tampa Bay and the Tampa Bay Estuary Program in the development of the 2009 Reasonable Assurance Addendum: Allocation and Assessment Report. This report synthesized more than 3 years of effort among the stakeholders group, TBNMC, to develop nitrogen load allocations for all entities and major sources within the Tampa Bay watershed, consistent with the federally recognized nitrogen Total Maximum Daily Load for Tampa Bay. As a TBNMC member representative while working for Sarasota County, Jon provided data required for assessing the load allocation for the County.

Various Clients, As-Needed Regulatory Review, FL. *Water Quality/Regulatory Specialist.* Jon provides ongoing technical support services for many clients regarding regulatory actions taken by the Florida Department of Environmental Protection, including Impaired Waters Rule assessments, and the development of Total Maximum Daily Loads and Basin Management Actions Plans. This effort often involves interacting with various agencies and stakeholder groups on a wide variety of water quality issues around the state.

Volusia County, Mosquito Lagoon Reasonable Assurance Plan, DeLand, FL. *Water Quality Specialist – Numeric Nutrient Criteria Review and Revision, Data Analysis, Statistical Evaluation.* Jon was a member of the team that developed the Mosquito Lagoon Reasonable Assurance Plan for Volusia County and several municipal stakeholders. He was responsible for the review of the existing numeric nutrient criteria and proposing updated criteria following the methodology laid out by Florida Department of Environmental Protection (FDEP). He also reviewed the existing seagrass and water quality data and searched for statistically significant relationships between the ambient water quality data and watershed loads and intersegment fluxes using empirical models to determine nutrient loading targets. A reference period approach was used to propose targets until a mechanistic modeling approach becomes available. The results of this project provided Volusia County and the other stakeholders a plan to protect Mosquito Lagoon and provided FDEP and United States Environmental Protection Agency assurance that Mosquito Lagoon will meet its designated use.

Walton County, Coastal Dune Lake Study, Walton County, FL. *Water Quality Specialist.* The project team was tasked with examining and reporting on the degree of current impact and how future land use changes could affect water quality conditions in Walton County's Coastal Dune Lakes. To achieve the first objective of this study, Jon related current water quality conditions to watershed characteristics and pollutant loading to predict lake response to future watershed changes. This information allowed development of a technically defensible framework for assessing changes and recommending targets that are feasible, achievable, and measurable.

**Prior experience*

19482 Canal Drive
Sugarloaf Key, FL 33042

305-797-3996
305-292-5100
Richard.Cleaver@jacobs.com

Richard Cleaver

Experience

2020 – Present Jacobs/OMI Key West, FL

Project Manager/Technical Director - City of Key West WWTP

Responsible for the overall management and leadership of the project including profit and loss, permit compliance, safety, quality, and client relationship management. Also provides leadership and management for all 32 employee functions including staffing, compensation, training and development, progressive discipline, rewards and recognition, and termination in accordance with standard company policy. Also responsible for the planning, organization, operations, maintenance, and improvement of the facility.

Project Facts
Budget: $5.4 million/year
Staff: 32 with 4 Supervisors

Essential Duties and Responsibilities
- Implementing Jacobs safety policy and procedures
- Maintaining the operation process control including compliance with regulatory agencies
- Developing and administering the project financial plan and budget
- Providing leadership in OMI's quality process
- Following company policy and procedure
- Developing the annual Project Business Plan

2004–Present Jacobs/OMI Key West, FL

Laboratory Director City of Key West WWTP

- Supervise all Laboratory and Operations staff in the daily laboratory responsibilities.
- Responsible for obtaining and maintaining Florida Lab Certification under the National Environmental Lab Accreditation Conference (NELAC) guidelines.
- Monitor a comprehensive quality assurance program in order to assure perfect compliance and reporting.
- Supervise the taking of all samples for laboratory tests applying all state and federal requirements and special analyses
- Advises Project Manager of results of various tests performed, and makes recommendations regarding the improvement of laboratory procedures, special studies and future laboratory operations
- Prepares reports and makes recommendations regarding laboratory record-keeping, reporting, operations, monitoring and control activities

Regional Lab Coordinator – Southeast Region

- Provide Lab and Compliance assistance to Southeast Project Laboratories. Review monthly QAQC reports from project laboratories. Participate in various troubleshooting teams to address compliance concerns.

2002–2004 **Florida Department of Health** Key West, FL

Environmental Health Inspector

- Inspector for Environmental Health in the following areas: Food Safety, Public Pools, Biomedical waste and Onsite Sewage Treatment and Disposal.

1986–1992 **Northeastern Analytical Corp.** Marlton, NJ

Laboratory Manager

- Environmental Lab Manager for a staff of 20 in the Inorganics and Microbiology Labs (Wet Chemistry, Trace Metals and Microbiology).

1984-1986 **Environmental Measurements** **Hammonton, NJ**

Trace Metals Analyst

- Trace Metals Analyst using flame, furnace and cold vapor AA.

Education

- 1980-1984 – Rowan University, Glassboro, NJ
- B.S. Biological Science

Interests

- Florida Society of Environmental Analysts
- The NELAC Institute Member
- Coach High School Football (Key West High School)

State of Florida

Department of Health, Bureau of Public Health Laboratories

This is to certify that

E84091

MOTE MARINE LABORATORY
1600 KEN THOMPSON PARKWAY
SARASOTA, FL 34236

has complied with Florida Administrative Code 64E-1,
for the examination of environmental samples in the following categories

NON-POTABLE WATER - GENERAL CHEMISTRY

Continued certification is contingent upon successful on-going compliance with the NELAC Standards and FAC Rule 64E-1 regulations. Specific methods and analytes certified are cited on the Laboratory Scope of Accreditation for this laboratory and are on file at the Bureau of Public Health Laboratories, P. O. Box 210, Jacksonville, Florida 32231. Clients and customers are urged to verify with this agency the laboratory's certification status in Florida for particular methods and analytes.

Date Issued: July 01, 2024   Expiration Date: June 30, 2025

Marie-Claire Rowlinson, PhD, D(ABMM)
Bureau of Public Health Laboratories
DH Form 1697, 7/04
NON-TRANSFERABLE E84091-30-07/01/2024
Supersedes all previously issued certificates

Ron DeSantis
Governor

Laboratory Scope of Accreditation

Attachment to Certificate #: E84091-30, expiration date June 30, 2025. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: E84091 EPA Lab Code: FL00191 (941) 388-4441

E84091
Mote Marine Laboratory
1600 Ken Thompson Parkway
Sarasota, FL 34236

Matrix: Non-Potable Water

Analyte#	Analyte	Method/Tech	Method Code	Category	Effective Date
1515	Ammonia as N	SM 4500-NH3 G-2011	20111415	General Chemistry	10/9/2018
1530	Biochemical oxygen demand	SM 5210 B-2011	20135266	General Chemistry	10/9/2018
1555	Carbonaceous BOD (CBOD)	SM 5210 B-2011	20135266	General Chemistry	10/9/2018
9345	Chlorophylls	EPA 445	10081400	General Chemistry	1/9/2002
9345	Chlorophylls	SM 10200 H	20300225	General Chemistry	1/9/2002
1605	Color	SM 2120 B-2011	20039310	General Chemistry	10/9/2018
1605	Color	SM 2120 C	20002000	General Chemistry	9/26/2019
1610	Conductivity	EPA 120.1	10006403	General Chemistry	7/6/2010
1610	Conductivity	SM 2510 B-2011	20048617	General Chemistry	10/9/2018
1795	Kjeldahl nitrogen - total	EPA 351.2	10065404	General Chemistry	1/9/2002
1810	Nitrate as N	EPA 353.2	10067604	General Chemistry	1/9/2002
1820	Nitrate-nitrite	EPA 353.2	10067604	General Chemistry	1/9/2002
1840	Nitrite as N	EPA 353.2	10067604	General Chemistry	12/23/2005
1865	Organic nitrogen	TKN minus AMMONIA	60034437	General Chemistry	3/3/2008
1870	Orthophosphate as P	EPA 365.1	10070005	General Chemistry	1/9/2002
1870	Orthophosphate as P	SM 4500-P F-2011	20125024	General Chemistry	10/9/2018
1910	Phosphorus, total	EPA 365.4	10071202	General Chemistry	1/9/2002
1955	Residue-filterable (TDS)	SM 2540 C-2011	20050413	General Chemistry	10/9/2018
1960	Residue-nonfilterable (TSS)	SM 2540 D-2011	20051212	General Chemistry	10/9/2018
1970	Residue-volatile	SM 2540 E-2011	20051596	General Chemistry	10/9/2018
1975	Salinity	SM 2520 B	20004006	General Chemistry	7/6/2010
1995	Silica-dissolved	USGS I-2700-85	40005605	General Chemistry	12/23/2005
2005	Sulfide	SM 4500-S^{2-} F-2011	20126663	General Chemistry	10/9/2018
1725	Total, fixed, and volatile residue	SM 2540 G	20005203	General Chemistry	1/9/2002
2055	Turbidity	SM 2130 B-2011	20048220	General Chemistry	10/9/2018
2058	Un-Ionized Ammonia	DEP SOP 02/12/01	90015820	General Chemistry	3/3/2008

State of Florida

Department of Health, Bureau of Public Health Laboratories

This is to certify that

E55389

CITY OF KEY WEST WWTP LABORATORY
TRUMBO POINT ANNEX, FLEMING KEY
KEY WEST, FL 33040

has complied with Florida Administrative Code 64E-1,
for the examination of environmental samples in the following categories

NON-POTABLE WATER - GENERAL CHEMISTRY, NON-POTABLE WATER - MICROBIOLOGY

Continued certification is contingent upon successful on-going compliance with the NELAC Standards and FAC Rule 64E-1 regulations. Specific methods and analytes certified are cited on the Laboratory Scope of Accreditation for this laboratory and are on file at the Bureau of Public Health Laboratories, P. O. Box 210, Jacksonville, Florida 32231. Clients and customers are urged to verify with this agency the laboratory's certification status in Florida for particular methods and analytes.

Date Issued: July 01, 2024 Expiration Date: June 30, 2025

Marie-Claire Rowlinson, PhD, D(ABMM)
Bureau of Public Health Laboratories
DH Form 1697, 7/04
NON-TRANSFERABLE E55389-24-07/01/2024
Supersedes all previously issued certificates

Ron DeSantis
Governor

Laboratory Scope of Accreditation

Attachment to Certificate #: E84091-30, expiration date June 30, 2025. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: E84091 EPA Lab Code: FL00191 (941) 388-4441

E84091
Mote Marine Laboratory
1600 Ken Thompson Parkway
Sarasota, FL 34236

Matrix: Non-Potable Water

Analyte#	Analyte	Method/Tech	Method Code	Category	Effective Date
1515	Ammonia as N	SM 4500-NH3 G-2011	20111415	General Chemistry	10/9/2018
1530	Biochemical oxygen demand	SM 5210 B-2011	20135266	General Chemistry	10/9/2018
1555	Carbonaceous BOD (CBOD)	SM 5210 B-2011	20135266	General Chemistry	10/9/2018
9345	Chlorophylls	EPA 445	10081400	General Chemistry	1/9/2002
9345	Chlorophylls	SM 10200 H	20300225	General Chemistry	1/9/2002
1605	Color	SM 2120 B-2011	20039310	General Chemistry	10/9/2018
1605	Color	SM 2120 C	20002000	General Chemistry	9/26/2019
1610	Conductivity	EPA 120.1	10006403	General Chemistry	7/6/2010
1610	Conductivity	SM 2510 B-2011	20048617	General Chemistry	10/9/2018
1795	Kjeldahl nitrogen - total	EPA 351.2	10065404	General Chemistry	1/9/2002
1810	Nitrate as N	EPA 353.2	10067604	General Chemistry	1/9/2002
1820	Nitrate-nitrite	EPA 353.2	10067604	General Chemistry	1/9/2002
1840	Nitrite as N	EPA 353.2	10067604	General Chemistry	12/23/2005
1865	Organic nitrogen	TKN minus AMMONIA	60034437	General Chemistry	3/3/2008
1870	Orthophosphate as P	EPA 365.1	10070005	General Chemistry	1/9/2002
1870	Orthophosphate as P	SM 4500-P F-2011	20125024	General Chemistry	10/9/2018
1910	Phosphorus, total	EPA 365.4	10071202	General Chemistry	1/9/2002
1955	Residue-filterable (TDS)	SM 2540 C-2011	20050413	General Chemistry	10/9/2018
1960	Residue-nonfilterable (TSS)	SM 2540 D-2011	20051212	General Chemistry	10/9/2018
1970	Residue-volatile	SM 2540 E-2011	20051596	General Chemistry	10/9/2018
1975	Salinity	SM 2520 B	20004006	General Chemistry	7/6/2010
1995	Silica-dissolved	USGS I-2700-85	40005605	General Chemistry	12/23/2005
2005	Sulfide	SM 4500-$S2^{-}$ F-2011	20126663	General Chemistry	10/9/2018
1725	Total, fixed, and volatile residue	SM 2540 G	20005203	General Chemistry	1/9/2002
2055	Turbidity	SM 2130 B-2011	20048220	General Chemistry	10/9/2018
2058	Un-Ionized Ammonia	DEP SOP 02/12/01	90015820	General Chemistry	3/3/2008

QUALITY MANUAL

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QUALITY MANUAL

Revision 2.24

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Acronyms

Acronyms and Abbreviations Used in this Document

AA	Autoanalyzer
ACS	American Chemical Society
BIO	Biological Sample
BOD	Biochemical Oxygen Demand
CBOD	Carbonaceous Biochemical Oxygen Demand
CEO	Chief Executive Officer
COD	Chemical Oxygen Demand
CCV	Continuing Calibration Verification
CFR	Code of Federal Regulations
DOC	Demonstration of Capability
FDEP	Florida Department of Environmental Protection
FDOH	Florida Department of Health
FDOH ELCP	Florida Department of Health Environmental Laboratory Certification Program
DO	Dissolved Oxygen
DI	Deionized
DW	Drinking Water
EFF	Effluent
EPA	Environmental Protection Agency
FAC	Florida Administrative Code
FCV	Final Calibration Verification
FDEP	Florida Department of Environmental Protection
FID	Flame Ionization Detector
FL	Florida
FWRI	Florida Wildlife Research Institute
GC	Gas Chromatograph
GW	Ground Water
HDPE	High Density Polyethylene
HPLC	High Performance Liquid Chromatography
IDOC	Initial Demonstration of Capability
IHC	In House Collection
ICV	Initial Calibration Verification
LOD	Limit of Detection
LOQ	Limit of Quantitation
LPL	Lowest Practical Taxonomic Level
MS	Mass Spectrometer
MDL	Method Detection Limit
MML	Mote Marine Laboratory, Inc.
NELAC	National Environmental Laboratory Accreditation Conference
NELAP	National Environmental Laboratory Accreditation Program
NIST	National Institute of Standards and Technology
NOAA	National Oceanic and Atmospheric Administration
NODC	National Oceanographic Data Center
NTU	Nephelometric Turbidity Unit
ORP	Oxidation Reduction Potential
PP	Polypropylene
PT	Proficiency Test
PTOB	Proficiency Testing Oversight Body
PTPA	Proficiency Test Provider Accreditor
PVC	Polyvinyl Chloride
PQL	Practical Quantitation Level
QA	Quality Assurance
QAC	Quality Assurance Committee
QAO	Quality Assurance Officer

QAPP	Quality Assurance Project Plan
QC	Quality Control
QM	Quality Manual
RCRA	Resource Conservation and Recovery Act
RPD	Relative Percent Difference
%RSD	Percent Relative Standard Deviation
SA	Saline Water
SED	Sediment
S	Soil
SOP	Standard Operating Procedure
SM	Standard Methods
SW	Surface Water
TCDD	2,3,7,8 – Tetrachlorodibenzo-p-dioxin
TEH	Total Extractable Hydrocarbons
TNI	The NELAC Institute
TOC	Total Organic Carbon
USGS	U.S. Geological Survey
VOC	Volatile Organic Carbon

3.0 STATEMENT OF POLICY

3.1 Description and History

Mote Marine Laboratory (MML) is an independent, nonprofit marine research organization dedicated to the advancement of marine and environmental sciences through research and education. Since its inception in 1955, the Laboratory's mission has been the pursuit of excellence in scientific research and the dissemination of information to the scientific community as well as the general public (**Table 3.1**). The research performed at MML is both basic and applied in scope, covering a wide range of subjects. Major funding for MML research includes federal and state grants and contracts, foundation and private gifts, and a MML Endowment.

Mote Marine Laboratory conducts about 150-200 funded research projects in a year, of which approximately 10% may be affected by the QA requirements of EPA, the U.S. Army Corps of Engineers, Florida DEP or DOH, or other agencies. The majority of projects requiring a QA plan are being conducted by staff in the Benthic Ecology, Chemical & Physical Ecology, Ocean Acidification, Red Tide Institute, Ecotoxicology, Phytoplankton Ecology, or Environmental Laboratory for Forensics Programs. NELAC (National Environmental Laboratory Accreditation Conference) certification for environmental analyses is currently maintained only by the Chemical and Physical Ecology Program.

3.2 General Capabilities

Capabilities of the research programs covered by this Quality Manual include sampling and analysis for granulometry, inorganic ions, minerals, residues, nutrients, demands, extractable organics, oil and grease, and benthic invertebrate community analysis (enumeration and identification), sampling for trace metals, phenols and cyanide, volatile organics, microbiology, radionuclides, and sampling for phytoplankton.

3.3 Commitment to Sound Quality Assurance/ Quality Control

Mote Marine Laboratory is dedicated to providing excellent data quality in all areas. Mote Marine Laboratory prepared the first QA Project Plan in Florida to receive approval by the Florida Department of Environmental Protection (FDEP), and since that time, MML has prepared several Quality Assurance Project Plans (QAPP) for complex, multidisciplinary environmental studies. Mote Marine Laboratory respects the State of Florida's requirements for comprehensive QA/QC and offers this document as its commitment to sound and useful QA/QC management.

Mote Marine Laboratory's Quality Manual provides guidance for environmental studies conducted at MML. The procedures and protocols outlined in this document are based on documents put forth by the State of Florida mandating QA/QC requirements for laboratories generating environmental data that will be submitted to FDEP. These documents are the FDEP Quality Assurance Rule 62-160, F.A.C., and the FDOH Rule, 64E-1, F.A.C. Specifically, the FDEP Quality Assurance Rule, 62-160, F.A.C., requires that all laboratories generating environmental data for submittal to FDEP, either directly or indirectly, be certified by the FDOH Environmental Laboratory Certification Program (ELCP), which is a National Environmental Laboratory Accreditation Program (NELAP) accrediting authority. This includes environmental data or reports for submission to FDEP or for use in FDEP-regulated or FDEP-sponsored activities. The current version of the FDEP Quality Assurance Rule F.A.C. 62-160 has an effective date of 04/16/2018 and can be found on FDEP's website or (https://www.flrules.org/gateway/ChapterHome.asp?Chapter=62-160). Environmental laboratory certification standards are mandated by the FDOH Rule F.A.C. 64E-1 Certification of Environmental Testing Laboratories (September 26, 2018). According to this rule, any certified environmental testing laboratory shall comply with the The NELAC Institute (TNI) Standards. In accordance with this rule, MML follows TNI 2016 Standards as of their effective date of September 26, 2018. This rule applies to analytes and test methods for which MML is NELAC-certified or is seeking NELAC-certification. In order to be compliant with NELAC Standards, MML has implemented laboratory policies and procedures in those programs for analytes and test methods for which NELAC certification is desired. These policies and procedures follow standards described in TNI Volume 1 Module 2 "Quality Systems General Requirements" (EL-V1M2-ISO-2016-Rev2.1).

Some projects may not require NELAC certification or may involve analyses for which NELAC certification is not available, but still include environmental data that will be submitted to FDEP. In these cases, related projects will operate a quality assurance program consistent with FDEP requirements and quality systems standards of NELAC in Chapter 64E-1, F.A.C. These policies and procedures appear throughout this document in the appropriate sections. Also according to QA Rule 62-160, F.A.C, field activities generating environmental data for submittal to FDEP either directly or indirectly, must follow FDEP standard operating procedures (SOP) for field activities (DEP-SOP-001/01, January 2017, effective 4/16/2018) or lab activities (DEP-SOP-002/01, January 2017, effective 4/16/2018) where applicable. Where applicable and required by specific project, NOAA's National Resource Damage Assessment (NRDA) protocols are followed.

Contracts, orders, permits or permit-related projects may require certain analyses as a condition of the contract, order, or permit that will be submitted to FDEP either directly by MML or through the agency that contracted MML to conduct these analyses. In these cases, the required analyses should be performed according to Quality Assurance guidelines described in this manual, to include NELAC certification and FDEP field sampling and laboratory SOPs as applicable. If specifically required by the EPA for activities conducted for or funded by EPA, Quality Assurance Project Plans (QAPPs) shall be prepared in accordance with "EPA Requirements for Quality Assurance Project Plans, EPA QA/R-5," (EPA/240/B-01/003 March 2001). As these rules, standards, and SOPs are updated, Mote Marine Laboratory will revise existing documents and procedures to be in compliance with current requirements.

In addition, it is official policy of Mote Marine Laboratory that employees know and abide by all pertinent QA requirements. The MML Policy Manual states,

(quote)

> Mote Marine Laboratory codifies its long-standing dedication to scientific excellence in several ways. A primary instrument is Mote's quality assurance program (QAP). The QAP institutionalizes a number of policies and procedures as the minimum necessary effort that will be expended in order to meet Laboratory objectives in a variety of environmental investigations. In 2002, the QAP took two forms. The first component of the QAP requires certification through the Florida Department of Health (DOH). Changes to Florida Department of Environmental Protection (DEP) Quality Assurance Rule 62-160, F.A.C., have resulted in the requirement that all laboratories generating environmental data for submittal to

DEP, either directly or indirectly, be certified through the Florida DOH Environmental Laboratory Certification Program (ELCP). The Florida DOH certifies all laboratories according to National Environmental Laboratory Accreditation Conference (NELAC) standards. Mote's quality assurance guidelines are described in Mote's Quality Manual, originally approved by Florida DEP, and more recently modified to be compliant with these NELAC standards. The Quality Manual replaces the Comprehensive Quality Assurance Plan (CompQAP), formerly required and approved by DEP for field or laboratory activities. The Quality Manual is available electronically on Mote's in-house web page, and in hard copy in the library, or in the Quality Assurance Officer's office. The second component of the QAP covers laboratory or field activities in which NELAC certification is not required. Where certification is not required, Mote's Quality Manual covers general laboratory and field procedures and can be used to prepare project-specific QA plans, when required. Project-specific quality assurance requirements should be followed. Standard Operating Procedures (SOP) provided by Florida DEP should be followed for field and laboratory activities not requiring NELAC certification but still involving submission of data to DEP. In order to implement the QAP and approved plans, it is necessary that certain precautions be taken, and these are adopted as Laboratory policy:

The Laboratory's QAP and approved plans will not be represented to other persons or agencies without prior knowledge and approval of the Quality Assurance Officer (QAO).

Interviews, publicity, and other public statements regarding QA will be made officially by the Laboratory's QAO, whenever possible, or by the President.

Statements of qualifications, technical proposals, and/or contracts referring to quality assurance in any way must be approved by the QAO prior to their submittal.

All QA project plans will be approved by the QAO prior to their submittal for review or approval.

All program managers will be familiar with the organization, content, and meaning of approved plans, and will consult the QAO on cases where the applicability of QA guidelines to their programs is in question. Also, program managers will ensure that principal investigators under their supervision understand all pertinent QA policies and procedures affecting specific projects.

As required by QA procedure, any other project staff affected by QA will be briefed on proper procedures.

The QAO has the authority to initiate system, performance, or spot-check audits of any project covered by a QA plan. Also, any person may request a QA audit of a project in which he or she is involved, if it is covered by a QA plan.

The QAO will report all audit results and recommendations to the President, who will cause the affected program manager and/or Principal Investigator to take corrective actions.

(end of quote)

3.4 Role of this Document

This Quality Manual documents the capabilities, methods, and procedures of MML, with respect to field sampling and laboratory analytical operations of its inorganic chemistry, organic chemistry, benthic ecology, phytoplankton ecology, and environmental forensics programs in which quality assurance requirements are mandated by granting agency or specified by Project Directors.

This plan presents all methods and standard procedures, either by complete description or by reference. This document will be used in new staff training, QA auditing, and in the preparation of QA project plans. QAPP may adopt sections of this Quality Manual by reference.

MML adheres to NELAC guidelines, methods and procedures for all NELAC-certified field and laboratory activities, as required. All field and laboratory activities without NELAC certification but still affected by Ch.62-160 F.A.C. will follow FDEP standard operating procedures, as required. While MML will make reasonable efforts to determine whether new projects are affected by Ch. 62-160 F.A.C., it is the responsibility of grantors, contractors and other sponsors to advise MML of QA requirements (S. Labie, FDEP, personal communication (1995)).

Mote Marine Laboratory participates in many diverse projects related to the marine environment, many of which do not include environmental data collection as covered by the FDEP Quality Assurance Rule, 62-160, F.A.C. Quality assurance requirements are project-specific and are generally specified by the granting agency or by MML Project Directors. If not specifically required in this capacity, the procedures described in this Quality Manual may not be applicable. Where not required, some programs voluntarily choose to adhere to procedures described in this manual.

3.5 Transfer of Records

NELAC standards require that NELAC – certified laboratories have a plan to ensure that records are maintained or transferred according to clients' instructions in the event that the laboratory transfers ownership or goes out of business. Mote Marine Laboratory does not have an owner, so transfer of ownership is not applicable. In the event that MML goes out of business, however, all records will be maintained or transferred according to the client's instructions. All record and analyses performed pertaining to accreditation will be kept for a minimum of 5 years. Technical directors will keep a data file of active and archived projects, including client contacts, in their program and project files. In the event MML goes out of business, technical directors will contact those clients for whom work is ongoing or has been performed in the last 5 years, and transfer project files according to their instructions.

Table 3.1 GOALS OF MOTE MARINE LABORATORY (adapted from Mote Marine Laboratory Beyond 2020 Vision & Strategic Plan, Version 3.0)

1. To be a leader in nationally and internationally respected research programs that are relevant to conservation and the sustainable use of marine biodiversity, healthy habitats and natural resources.

2. To continue to impact a diversity of public policy challenges through strong linkages to public outreach and education.

3. To continue our commitment to leadership in pushing forward the frontiers of marine science and technology.

4. To continue our commitment to integrity and ethics in all endeavors.

5. To develop creativity, collegiality, inclusiveness, collaborations and partnerships as foundations for achieving goals.

6. To provide responsible stewardship of both natural resources and fiscal assets.

7. To provide service to local, state, regional, national, and international communities.

8. To advance marine and environmental sciences through scientific research, education, and public outreach leading to new discoveries, revitalization and sustainability of our oceans and greater public understanding of our marine resources.

4.0 ORGANIZATION AND RESPONSIBILITY

4.1 Name of the Organization

This Quality Manual is prepared for Mote Marine Laboratory, Inc. The main facility is located on City Island in Sarasota, FL. Field stations are maintained in the Florida Keys on Summerland Key, Islamorada, Key Largo, and Key West, and at Mote Aquaculture Research Park in eastern Sarasota County.

4.2 Capabilities

Mote Marine Laboratory is an independent, non-profit organization dedicated to excellence in marine science and education. Mote Marine Laboratory performs basic and applied research in many scientific disciplines encompassing various aspects of biology and chemistry. For purposes of this Quality Manual, MML is a chemical and biological laboratory capable of field and laboratory operations in the marine environment, estuaries, lakes, rivers and other fresh waters and in the atmosphere, hydrosphere, and lithosphere.

4.2.1 Accepting New Work

Technical directors familiar with laboratory facilities and resources are currently responsible for accepting work and initiating projects. Before initiating projects, technical directors complete a New Project Authorization Sheet (**Figure 4.1**) which is submitted to the Associate Vice President of the Directorate in which the work will be conducted, and President and CEO of Mote Marine Laboratory, for approval before any work can be accepted. This sheet addresses whether the program currently has, or intends to have, the capabilities necessary to complete this project. This process ensures that the necessary facilities and personnel are available or planned for within the project schedule.

4.3 Organizational Structure

4.3.1 Management and Administration

A chart outlining the organizational structure of Mote Marine Laboratory is shown in **Figure 4.2**. Mote Marine Laboratory is governed by a Board of Trustees. A Chairman leads the Board. ~~The Board is assisted by several advisory councils, including an ad-hoc Scientific Advisory Council that meets every five years.~~ Mote Marine Laboratory is administered by a President and CEO who supervises all scientific, administrative, educational, aquarium, and public affairs of the Laboratory. The President also supervises three directorates in the Research Division and ten Centers of Excellence (www.mote.org/research/centers-of-excellence/. The directorates comprising the Research Division include the Directorate of Environmental Health and Ocean Technology, the Directorate of Marine Biology and Conservation, and the Directorate of Fisheries and Aquaculture. Non-research divisions include the Education, Aquarium & Public Outreach Division and Support Services. ~~Mote also has a Mote Aquaculture Park and a Marine Policy Institute.~~

4.3.2 Research Organization

All research sampling, measurement and analysis is conducted within three directorates of the Research Division. The research programs (departments) covered by this Quality Manual are Benthic Ecology, Ecotoxicology, Chemical & Physical Ecology, Red Tide Institute, Ocean Acidification, Phytoplankton Ecology, and Environmental Laboratory for Forensics.

4.3.3 Personnel and Responsibilities

A. Administration
   1. *Dr. Michael P. Crosby*, President, is responsible to the Board of Trustees and all project sponsors for all research performed at MML. He has the authority to initiate audits, implement recommendations of the QA Officer, and commit such resources as necessary to fulfill QA/QC policy and objectives.

B. Ecotoxicology
   1. *Dr. Richard Pierce* is the manager of the Ecotoxicology Program, and supervises all field sampling, logistic planning, analytical operations, data reduction and analysis. He is also responsible for designing and budgeting research projects.
   2. ~~*Ms. Patricia Blum* is the lab manager. She is responsible for scheduling and overseeing all activities associated with the extractions laboratory, including maintenance of the custody sheet and all laboratory notebooks. She is responsible for all data entry, transfer of automated data, data quality checks, archiving, and reporting. Ms. Blum is responsible for all laboratory operations and supervision of analysts and laboratory assistants. She is also responsible for supervising routine QA/QC activities and authorizing corrective actions in the program.~~ Dr. Jennifer Toyoda is the Postdoctoral Research Fellow for the Ecotoxicology Program and supervises experimental design and setup, identifies new research directions and funding opportunities, data analysis, and assessment.
   3. *Ms. Samantha Harlow* is the ~~staff~~ senior chemist and sample custodian for the Ecotoxicology Program and is responsible for the documented receipt, storage, routing and disposal of all samples. She is responsible for sample extractions, data entry, recording data, generating reports and intern training~~, and ordering supplies~~.
   4. ~~*William Geisbert* is an analytical chemist responsible for LC and GC systems operations including maintenance, calibration and data analysis and interpretation. He is also responsible for data management and for instrument quality assurance.~~Nicholas Ohnikian is the Lab Manager. He is responsible for day-to-day laboratory activities and responsibilities, ordering supplies, communicating and working with staff, maintaining status of current projects, data, and reports, and oversees QA/QC compliance.

C. Chemical & Physical Ecology
   1. *Dr. Emily Hall* is the manager of the Chemical & Physical Ecology Program, and supervises analytical operations, data reduction and data analysis conducted in that program. She is responsible for corrective actions in her program.
   2. ~~*Dr. Ari Nissanka*~~ *Ms. Susan Launay* is the analytical and data manager and is responsible for all laboratory operations, including supervision of analysts, maintenance of infrastructure, and internal and external QA/QC activities. ~~Dr. Nissanka~~ Ms. Launay also manages all data produced by the Chemical and Physical Ecology program. She is responsible for review of data entry, transfer of automated data, data quality checks, archiving, data reduction and analysis, and reporting. She also maintains the logbook for all laboratory notebooks, instrument logbooks, and standard logbooks.
   3. *Ms. ~~Susan~~ Launay* is also the manager of the Laboratory Information Management System (LIMS) which is used to electronically maintain custody, preparation, field and analytical data for the program in a protected and traceable manner and facilitates sample tracking, observance of holding times, and reporting.
   4. *Ms. Camia Charniga* is responsible for field operations for the Chemical & Physical Ecology program. She coordinates field sampling crews and logistics, instrument pre- and post-calibrations, communications, and sample delivery.

D. Ocean Acidification

1. *Dr. Emily R. Hall* is the manager of the Ocean Acidification Program and supervises all aspects of the program including fieldwork, experimental work, analytical operations, data reduction and data analysis conducted in that program. She is responsible for corrective actions in her program.
2. *Jessica Frankle* is the analytical and data manager at the Sarasota, FL campus and is responsible for laboratory operations including maintenance of infrastructure, experiments, fieldwork, internal and external QA/QC activities, data analysis, data entry, data reduction, and reporting.
3. *Melissa Sante* is the analytical and data manager at the Elizabeth Moore International Center for Coral Reef Restoration and Research (IC2R3) campus in Summerland Key, FL and is responsible for laboratory operations including maintenance of infrastructure, experiments, fieldwork, internal and external QA/QC activities, data analysis, data entry, data reduction, and reporting.

E. Benthic Ecology

1. *Mr. James K. Culter* is the manager of the Benthic Ecology Program. He supervises all field sampling, sample custody, analytical operations, and data reduction and analysis conducted in that program. He is responsible for supervising routine QA/QC activities and authorizing corrective actions in his program. He manages field and analytical logistics planning of the benthic ecology program and is responsible for data entry, transfer of automated data, data quality checks, archiving, data reduction and analysis, and reporting of benthic ecological data.

F. Phytoplankton Ecology

1. *Dr. Vincent Lovko* is the manager of the Phytoplankton Ecology program. He is in charge of all aspects of the program and supervises all field sampling and laboratory analyses. He is responsible for supervising routine QA/QC activities and authorizing corrective actions in his program.
2. *Dr. Sumit Chakraborty* manages operation of the HPLC facility and performs data analysis and interpretation and assists in data management and custody, ~~and quality assurance~~
3. ~~*Mr. Valeriy Palubok* performs field and laboratory work and is the Sample Custodian for cell count and CTD data. He is responsible for maintaining all aspects of red tide and other phytoplankton cultures at the laboratory. He enumerates phytoplankton in field and laboratory samples, performs culture transfers, and prepares culture media for the laboratory.~~

~~3. *Ms. Devin Burris* performs processing of HPLC samples, maintains HPLC laboratory, assists in processing of field and laboratory samples, and assists in maintenance of laboratory equipment and supplies.~~

G. Environmental Laboratory for Forensics

1. *Dr. Dana Wetzel* is the manager of the Environmental Laboratory for Forensics. In this capacity, Dr. Wetzel designs and supervises all laboratory activities including QA/QC and is in charge of daily operations for a wide array of analytical testing, record keeping, and instrument maintenance.
2. *Ms. Christelle Miller* is the Environmental Laboratory for Forensics analytical supervisor. She is in charge of daily operations of a wide array of analytical testing, record keeping, and instrument maintenance.

H. Red Tide Institute

1. *Dr. Cynthia Heil* is a Senior Research Scientist and Director of the Red Tide Institute (RTI). She designs and supervises all Institute planning, and data oversight and operations and is responsible for all corrective actions at the Institute.

2. *Sarah Klass* is a Staff Biology and RTI Laboratory Manager in charge of daily operations at the Institute as well as Institute scheduling, safety, and field, mitigation, and laboratory Operations. She serves as RTI sample custodian.

4.4 Quality Assurance Organization and Responsibilities

4.4.1 QA Officer and QA Committee

A Quality Assurance Committee has direct input to the President. The chairman of the committee serves as the QA Officer (QAO) at MML. Other members of the committee replace the QA Officer in his or her absence and assist the QA Officer in complex or large audits, routine checks of general lab operations, and in the special case of the QA Officer leading a project for which a QAPP and autonomous audits are needed.

Dr. Cathy Walsh is the MML QA Officer. She is responsible to the President for all aspects of QA/QC, including preparation of the Quality Manual; review and approval of new projects, contracts and grants, and QAPP; systems and performance auditing; approval of data validation systems; direction of corrective actions, and QA reporting. ~~Dr. Carl Luer is a member the QA Committee.~~

4.4.2 Project QA

Most research performed at MML is organized on a project-wide basis. Individual projects are separately tracked by the business office using unique project codes, which are also used as primary sample, equipment, and data labels. Project QA Plans are prepared as necessary, under the supervision of the QA Officer. The QAO may serve as a project QA Officer or another member of the QA Committee may be appointed to serve in that role. The project QA Officer's duties are described in individual QAPPs. At no time does a project manager or principal investigator serve as his or her own QAO.

4.4.3 Client Confidentiality and Proprietary Rights

Mote Marine Laboratory respects requests to protect the confidentiality of client records. When applicable, client confidentiality and proprietary rights will be protected, as per instructions provided by individual clients. The confidentiality requirement of any new project will be indicated on the Project Authorization Sheet. MML will maintain confidentiality of all data generated, reports prepared, files, and records, including all e-mail messages, text messages, telephone calls, and facsimiles either sent or received. Confidentiality messages are included on pertinent fax transmittal forms and at the end of relevant e-mail messages. The employment letter that every new hire signs includes a discussion of confidentiality of data and information as well as penalties for violations.

4.4.4 Departures from Documented Policies and Procedures

Occasionally, it may be necessary to exceptionally permit departures from documented policies and procedures. In these instances, the departure will be fully documented, including circumstances and explanation for departure, and kept in project-specific files. Deviations from documented procedures are fully discussed by appropriate laboratory staff and/or outside parties, either before or after the event.

Those personnel in employed in positions of Technical Directors, Program Managers, Principal Investigators or higher, may authorize departures from documented policies and procedures.

4.5 Personnel Qualifications and Training

4.5.1 Minimum Level of Qualifications, Experience and Skills Necessary for Staff Conducting NELAC Certified Analyses

Laboratory personnel in areas where NELAC certification is required will possess the minimum qualifications, skills, and experience defined below. When hiring new personnel, posted job descriptions may define additional qualification and experience required for a specific position. Minimum level qualifications for new positions will be added as necessary. For all positions, knowledge of basic laboratory skills such as using a balance, pipetting, and quantitative techniques will be required. If an employee does not already have prior knowledge of these basic laboratory techniques, these skills must be learned before conducting NELAC certified analyses. For all positions, employees must be able to read and follow chemical methods in standardized testing references, and follow both written and verbal instruction, have numerical competence (basic geometry, algebra, and minimal statistics), be able to swim, have minimal susceptibility to motion sickness, and have a desire to produce high quality scientific data.

Technician: At a minimum, an employee hired at the technician level must possess either 1) a high school degree with at least one year of high school chemistry, or 2) at least one year of experience in a chemical or analytical laboratory setting.

Staff Chemist: An employee hired at the level of Staff Chemist must possess either 1) a Bachelor's degree from an accredited university with a major or minor in chemistry, biochemistry, or other natural science areas, 2) at least 12 semester hours of college credit in chemistry, or other quantitative natural science areas, 3) a high school degree with at least two years' experience in a chemical or analytical laboratory setting.

Senior Chemist: An employee hired at the level of Senior Chemist must possess either 1) a Bachelor's degree with a major or a minor in chemistry, biochemistry or other natural science from an accredited university plus two years of experience in a chemical or laboratory setting or 2) 12 semester hours of college credit in chemistry or other quantitative natural science plus three years of experience in a chemical or laboratory setting.

Staff Scientist: An employee hired at the level of Staff Scientist must have either 1) a Bachelor's degree with a major or a minor in chemistry, biochemistry or other natural science from an accredited university plus three years of experience in a chemical or laboratory setting, or 2) a Master's degree plus one years' experience.

Senior Scientist: An employee hired at the level of Senior Scientist must have a Ph.D. or equivalent experience in a scientific field who has attained a senior level of expertise and recognition with at least seven (7) years' experience at the level of Staff Scientist or equivalent in his/her field.

Technical Director: A Technical Director for Chemical Analyses must have a Bachelor's degree in chemical, environmental, biological, or physical sciences, at least 24 semester hours of college credit in chemistry, and at least two years of experience in environmental analysis in areas for which the laboratory holds NELAC accreditation. A Master's degree or doctorate may substitute for one year of experience.

4.5.2 Personnel Training

Technical directors are responsible for ensuring that Program staff receives appropriate training, including QA training appropriate to their job assignments. Technical directors will ensure that the staff has the necessary education, experience and/or training to perform their stated duties.

Employees receive on the job training for analyses necessary for their duties. When a new employee begins work in a program, they are trained by more experienced analysts who are proficient in the duties that the new analyst will undertake. For analyses which the Laboratory has NELAC certification, the demonstration of capability (DOC), described in **Section 11.6**, will be used to establish that personnel are adequately experienced in the duties they are expected to carry out. In the event that additional training is required and training courses are available, new analysts will go through these courses whenever practical. Primary staff members responsible for phytoplankton (*Karenia brevis*) cell counts will participate in a phytoplankton; darkroom class through Florida Wildlife Research Institute (FWRI).

4.5.3 Data Integrity Training

Data integrity training will be provided as one component of new employee training for staff hired in programs that conduct NELAC certified analyses and is also provided on an annual basis for current employees conducting NELAC-certified analyses. The Data Integrity Plan is described in a Standard Operating Procedure. The data integrity training curriculum includes discussion on data integrity procedures, data integrity training documentation, in-depth data monitoring and data integrity procedure documentation. The curriculum also includes specific examples of breaches of ethical behavior. As part of this training, employees are required to understand that infractions of the laboratory's data integrity procedures will result in a detailed investigation that could lead to serious consequences, including immediate termination, debarment or civil/criminal prosecution. Staff participation in data integrity training will be documented by a signature page which will be kept in QA Officer files.

4.6 Document Control and Maintenance

Mote Marine Laboratory maintains a document control system to ensure the use of correct document versions in the locations where they are utilized. MML's document control system is outlined in an SOP. Steps before implementation of document revisions include proposal of documents or revisions, the actual modifications to documents or revisions, review for accuracy, and finally, approval of documents and/or revisions for release by authorized personnel. Once approved, documents and/or revisions are distributed to appropriate personnel. Prior versions of all essential documents and revisions are maintained and archived to facilitate documentation tracking and retrieval of all current and archived records for purposes of inspection, verification, and historical reconstruction of all procedures and measurement data. Cross-references to specific documentation will be made when necessary.

Laboratory personnel review and update, if necessary, all Standard Operating Procedures (SOPs) that pertain to the work they perform within the laboratory. SOPs are reviewed every 2 years and a record of reviews is maintained. Any updates or modifications to SOPs must be approved by the Technical Director responsible for implementing SOPs in their area. Each SOP will contain the effective date, revision number, revision date and Technical Director approval signature on each page. When an SOP is withdrawn, the approval signature for the withdrawal and the date of the withdrawal is also recorded. Copies of withdrawn SOP versions are maintained and archived. The latest official version of SOPs is readily accessible to all analysts electronically and is printed on colored paper for clear identification. Whenever practical, new information is highlighted, and deleted information appears in strikethrough font. A master list of current SOPs, their distribution, and their location is maintained in the Data Manager's office. Electronic copies of SOP's are maintained in "pdf" format to discourage unauthorized changes to these documents. Citations to SOPs and other documents will be linked by revision number and revision date for the cited document, when applicable.

The Laboratory's Quality Manual is updated on an annual basis to reflect changes in personnel, procedures, Laboratory capabilities, and other areas. The effective date of each version of the Quality Manual appears on the cover of the manual. Changes to the Quality Manual are indicated by highlighting and deleted material is indicated using strikeout wherever possible. After annual updates have been completed and approved, the revised sections are provided to Technical Directors as an electronic copy for distribution to appropriate personnel in their laboratory section. The most recent version of the QA Manual is also maintained on Mote's inhouse webpage. Hard copies of QA Manuals are maintained in the QA Office and in the Library and provided upon request to programs that request a hard copy. Each hard copy of the Quality Manual has a unique identifying number. A master distribution list of Quality Manuals and their identifying numbers is maintained by the QAO. Technical Directors also maintain a list of the copies in use in their sections to ensure that updates reach all documents in use. Updated sections are also provided to the library for maintenance of the library's copy of the current Quality Manual. Archival copies of the Quality Manual are maintained in the QAO's office. Each archived copy of the Quality Manual will be clearly labeled with the effective date as well as the retired date of the manual. Electronic copies of past QA Manuals are also archived on laboratory-wide network back-up system.

4.7 Ethical and Legal Responsibilities

The ethics policy of Mote Marine Laboratory is clearly outlined in the Employee Policy Manual. The Employee Policy Manual states that violation of the policies will be grounds for immediate dismissal. All new employees receive and are required to read this manual. Each new employee signs a checklist indicating they have received and read this manual and agree to conform to the rules and regulations of the Laboratory set forth in MML's Employee Policy Manual. The checklist for each employee is kept on file in the Human Resources Office.

4.8 Approved Signatures

Technical Directors covered by this Quality Assurance Manual are listed on page 1 of Section 1.0. Additional approved signatures are included on page 2 of Section 1.0. Signatories included in both pages of Section 1 have the authority to approve and sign all project-related documents, including reports, Standard Operating Procedures (SOPs), permitted departures, and all other documents within their program area related to projects to which this QA Manual pertains. The Quality Assurance Office (QAO) has the authority to sign Project Authorization sheets, documentation related to Demonstration of Capability (DOC and IDOC), permitted departures, documents related to data integrity training, internal audit documentation, documentation related to corrective actions, as well as all other documents necessary for responsibilities related to serving as QAO.

Figure 4.1 PROJECT AUTHORIZATION SHEET

Effective Date: 01/23/17

Project Authorization Sheet

Project No: ____________ Date ____________

Title / Project Name: ____________

Short Title: ____________ Contract No: ____________

Project Location:: ____________ Program Area(s) ____________

Principal Investigator(s) ____________ Mote Proposal No: ____________

Is Mote:

☐ Prime Contractor

☐ Sub Contractor ☐ Consultant

If sub-contractor or consultant, who is the prime contractor:

____

Client Name: ____________

Address: ____________

Contact Name: ____________

Contact Phone: ____________

Funding Agency: ____________

☐ FEDERAL CFDA #: ____________

☐ STATE CSFA #: ____________

☐ OTHER

Duration of Project: ____________

Anticipated Start Date: ____________

Anticipated Completion Date: ____________

BUDGET SUMMARY:

Total Contract Amount: $ ____________

MML Cost Share: $ ____________

Other Cost Share: $ ____________

Total Project Cost: $ ____________

FIXED PRICE: ☐ yes ☐ no

Fringe Benefits Rate ____________ %

Indirect cost rate (Mote) ____________ %

Indirect cost rate (Agency) ____________ %

ATTACHMENTS: ☐ P.O. / work order

☐ Contract/Award ☐ Budget Summary Sheet

BILLING INFORMATION:

a. ☐ Monthly ☐ Quarterly

☐ Other: *describe* ____________

b. ☐ Flat rate ☐ Cost reimbursable

c. Special Requirements:

☐ Backup copies

☐ Other: *describe* ____________

Is this a continuation of a previous project? ☐ No ☐ Yes Previous project no: ____________

DESCRIPTION: *Three (3) to five (5) sentences describing the nature of the project, MML's role. issues involved, technical approach and anticipated products (e.g. permit application, Environmental Impact, problem solution, management plan, etc.)*

____

Figure 4.1 ~~NEW~~ PROJECT AUTHORIZATION SHEET (continued)

Project Authorization Sheet –continued
EFFECTIVE DATE: 01/23/2017

Mandatory Safety Questions

Will the project require work with chemicals or compounds with MSDS? ☐ yes ☐ no

If yes, the P.I. will conduct and document training regarding MSDS, use, storage, spill clean-up, and disposal of chemicals and lab process wastes ***prior to beginning work.*** (Consult the Safety Officer for assistance.)

Extremely Hazardous Substances to be used? (See 40 CFR 355 Appendix A) ☐ yes ☐ no
(Plan may be required)

Sediments or organisms to be received from out of state/region? ☐ yes ☐ no
(USDA or other permit may be required)

Vertebrate Animals Use Plan required? ☐ yes ☐ no
☐ Pending ☐ In Place
IACUC No: Date:

Human subjects and IRB review required? ☐ yes ☐ no
IRB Review Date

P.I. (Principal Investigator) Date **Reviewed by AVP Date**

After AVP review, PI Delivers to Terri Deppe (Sponsored Programs Office) and is not responsible for additional signatures.

YOU WILL BE NOTIFIED WHEN PROJECT IS ACTIVE

TO BE COMPLETED BY THE QA OFFICER:
Q.A. REQUIREMENT: ☐ Quality Manual ☐ QA Project Plan ☐ Not Applicable
☐ Other: *describe*:

MML Quality Assurance Officer Date

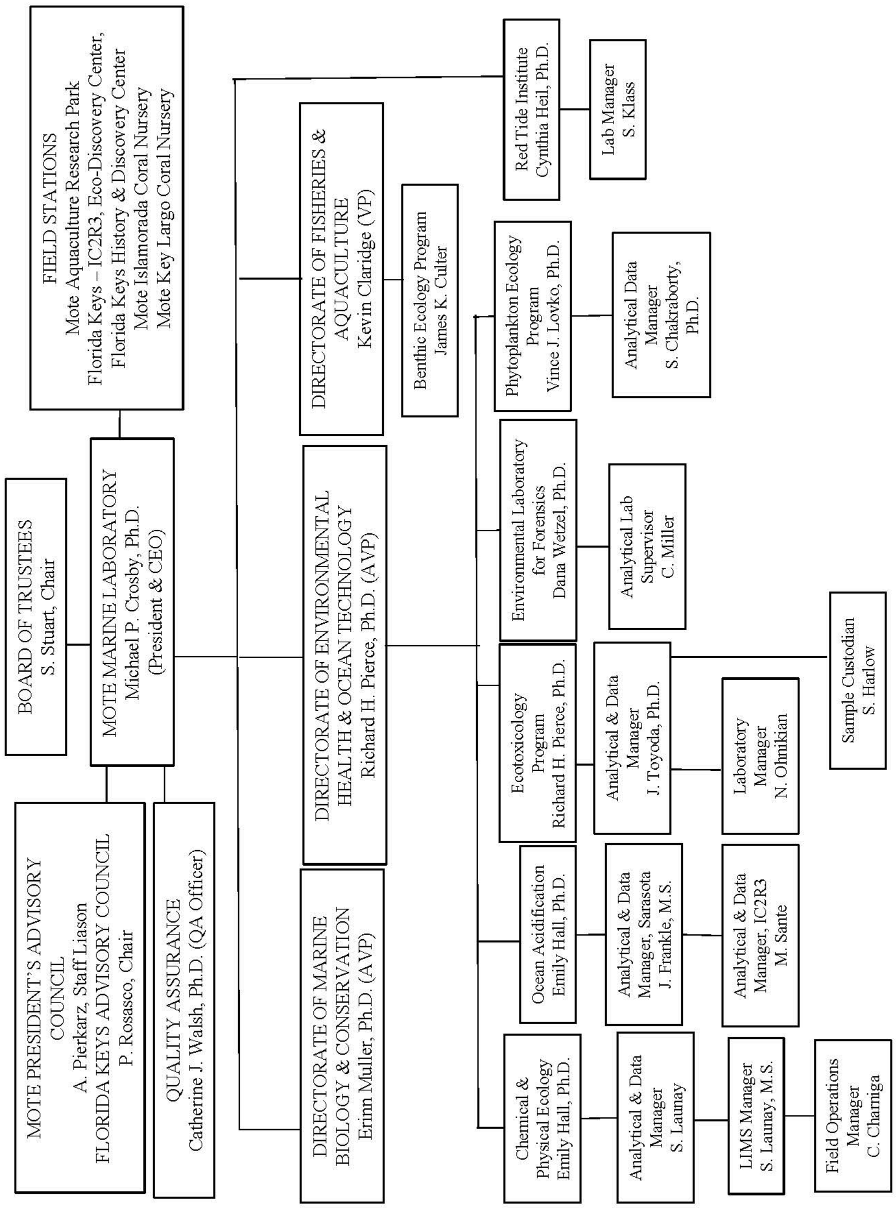
TO BE COMPLETED BY THE SAFETY OFFICER: (as needed)
☐ Needed review of PI training scheduled __________Date ☐ Hazardous Use Plan status confirmed

MML Safety Officer Date

Reviewed by Grants Manager Date **Approved by President Date**

Notes:

Figure 4.2 <u>MML ORGANIZATIONAL CHART</u>



5.0 QA TARGETS FOR PRECISION, ACCURACY, AND METHOD DETECTION LIMITS

A list of all references included in this manual can be found in **Appendix II**. The following tables list the data quality objectives in use at Mote Marine Laboratory on a routine basis. **Table 5.1** specifies the sample preparation methods in the laboratory together with applicable analyses for trace organics~~ and metals~~.

Tables 5.2A - 5.2E list methods, references, precision and accuracy goals, together with method detection limits, for trace organics for liquids (**5.2A**) and solids (**5.2B**); for general chemical parameters for solids (**5.2C**) and liquids (**5.2D**); and for macroinvertebrate identifications (**5.2E**). All precision and accuracy goals and method detection limits listed in **Tables 5.2A - 5.2D** have been historically generated in-house. The key to references abbreviated in the following tables is as follows:

ASTM Annual Book of ASTM Standards Volume 4.08, Soil and Rock, American Society for Testing and Materials, 1991.

EPA1 *Methods for Chemical Analysis of Water and Wastes*, EPA-600/4-79-020, 1979, revised March 1983.

EPA2 *Test Methods for Evaluation Solid Waste, Physical/Chemical Methods*, EPA SW-846, 3rd Edition, Update VI, May 21, 2019. Washington, D.C. 4 Volumes.

EPA3 *Methods for the Determination of Metals in Environmental Samples*, EPA/600/4-91/010, June 1991.

EPA4 Arar, E.J. and G.B. Collins September 1997 Method 445.0, *In vitro* Determination of Chlorophyll a and Pheophytin a in Marine and Freshwater Algae by Fluorescence. Revision 1.2. National Exposure Research Laboratory, Office of Research and Development, U.S. EPA, Cincinnati, Ohio 45268.

EPA5 *Methods for the Determination of Inorganic Substances in Environmental Samples*, EPA/600/R-93/100 August 1993.

EPA6 Shoemaker, J., Dan Tettenhorst, AND A. Delacruz. METHOD 544. Determination of Microcystins and Nodularin in Drinking Water by Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry (LC/MS/MS). U.S. Environmental Protection Agency, Washington, DC, 2015.

SM20 *Standard Methods for the Examination of Water and Wastewater*, American Public Health Association, American Water Works Association, Water Pollution Control Federation 20th Edition, 1998.

SM21 *Standard Methods for the Examination of Water and Wastewater*, American Public Health Association, American Water Works Association, Water Pollution Control Federation 21st Edition, 2005.

SM22 *Standard Methods for the Examination of Water and Wastewater*, American Public Health Association, American Water Works Association, Water Pollution Control Federation 22nd Edition, 2012.

SM23 *Standard Methods for the Examination of Water and Wastewater*, American Public Health Association, American Water Works Association, Water Pollution Control Federation 23rd Edition, 2017.

SM24 *Standard Methods for the Examination of Water and Wastewater,* American Public Health Association, American Water Works Association, Water Environment Federation, 24th Edition, 2023.

EPA/CE *Procedures for Handling and Chemical Analyses of Sediment and Water Samples*, EPA/CE-81-1, R.H. Plumb, Jr., US EPA/Corps of Engineers, Buffalo, NY. 1981.

DEP SOPS. 2017 (effective 04/16/2018) https://floridadep.gov/dear/quality-assurance/content/dep-sops

DER *Deepwater Ports Maintenance Dredging and Disposal Manual*. Department of Environmental Regulation. Coastal Zone Management. Revision 4. December 1984.

NOAA *Standard Analytical Procedure of the NOAA Analytical Facility, Extractable Organic Compounds*. Commerce Department (NOAA/NMFS) Status and Trends Program. Seattle, Washington, 1984.

USGS *U. S. Geological Survey, Techniques of Water-Resources Investigations, Book 5, Chapter 1A* Editors, Marvin J. Fishman and Linda C. Friedman.

USNO United States Naval Oceanographic Office. 1968. Instruction manual for obtaining oceanographic data. 3rd Edition. Washington, DC.

Bran+Luebbe/Seal Analytical Method No. G-166-96 Rev. 2. Urea in Water and Seawater.

Bran+Luebbe/Seal Analytical Method No. G-171-96 Rev. 10. Ammonia in Water and Seawater.

Bran+Luebbe/Seal Analytical Method No. G-172-96 Rev. 10. Nitrate and Nitrite in Water and Seawater Total Nitrogen in persulfate digests.

Bran+Luebbe/Seal Analytical Method No. G-175-96 Rev. 12. Phosphate in Water and Seawater Total P in persulfate or Kjeldahl digests.

Bran+Luebbe/Seal Analytical Method No. G-177-96 Rev. 8. Silicates in Water and Seawater.

CHEMetrics™ part #K2513. Chlorine (free & total) – Vacu-vials® Instrumental Test Kit. chemetrics.com/uploads/2018/07/i25x3.pdf

CHEMetrics™ part #K9503. Sulfide Vacu-vials® Instrumental Kit. Range 0-3.00 ppm. Midland, VA, USA. chemetrics.com/uploads/2019/11/i9503.pdf

CHEMetrics™ part #9510D. Sulfide - VACUettes® Visual High Range Kit. Midland, VA. USA. chemetrics.com/uploads/2019/11/i9510x.pdf

CHEMetrics™ part #K9523. Sulfide Vacu-vials® Instrumental Kit. Range 0-6.00 ppm. Midland, VA. USA. chemetrics.com/uploads/2019/11/i9523.pdf

Dickson, A. G., C. L. Labine, and J. R. Christian. 2007. Guide to best practices for ocean CO_2 measurements. North Pactific Marine Science Organization.

Mueller J.L., G.S. Gargion, and C.R. McClain, editors. 2002. Ocean Optics Protocols for Satellite Ocean Color Sensor Validaiton, Revision 4, Volume IV, Section 4.5. *Soluble Absorption Sample Preparation and Analysis*.

Price, N. M, and P. J. Harrison, 1987. Comparison of methods for the analysis of dissolved urea in seawater. Marine Biology, 94, pp307-317

Ragueneau O. and P. Treguer. 1994. Determination of biogenic silica in coastal waters: applicability and limits of the alkaline digestion method. Marine Chemistry 45: 43-51.

Pinkney, J., R. Papa, and R. Zingmark. 1994. Comparison of high performance liquid chromatographic, spectrophotometric, and fluorometric methods for determining chlorophyll a concentrations in estuarine sediments. J. Microbiol. Methods. 19:59-66.

Solórzano, L. and J. H. Sharp. Jul. 1980a. Determination of Total Dissolved Nitrogen in Natural Waters. Limnology and Oceanography, Vol.25, No.4, pp751-754.

Solórzano, L. and J. H. Sharp. Jul. 1980b. Determination of Total Dissolved Phosphorus and Particulate Phosphorus in Natural Waters. Limnology and Oceanography, Vol.25, No.4, pp754-758.

Thermo Electron. 2004. FlashEA® 1112 Elemental Analyzer Operating Manual. April, 2004.

Whitney, D.E. and W.M. Darley. 1979. A method for the determination of chlorophyll a in samples containing degradation products. Limnology and Oceanography 24(1):183-186.

Urea:
Goeyens, L., Kindermans, N., Abu Yusuf, M., Elskens, M., 1998. A Room Temperature Procedure for the Manual Determination of Urea in Seawater. Estuar. Coast. Shelf Sci. 47, 415–418.
Mulvenna, P.F., Savidge, G., 1992. A modified manual method for the determination of urea in seawater using diacetylmonoxime reagent. Estuar. Coast. Shelf Sci. 34, 429–438.
Revilla, M., Alexander, J., Glibert, P.M., 2005. Urea analysis in coastal waters: comparison of enzymatic and direct methods: Comparison of methods for urea analysis. Limnol. Oceanogr. Methods 3, 290–299.

Silica-dissolved, biogenic:
Fanning, K.A., Pilson, M., 1973. On the spectrophotometric determination of dissolved silica in natural waters. Anal. Chem. 45, 136–140.
Paasche, E., 1980. Silicon content of five marine plankton diatom species measured with a rapid filter method. Limnol. Oceanogr. 25(3): 474-480.

Chl a:
Kalaji, H.M., Schansker, G., Brestic, M., Bussotti, F., Calatayud, A., Ferroni, L., Goltsev, V., Guidi, L., Jajoo, A., Li, P., Losciale, P., Mishra, V.K., Misra, A.N., Nebauer, S.G., Pancaldi, S., Penella, C., Pollastrini, M., Suresh, K., Tambussi, E., Yanniccari, M., Zivack, M., Cetner, M.D., Samborska, I.A., Stirbet, A., Olsovska, K., Kunderlikova, K., Shelonzek, H., Rusinowski, S., Baba, W. 2017. Frequently asked questions about chlorophyll fluorescence the sequel. *Photosynthesis Research, 132, 13-66.* DOI: 10.1007/s11120-016-0318-y

DON:
Bronk, D.A., Lomas, M.W., Glibert, P.M., Schukert, K.J., Sanderson, M.P. 2000. Total dissolved nitrogen analysis: comparisons between the persulfate, UV and high temperature oxidation methods. *Marine Chemistry, 69, 163-178.*

Dissolved Humic Substances (DHS):
Lindberg, W., Persson, J. 1983.Partial least-squares method for spectrofluorimetric analysis of mixtures of humic acid and ligninsulfonate. *Analytical Chemistry, 55, 643-648.*

qPCR:
Countway, P.D., Caron, D.A. 2006. Abundance and distribution of *Ostreococcus* so. in the San Pedro Channel, California, as revealed by quantitative PCR. *Applied and Environmental Microbiology, 72(4), 2496-2506.*

Matrices in which these methodologies can be used are also listed with any notes or exceptions stated. A matrix is listed for a particular analysis so long as the matrix of the sample does not prevent or routinely interfere with the analysis, even if the performance of the analysis in that matrix might be unlikely (*i.e.* biomass in drinking water).

Precision goals are listed as the maximum allowable Percent Relative Standard Deviation (%RSD) or Relative Percent Difference (RPD). In the event of sample concentrations near the detection limit, precisions are also acceptable if the differences between duplicate analyses are three times the detection limit or less. Accuracy goals are stated as the maximum allowable range of Percent Recovery (%R). Limits are calculated according to the formulas and methodologies described in **Section 11.0**, QC CHECKS. Concentration ranges used to develop the precision and accuracy criteria are also given as Low (lower 20% of method range), Medium (20-80% of method range), and High (greater than 80% of method range).

Method detection limits are determined by the procedure described by EPA in *Definition and Procedure for the Determination of the Method Detection Limit-Revision 2.0*, 40 CFR Part 136, Appendix B. Criteria or Action Levels Goals are not used at MML.

In **Table 5.2**, many acronyms are used to describe sample matrices. Definitions for these matrix acronyms are included in **Section 2.0** of this manual and are also provided here:

SW – Surface Water
GW – Ground Water
EFF – Effluent
SA – Saline Water
SED – Sediment
S – Soil
BIO – Biological Sample

Table 5.3 lists the methodologies in use for parameters measured in the field. Any methods without explicit DEP approval will be reviewed and approved in writing by DEP before using on any DEP related work.

Table 5.1 SAMPLE PREPARATION METHODS IN ORGANICS

Ref	Sample Prep Method #	Description	Matrix	for Methods
EPA2	3510	Liq/Liq Extraction	Aqueous	8081, 8100, 8120, 8270
EPA2	3520	Continuous Liq/Liq	Aqueous	8081, 8100, 8120, 8270
EPA2	3545	Accelerated Solvent Extraction (ASE)	Solids	8081, 8100, 8120, 8270
EPA2	3550	Sonication	Solids	8081, 8100, 8120, 8270
EPA2	3610	Alumina Cleanup	Aqueous/Solids	8081, 8100, 8120
EPA2	3620	Florisil Cleanup	Aqueous/Solids	8081, 8120
EPA2	3630	Silica Cleanup	Aqueous/Solids	8081, 8100, 8120
EPA2	3660	Sulfur Cleanup	Aqueous/Solids	8081, 8120, 8100, 8270
EPA2	3665	Sulfuric Acid/Permanganate Cleanup	Aqueous/Solids	8081
EPA2	3005	Acid Digestion (Total Recoverable) (Dissolved)	Aqueous	7020, 7040, 7041, 7080, 7090, 7130, 7140, 7190, 7200, 7210, 7380, 7420, 7450, 7460, 7480, 7520, 7610, 7770, 7780, 7840, 7870, 7910, 7950
EPA2	3010	Acid Digestion (Total)	Aqueous	7020, 7080, 7090, 7130, 7140, 7190, 7200, 7210, 7380, 7420, 7450, 7460, 7480, 7520, 7610, 7770, 7780, 7840, 7870, 7910, 7950
EPA2	3020	Acid Digestion (Total)	Aqueous	7081, 7091, 7131, 7191, 7201, 7211, 7381, 7421, 7461, 7481, 7841, 7911, 7951
EPA2	3040	Dissolution	Oily, Greasy, Waxy Solids	7090, 7091, 7130, 7131, 7190, 7191, 7210, 7211, 7380, 7381, 7460, 7461, 7520, 7910, 7911
EPA2	3050	Acid Digestion	Soil/Sediment	7020, 7060, 7061, 7130, 7131, 7140, 7190, 7210, 7211, 7380, 7381, 7420, 7421, 7520, 7610, 7870, 7950, 7951
NOAA	S.8.1-3	Maceration/Liq. Extraction	Tissue	8081, 8100, 8120, 8270

Table 5.2.A **QA OBJECTIVES: ORGANICS IN LIQUIDS**

EPA Method	Matrix	Compound	Precision %RSD	Conc. Range	%R	Conc. Range	MDL µg/L
625, 8270	GW, SW, EFF, SA	Aldrin	19	L	58-108	L	1.400
		Alpha-BHC	20	L	57-113	L	1.300
		Beta-BHC	20	L	47-123	L	1.300
		Delta-BHC	27	L	43-127	L	1.300
		Gamma-BHC	23	L	56-104	L	1.400
		α-Chlordane	35	L	87-111	L	1.500
		T-Chlordane	35	L	87-111	L	2.000
		4,4-DDD	25	L	55-119	L	2.400
		4,4-DDE	23	L	62-124	L	1.900
		4,4-DDT	19	L	52-130	L	3.100
		Dieldrin	24	L	50-132	L	1.800
		Endosulfan I	22	L	74-122	L	3.100
		Endosulfan II	45	L	36-159	L	1.000
		Endosulfan sulfate	28	L	53-117	L	1.000
		Endrin	27	L	46-130	L	2.300
		Endrin aldehyde	26	L	50-120	L	4.900
		Heptachlor	22	L	44-100	L	1.400
		Heptochlor epoxide	21	L	66-122	L	1.900
		Hexachlorobenzene	35	L	77-121	L	1.000
		Acenapthene	55	L	0-128	L	0.05
		Acenapthylene	43	L	0-134	L	0.04
		Anthracene	43	L	16-108	L	0.04
		Benzo(a)anthracene	34	L	20-128	L	0.06
		Benzo(a)pyrene	53	L	0-127	L	0.04
		Benzo(b)fluoranthene	38	L	38-118	L	0.05
		Benzo(ghi)perylene	60	L	11-97	L	0.04
		Benzo(k)fluoranthene	69	L	1-141	L	0.05
		Chrysene	64	L	40-136	L	0.04
		Dibenzo(a,h)anthracene	46	L	13-91	L	0.04
		Fluoranthene	32	L	26-112	L	0.04
		Fluorene	62	L	10-132	L	0.04
		Indeno(1,2,3,-cd)pyrene	42	L	2-110	L	0.05
		Napthalene	42	L	0-128	L	0.04
		Phenanthrene	33	L	19-124	L	0.04
		Pyrene	42	L	18-118	L	0.04
608, 8081	SW, GW, EFF, SA	Aldrin	19	L	58-108	L	0.028
		Alpha-BHC	20	L	57-113	L	0.027
		Beta-BHC	20	L	47-123	L	0.099
		Bifenthrin	30	L	83-118	L	0.01
		Bisphenol A	30	L	92-125	L	0.04
		Delta-BHC	27	L	43-127	L	0.099
		Gamma-BHC	23	L	56-104	L	0.029
		Chlordane	18	L	58-106	L	0.010
		4,4-DDD	25	L	55-119	L	0.048
		4,4-DDE	23	L	62-124	L	0.039
		4,4,-DDT	19	L	52-130	L	0.061
		Dieldrin	24	L	50-132	L	0.035
		Endosulfan I	22	L	74-122	L	0.063
		Endosulfan II	45	L	36-159	L	0.015
		Endosulfan sulfate	28	L	53-117	L	0.010
		Endrin	27	L	46-130	L	0.047
		Endrin aldehyde	26	L	50-120	L	0.099
		Estradiol	30	L	77-121	L	0.04
		Heptachlor	22	L	44-100	L	0.027
		Heptachlor epoxide	21	L	66-122	L	0.037
		Toxaphene	20	L	53-113	L	0.500

Table 5.2.A QA OBJECTIVES: ORGANICS IN LIQUIDS (continued)

EPA Method	Matrix	Compound	Precision %RSD	Conc. Range	%R	Conc. Range	MDL µg/L
610, 8100	SW, GW, EFF, SA	Acenapthene	55	L	0-128	L	2.000
		Acenaphthylene	43	L	0-134	L	2.000
		Anthracene	43	L	16-108	L	2.000
		Benzo(a)anthracene	34	L	20-128	L	5.000
		Benzo(a)pyrene	53	L	0-127	L	5.000
		Benzo(b)fluoranthene	38	L	38-118	L	5.000
		Benzo(ghi)perylene	60	L	11-97	L	10.000
		Benzo(k)fluoranthene	69	L	1-141	L	5.000
		Chrysene	64	L	40-136	L	2.000
		Dibenzo(a,h)anthracene	46	L	13-91	L	10.000
		Fluoranthene	32	L	26-112	L	2.000
		Fluorene	62	L	10-132	L	2.000
		Indeno(1,2,3,-cd)pyrene	42	L	2-110	L	10.000
		Napthalene	42	L	0-128	L	2.000
		Phenanthrene	33	L	19-124	L	2.000
		Pyrene	42	L	18-118	L	2.000
544	SW	MC-LA	20	M	100-152	L	0.050
		MC-LF	20	M	83-127	L	0.050
		MC-LR	12	M	100-135	L	0.150
		MC-LY	20	M	83-147	L	0.050
		MC-RR	20	M	97-158	L	0.050
		MC-YR	20	M	93-156	L	0.050
		Nodularin-R	20	M	105-151	L	0.050
8015	SA	TEH*					10.000

*TEH = Total Extractable hydrocarbons with silica gel “clean-up:. $\Sigma(C_9\text{-}C_{44})$ - Integration of the FID signal over the entire hydrocarbon range from n-C9 to n-C44 after silica gel cleanup.

TABLE 5.2.B **QA OBJECTIVES: ORGANICS IN SOLIDS**

EPA Method	Matrix	Compound	Precision %RSD	Conc. Range	%R	Conc. Range	MDL µg/kg
8100	SED, S, BIO	Acenapthene	40	L	0-124	L	20.0
		Acenaphthylene	45	L	0-139	L	20.0
		Anthracene	29	L	0-126	L	20.0
		Benzo(a)anthracene	40	L	12-135	L	50.0
		Benzo(a)pyrene	40	L	0-128	L	50.0
		Benzo(b)fluoranthene	31	L	6-150	L	50.0
		Benzo(j)fluoranthene	31	L	6-156	L	50.0
		Benzo(k)fluoranthene	50	L	0-159	L	50.0
		Benzo(ghi)perylene	23	L	0-116	L	100.0
		Chrysene	42	L	0-199	L	20.0
		Dibenzo(a,h)anthracene	20	L	0-110	L	100.0
		Fluoranthene	30	L	14-123	L	20.0
		Fluorene	43	L	0-142	L	20.0
		Indeno(1,2,3-cd)pyrene	30	L	0-116	L	100.0
		Napththalene	41	L	0-122	L	20.0
		Phenanthrene	38	L	0-155	L	20.0
		Pyrene	34	L	0-140	L	20.0
8015	S	TEH*					0.001

*TEH = Total Extractable Hydrocarbons after silica gel “Clean-up”. Σ(C9-C44) – Integration of the FID signal over the entire hydrocarbon range from n-C9 to n-C44 after silica gel cleanup

Table 5.2.C QA OBJECTIVES: GENERAL PARAMETERS IN SOLIDS Soils Sediments and Biological Tissues

Reference	Method	Matrix SED, S, BIO*	Parameter	Precision (RPD)	Accuracy (%Recovery)	MDL
EPA/CE	p.3-73,1	not BIO	Carbon, Inorganic	L 20	N/A	2 mg/g
EPA/CE	p.3-73,1	not BIO, S	Carbon, Total Organic	L 20	L 74-125	2 mg/g
Whitney 1979; Pinkney 1994 modified++		SED, Bio	Chlorophyll, benthic	L-M-H 20	L-M-H 80-120	10 mg/m^2
EPA/CE	p.3-154, 1,3	not BIO	Nitrogen, Ammonium	L 20	L 68-118	0.01 mg/g
EPA1; DER	350.3	not BIO	Nitrogen, Ammonium	L 20	L 68-118	0.01 mg/g
EPA/CE	p.3-183	not BIO	Nitrogen, Nitrate	Calculated	Calculated	
EPA/CE	p.3-183	not BIO	Nitrogen, Nitrate-Nitrite	L 20	L 75-124	0.01 mg/g
EPA1; DER	353.3	not BIO	Nitrogen, Nitrate-Nitrite	L 20	L 75-124	0.01 mg/g
EPA/CE	p.3-183	not BIO	Nitrogen, Nitrite	L 20	L 76-124	0.01 mg/g
EPA/CE	p.3-205	not BIO	Nitrogen, Organic	Calculated	Calculated	
EPA/CE	p.3-183,202	not BIO	Nitrogen, Total	Calculated	Calculated	
EPA/CE	p.3-201,2/EPA 351.2	not BIO	Nitrogen, Total Kjeldahl	L 20	L 75-127	3 mg/kg
EPA1; DER	351.3	not BIO	Nitrogen, Total Kjeldahl	L 20	L 75-127	3 mg/kg
ASTM	D-2217(B), D-422	not BIO	Particle Size (<0.063 µ)	L 20	N/A	4% by weight
EPA/CE	p.3-39	not BIO	Particle Size (<0.063 µ)	L 22	N/A	7% by weight
EPA/CE	p.3-39	not BIO	Particle Size (>0.063 µ)	L 20	N/A	2% by weight
ASTM	D-2217(B), D-422	not BIO	Particle Size (>0.063 µ)	L 20	N/A	2% by weight
ASTM	D-4464-85, C-1070-86	not BIO	Optical Particle Size (0.4-2000µ)	L-M-H 10	M N/A	1 µ
EPA/CE	p.3-232	not BIO	Phosphorous, Organic	Calculated	Calculated	
EPA/CE	p.3-223	not BIO	Phosphorous, Orthophosphate	L 20	L 85-111	0.001 mg/g
EPA1; DER	365.2	not BIO	Phosphorous, Orthophosphate	L 20	L 85-111	0.001 mg/g
EPA/CE	p.3-227(e)/EPA 365.4		Phosphorous, Total	L 20	L 76-125	3 mg/kg
EPA1; DER	365.2		Phosphorous, Total	L 20	L 76-125	3 mg/kg
‡SM 18	***2540G-1991***	***Not BIO***	***Solids Fixed***	***L-M-H 10***	***N/A***	***2% by weight***
‡SM 20,21,22	***2540G-2011***	***Not BIO***	***Solids Fixed***	***L-M-H 10***	***N/A***	***2% by weight***
EPA1; DER	160.2	Not BIO	Solids fixed	L-M-H 10	N/A	2% by weight
EPA/CE	p-3-59	Not BIO	Solids Fixed	L-M-H 10	N/A	2% by weight
‡SM 18	***2540G-1991***	***Not BIO***	***Solids Total***	***L-M-H 10***	***N/A***	***2% by weight***
‡SM 20,21,22	***2540G-2011***	***Not BIO***	***Solids Total***	***L-M-H 10***	***N/A***	***2% by weight***
EPA1; DER	160.3	Not BIO	Solids Total	L-M-H 10	N/A	2% by weight
EPA/CE	p-3-58	Not BIO	Solids Total	L-M-H 10	N/A	2% by weight
‡SM 18	***2540G-1991***	***Not BIO***	***Solids Volatile***	***L-M-H 10***	***N/A***	***2% by weight***
‡SM 20,21,22	***2540G-2011***	***Not BIO***	***Solids Volatile***	***L-M-H 10***	***N/A***	***2% by weight***
EPA1; DER	160.4	Not BIO	Solids Volatile	L-M-H 10	N/A	2% by weight
EPA/CE	p-3-59	Not BIO	Solids Volatile	L-M-H 10	N/A	2% by weight
EPA/CE	p.3-61	Not BIO	Specific Gravity	M 10	N/A	1.00
ASTM	D-854	Not BIO	Specific Gravity	M 10	N/A	1.00
EPA/CE	p.3-243	Not BIO	Sulfide	L-M 10	L-M 75-125	2 mg/g
CHEMetrics™ part # K9503	Photometer	Pore water	Sulfide-pore water	L-M 10	L-M 85-115	0.1 mg/L

Table 5.2.C QA OBJECTIVES: GENERAL PARAMETERS IN SOLIDS Soils Sediments and Biological Tissues (continued)

Reference	Method	Matrix SED, S, BIO*	Parameter	Precision (RPD)	Accuracy (%Recovery)	MDL
CHEMetrics™ part # K9523	Photometer	Pore water	Sulfide-pore water	M 10	L-M 85-115	0.1 mg/L
CHEMetrics™ part # 9510D	Visual	Pore water	Sulfide-pore water	M-H 10	L-M 85-115	5 mg/L

++ modified for fluorometer
‡ NELAC certification
* Except as noted

Table 5.2.D QA OBJECTIVES: GENERAL PARAMETERS IN LIQUIDS

Reference	Method	Matrix DW SW GW EFF SA	Parameter	Precision (RPD)	Accuracy (%Recovery)	MDL
SM22,23	2320B (5c)- 2011	All	Alkalinity, bicarbonate	Calculated	Calculated	
SM22,23	2320B (5c)- 2011	All	Alkalinity, carbonate	Calculated	Calculated	
EPA1	310.2	All	Alkalinity, total	L-M 10	L-M 91-107	2 mg $CaCO_3$/L
EPA1	310.1	All	Alkalinity, total	L-M 10	L-M 92-108	1 mg $CaCO_3$/L
‡SM22,23	*2320B- 2011*	All	*Alkalinity, total*	*M-H 10*	*M-H 82-108*	*5 mg $CaCO_3$/L*
‡SM22,23	*2320B-2011*	All	*Alkalinity, Low Level*	*M-H 10*	*L-M 82-108*	*1 mg $CaCO_3$/L*
DEP (10/3/83)		All	Ammonia, Unionized	Calculated	Calculated	
‡DEP (02/12/2001)		All	***Ammonia, Unionized***	***Calculated***	***Calculated***	
‡SM22,23	***4500-NH3 G-2011***	All	***Ammonium-N***	***L 10***	***L 90-110***	***0.005 mg/L***
Dickson et al., 2007	SOP 3b	SW	Alkalinity, Total	L 0.25	N/A	2 µmol/kg
EPA1	350.1	All	Ammonium-N	L 10		
EPA1	350.3	All		L 10	L 85-113	0.05 mg/L
SM22,23	4500-NH3 D or E-2011	All	Ammonium-N	L 10	L 85-113	0.05 mg/L
B+L/Seal	G-171-96 R10	All	Ammonium-N	L 10	L 85-115	0.001 mg/L
SM22,23	10200I (5) -2011	All	Biomass	L 10	N/A	0.5 mg/L
EPA1	405.1	All	BOD5	L 10	85-115	0.5 mg/L
‡SM22	***5210B,2011***	All	***BOD5***	***L 10***	***85-115***	***0.5 mg/L***
‡SM22	***5210B,2011***	All	***BOD5, Carbonaceous***	***L 10***	***85-115***	***0.5 mg/L***
ThermoElectron		All	Carbon, particulate	20		1.2 µg/L
SM22	5210B	All	Carbon, organic Carbon, inorganic	10	85-115	0.5 mg/L 2 µmol/kg
SM22,23	4500-Cl E-2011	All	Chloride	L 10	L 85-115	1 mg/L
EPA1	325.2	All	Chloride	L 10	L 85-115	1 mg/L
EPA2	9251	All	Chloride	L 10	L 85-115	1 mg/L
‡SM22,23	*4500-Cl^- B-2011*	All	*Chloride*	*L 10*	*L 92-108*	*1 mg/L*
+Mueller et al., 2002		All	Colored Dissolved Organic Matter	10	N/A	0.001A(.02m^{-1}
SM22,23	4500-Cl C-2011	All	Chlorine, Residual	L 10	N/A	0.2 mg Cl as Cl_2/l
SM22,23	4500-Cl B-2011	All	Chlorine, Residual	L 10	N/A	0.2 mg Cl as Cl_2/L
CHEMetrics™ part # K*2513	Photometer	All	Chlorine Recidual – DPD (free & total)	L 10	N/A	0.05 mg/L
‡EPA 4	***445.0***	All	***Chlorophyll a***	***L 20***	***N/A***	***0.05mg/m^3***
‡SM,21	***10200H (1,2)-2001***	All	***Chlorophyll a, b, c***	***L 20***	***N/A***	***0.5 mg/m^3***
SM21	10200H (1,2)	All	Pheophytin a	L 20	N/A	0.5 mg/m^3-
‡SM22,23	***2120B-2011***	All	***Color***	***L-M 10***	***N/A***	***2 PCU***
SM,21,22,23	2120C-2001	All	Color	L-M 10	N/A	1 PCU
Dickson et al., 2007	SOP 2	SW	Dissolved inorganic carbon	L 0.25	N/A	2 µmol/kg
SM,22,23	4500-F C-2011	All	Fluoride	L 10	L 82-116	0.05 mg/L
EPA1	340.2	All	Fluoride	L 10	L 82-116	0.05 mg/L
SM22,23	3111B (2340B)2011	All	Hardness	Calculated	Calculated	
SM22,23	2340C-2011	All	Hardness	L-M 10	L-M 93-107	5 mg $CaCO_3$ equiv/L
EPA1	351.2	All	Kjeldahl Nitrogen, Total	L 20	L 85-115	0.05 mg/L
‡EPA5	***351.2***	All	***Kjeldahl Nitrogen, Total***	***L 20***	***L 90-110***	***0.05 mg/L***
EPA1	351.4	All	Kjeldahl Nitrogen, Total	L 20	L 85-118	0.1 mg/L
Solórzano 1980[a], modified		All	Nitrogen, Total	L 20	L 80-120	0.005 mg/L
EPA1	353.2	All	Nitrate-N	Calculated	Calculated	
‡EPA5	***353.2***	All	***Nitrate-N***	***Calculated***	***Calculated***	
EPA1	353.3	All	Nitrate-N	Calculated	Calculated	
B+L/Seal	G-172-96 R10	All	Nitrate-N	L	Calculated	

Table 5.2.D QA OBJECTIVES: GENERAL PARAMETERS IN LIQUIDS (continued)

Reference	Method	Matrix DW SW GW EFF SA	Parameter	Precision (RPD)	Accuracy (%Recovery)	MDL
EPA1	353.2	All	Nitrite-N	L 10	L 80-111	0.005 mg/L
‡EPA5	***353.2***	All	***Nitrite-N***	***L 10***	***L 90-110***	***0.005 mg/L***
SM22	4500-NO_3-F-2011	All	Nitrite-N	L 10	L 90-110	0.005 mg/L
EPA1	354.1	All	Nitrite-N	L 10	L 80-111	0.01 mg/L
SM22	4500-NO2 B-2011	All	Nitrite-N	L 10	L 80-111	0.01 mg/L
EPA1	353.3	All	Nitrite-N	L 10	L 80-112	0.01 mg/L
B+L/Seal	G-172-96 R10	All	Nitrite-N	L 10	L 85-115	0.001 mg/L
ThermoElectron		All	Nitrogen, particulate	20		1 µg/L
EPA1	353.2	All	Nitrite-Nitrate-N	L 10	L 88-109	0.005 mg/L
‡EPA5	***353.2***	All	***Nitrite-Nitrate-N***	***L 10***	***L 90-110***	***0.005 mg/L***
SM22	4500-NO_3-F-2011	All	Nitrite-Nitrate-N	L 10	L 90-110	0.005 mg/L
EPA1	353.3	All	Nitrite-Nitrate-N	L 10	L 82-117	0.01 mg/L
~~SM20~~	~~4500-NO3 E~~	~~All~~	~~Nitrite-Nitrate-N~~	~~L 10~~	~~L 82-117~~	~~0.01 mg/L~~
B+L/Seal	G-172-96 R10	All	Nitrite-Nitrate-N	L 10	L 85-115	0.001 mg/L
‡SM22~~,~~ EPA5	***351.2, 4500-NH3 G-2011***	All	***Organic N***	***Calculated***	***Calculated***	
SM22,23	4500NH3 G-2011	All	Organic N	Calculated	Calculated	
EPA1	350.1, 350.3, 351.2, 351.4	All	Organic N	Calculated	Calculated	
EPA5	351.2	All	Organic N	Calculated	Calculated	
EPA1	360.1	All	Oxygen, Dissolved	L-M 10	N/A	0.2 mg/L
SM22	4500-O-G-2011	All	Oxygen, Dissolved	L-M 10	N/A	0.2 mg/L
EPA1	360.2	All	Oxygen, Dissolved	L-M 10	N/A	0.2 mg/L
~~SM22~~	~~4500-O-C-2011~~	~~All~~	~~Oxygen, Dissolved~~	~~L-M 10~~	~~N/A~~	~~0.2 mg/L~~
EPA1	150.1	All	pH	L-M 10	N/A	0.05 SU
SM20	4500-H+ B	All	pH	L-M 10	N/A	0.05 SU
Dickson et al., 2007	SOP 6b	SW, SA	pH, Total	0.25	NA	0.01
‡SM,22,23	***4500-P F-2011***	All	***Phosphorous, Ortho-***	***L 10***	***L 90-110***	***0.005 mg/l***
EPA1	365.1	All	Phosphorous, Ortho-	L 10	L 90-110	0.005 mg/L
‡EPA5	***365.1***	All	***Phosphorous, Ortho-***	***L 10***	***L 90-110***	***0.005 mg/L***
EPA1	365.3	All	Phosphorous, Ortho-	L 10	L 87-115	0.01 mg/L
EPA1	365.2	All	Phosphorous, Ortho-	L 10	L 87-115	0.01 mg/L
B+L/Seal	G-175-96 R12	All	Phosphorus, Ortho	L 10	L 85-115	0.002 mg/L
Solórzano 1980b, modified		All	Phosphorus, Particulate	L 20	L 87-115	0.003 mg/L
‡EPA1	***365.4***	All	***Phosphorous, Total***	***L 20***	***L 90-110***	***0.05 mg/L***
EPA1	365.3	All	Phosphorous, Total	L 20	L 82-115	0.02 mg/L
Solórzano 1980b modified		All	Phosphorus, Total	L 20	L 87-115	0.003 mg/L
~~SM20~~	~~4500-P B5, E~~	~~All~~	~~Phosphorus, Total~~	~~L 20~~	~~L 87-115~~	~~0.003 mg/L~~
SM22,23	10200F-2011	All	Plankton Counts	L-M-H 10	N/A	N/A
‡SM,22	***2540C-2011***	All	***Solids, Total Dissolved***	***L 10***	***N/A***	***0.5 mg/L***
EPA1	160.1	All	Solids, Total Dissolved	L 10	N/A	0.5 mg/L
‡SM22	***2540D-2011***	All	***Solids, Total Suspended***	***L 10***	***N/A***	***2 mg/L***

Table 5.2.D QA OBJECTIVES: GENERAL PARAMETERS IN LIQUIDS (continued)

Reference	Method	Matrix DW SW GW EFF SA	Parameter	Precision (RPD)	Accuracy (%Recovery)	MDL
EPA1	160.2	All	Solids, Total Suspended	L 10	N/A	2 mg/L
SM22	2540B-2011	All	Solids, Total	L 10	N/A	2 mg/L
EPA1	160.3	All	Solids, Total	L 10	N/A	2 mg/L
‡SM22	***2540E--2011***	All	***Solids, Volatile***	***L 10***	***N/A***	***0.5 mg/L***
EPA1	160.4	All	Solids, Volatile	L 10	N/A	0.5 mg/L
‡SM22	***2540E-2011***	All	***Solids, Volatile Suspended***	***L 10***	***N/A***	***0.5 mg/L***
‡SM22	***2540E-2011***	All	***Solids Volatile Dissolved***	***L 10***	***N/A***	***0.5 mg/L***
‡SM22	***2540E -2011***	All	***Solids, Fixed***	***L 10***	***N/A***	***0.5 mg/L***
‡SM22	***2540E-2011***	All	***Solids, Fixed Suspended***	***L 10***	***N/A***	***0.5 mg/L***
‡SM22	***2520B***	All	***Salinity***		***Calculated***	
EPA1	370.1	All	Silica, Dissolved	L-M 10	L-M 90-117	0.05 mg/L
SM22	4500SiO_2 C,D	All	Silica, Dissolved	L-M 10	L-M 90-117	0.05 mg/L
‡USGS	***I-2700-85***	All	***Silica, Dissolved***	***M-H 10***	***M-H 85-115***	***1 mg/L***
‡USGS	***I-2700-85***	All	***Silica, Dissolved***	***L-M 10***	***L-M 85-115***	***0.1 mg/L***
B+L/Seal	G-177-96 R8	All	Silica, Dissolved	L 10	L 85-115	0.005 mg/L
Rageneau & Treguer,1994++		All	Silica Biogenic	L-M-H 20	L-M-H 85-115	0.05 mg/L
‡EPA1	***120.1***	All	***Specific Conductance***	***L-M-H 10***	***NA***	***5 µmho/cm***
‡SM22	***2510B-2011***	All	***Specific Conductance***	***L-M-H 10***	***NA***	***5 µmho/cm***
EPA1	375.1	All	Sulfate	L-M 10	L-M 85-115	10 mg/L
EPA1	375.2	All	Sulfate	L-M 10	L-M 86-112	5 mg/L
EPA5	375.2	All	Sulfate	L-H 10	H 90-110	5 mg/L
EPA5	375.2	All	Sulfate	L-M 10	L-M 90-110	1mg/L
EPA2	9036	All	Sulfate	L-M 10	L-M 86-112	5 mg/L
SM22	4500-S04 E-2011	All	Sulfate	L 10	L 87-116	1mg/L
‡SM22	***4500-S^2 F-2011***	All	***Sulfide***	***L 10***	***L 85-115***	***1mg/L***
‡SM22	***4500-S^2 B-2011***	All	***Sulfide, Dissolved***	***L 10***	***NA***	***1mg/L***
EPA2	9030	All	Sulfide, Acid Soluble	L 10	NA	5mg/L
SM22	4500-S^2 H-2011	All	Sulfide, Unionized		Calculated	
SM,22	2550B-2010	All	Temperature	L-M-H 10	NA	0.1ºC
EPA1	170.1	All	Temperature	L-M-H 10	NA	0.1ºC
		All				
F.A.C. 62-302.200(6)		SW Only	Transparency		Calculated	
‡SM22	***2130B-2011***	All	***Turbidity***	***L-M 10***	***NA***	***0.2 NTU***
EPA5	180.1	All	Turbidity	L-M 10	NA	0.2 NTU
B+L/Seal	G-166-96 R2	All	Urea	L-M 10	L 85-115	0.005 mg/L
Price & Harrison		All	Urea	L-M 10	L 85-115	0.005 mg/L

++ modified for AutoAnalyzer
‡NELAC certification

Table 5.2.E BENTHIC LABORATORY PROCEDURES SUMMARY AND QA OBJECTIVES

Procedure	Component[1]	QA Objective	Method
Rough sorting	All groups	95% recovery	10% Re-sort Check
Identification	Porifera	Class	Literature[2], IHC[3]
	Cnidaria		
	Hydrozoa	Class	Literature, IHC
	Anthozoa	Order	Literature, IHC
	Platyhelminthes	Class	Literature, IHC
	Nemertea	Letter type	IHC
	Annelida		
	Polychaeta	Species or LPL[4]	Literature, IHC
	Oligochaeta	Species or LPL	Literature, IHC
	Hirudinea	Species or LPL	Literature, IHC
	Mollusca		
	Gastropoda	Species or LPL	Literature, IHC
	Bivalvia	Species or LPL	Literature, IHC
	Arthropoda		
	Crustacea	Species or LPL	Literature, IHC
	Insecta	Species or LPL	Literature, IHC
	Pycnogonida	Species or LPL	Literature, IHC
	Sipunculida		
	Echiurida	LPL	Literature, IHC
	Asteroidea	Species or LPL	Literature, IHC
	Ophiuroidea	Species or LPL	Literature, IHC
	Echinoidea	Species or LPL	Literature, IHC
	Holothuroidea	Species or LPL	Literature, IHC
	Hemichordata	Class	Literature, IHC
	Chordata	Class or LPL	Literature, IHC

[1]Level of taxonomy defined by project scope of work.
[2]Literature refers to standard published taxonomic descriptions, for externally visible features.
[3]In-House Collections, refers to MML-maintained species reference collection.
[4]Lowest Practical taxonomic Level, based on available literature, using light microscopy, excluding special techniques of staining, sectioning, etc.

Table 5.3 FIELD MEASUREMENTS

Reference	Method No.	Matrix	Analyte/Component
EPA1	120.1	W	Conductivity/Salinity
DEP (January 2017)	FT 1200	W	Conductivity/Salinity
SM 22, 23	2510B-2011	W	
SM 22, 23	2520B	W	Salinity
EPA1	360.1	W	Dissolved Oxygen (probe)
DEP (January 2017)	FT 1500	W	Dissolved Oxygen
SM 22	4500-0.G-2011	W	
EPA1	150.1	W	Oxidation/Reduction Potential
EPA/CE	3-51	SED	
Manufacturer Instructions		W	Photosynthetically Active Radiation (400-700 nm)
USNO	B-14	W	Secchi depth (limnological)
DEP (January 2017)	FT 1700	W	Light Penetration (Secchi Depth and Transparency)
EPA1	150.1	W	pH
DEP (January 2017)	FT 1100	W	pH
EPA2	9040	W	
SM 22, 23	4500-H+. B-2011	W	
EPA/CE	3-52	SED	
EPA2	9045	S	
EPA1	170.1	W, SED	Temperature
DEP (January 2017)	FT 1400	W	Temperature
EPA2	9040	W	
EPA1	180.1	W	Turbidity
SM 22, 23	2130B-2011	W	Turbidity
DEP (January 2017)	FT 1600	W	Turbidity
SM 22, 23	4500-Cl B-2011	W	Chlorine, Residual
DEP (January 2017)	FT 2000	W	Chlorine, Residual
Manufacturer Instructions		W	Depth
Manufacturer Instructions		W	Flow

6.0 SAMPLING PROCEDURES

6.1 General

Mote Marine Laboratory provides sampling services, chemical analyses and containers to clients to collect their own samples. Sampling capabilities of MML are categorized by sample matrix and major analyte groups and are listed in **Table 6.1**. For sampling performed by MML, the appropriate SOP will be available in the field for reference and consultation. If a sampling procedure is a citation, then a copy of the citation itself will be carried in the field.

When required, DEP SOPs for field sampling will be followed. According to QA Rule 62-160, DEP field SOPs are required for all organizations submitting data to DEP. The official DEP Field SOPs that have been developed through the QA Rule process have an effective date of January 2017 and can be accessed on the website maintained by DEP Bureau of Laboratories using the following link: https://floridadep.gov/dear/quality-assurance/content/dep-sops and are described as DEP-SOP-001/01, and DEP-SOP-002/01. As these SOPs are updated and incorporated into the QA rules, updated SOPs will be followed as required.

The procedures outlined in this section are followed by projects which have sampling QA requirements, unless a specific project has other requirements or unless project-specific procedures have been reviewed and approved by the granting agency. Some of the procedures outlined in this section have been specifically developed by Mote staff to be suited for particular sampling needs and do not necessarily follow DEP sampling protocols. Where required by grant, permit, or contract, DEP SOPs will be adhered to. When extraordinary circumstances arise, MML staff may deviate from DEP SOPs. Such deviations will be documented.

6.1.2 Representative Subsamples

When a submitted sample is divided into aliquots prior to analysis as part of the test method, specific procedures outlined in individual Method SOPs are followed. When aqueous samples are divided into subsamples, the parent container is inverted several times to allow for adequate mixing to ensure homogeneity of the sample before removing a subsample aliquot. Sediment samples that are divided into subsamples are mixed thoroughly in the parent container using means to ensure homogeneity of the sample, such as mixing using a stainless steel spatula, but according to procedures specified in methods SOPs. Sediment aliquots are weighed and recorded prior to analysis. All subsamples are assigned a unique laboratory ID code.

6.2 Sampling Equipment

Lists of sample purging and collection equipment, together with equipment construction and use requirements are specified in **Table 6.2**. Field instrumentation, miscellaneous equipment and sample storage and transport items appear in **Table 6.3** (See **Section 9**, **Table 9.1** for additional listing of field equipment). Preservation reagents, standards, and cleaning materials typically used in the field are listed in **Table 6.4**. Cleaning procedures for all sample containers as required by parameter analyzed are described in **Table 6.5**. Required containers, sample preservation, and holding times for aqueous and non-aqueous samples are listed in **Tables 6.6 and 6.7** or specified in DEP SOPs.

Table 6.1 **SAMPLING CAPABILITIES**

Major Sampling Groups	Sample	Source
Volatile Organics	Aqueous:	Drinking, surface, saline, ground, waste, storm
	Solids:	Sediment, soil
Extractable Organics	Aqueous:	Drinking, surface, saline, ground, waste, storm
	Solids:	Sediment, soil, biological material*
Trace Metals	Aqueous:	Drinking, surface, saline, ground, waste, storm
	Solids:	Sediment, soil
Inorganic Anions & Organics	Aqueous:	Drinking, surface, saline, ground, waste, storm
	Solids:	Sediment, soil
Physical Properties	Aqueous:	Drinking, surface, saline, ground, waste, storm
	Solids:	Sediment, soil, biological material*
Microbiology	Aqueous:	Drinking, surface, saline, ground, waste, storm
	Solids:	Sediment, biological material*
Cyanide & Radionuclides	Aqueous:	Drinking, surface, saline, ground, waster, storm
	Solids:	Sediment, soil
Macroinvertebrate ID	Solids:	Sediment
Plankton	Aqueous:	Surface, saline
Biotoxicity	Aqueous:	Surface, saline, ground, waste, storm
	Solids:	Sediment, soil
Granulometry	Solids:	Sediment, soil
Carbonate Chemistry	Aqueous:	Drinking, surface, saline, ground, waste, storm

*Biological material includes terrestrial, marine, and aquatic invertebrrates, vertebrates, algae, and vascular plants (whole or tissue/organ).

Table 6.2 SAMPLING EQUIPMENT - CONSTRUCTION AND APPROPRIATE USE

Equipment Type	Construction	Use	Parameters	Restrictions/Precautions
Groundwater Sampling				
Centrifugal Suction Lift Pump	HDPE, PP tubing	Purging	All parameter groups	[a]Foot valve required
				polishing required
Peristaltic Suction Lift Pump	Teflon tubing	Purging	All parameter groups	[a]Foot valve required;
				polishing required
		Sampling	All but extractable organics, VOCs	Medical grade silicone tubing in pump head
			Extractable organics	[a]Configured as specified in SOPs
	HDPE, PP tubing	Purging	All parameter groups	Polishing required
Above-ground Hand Pump	Teflon tubing	Purging	All parameter groups	[a]Foot valve required
		Sampling	All but extractable organics, VOCs, metals	[a]Foot valve required
			Extractable organics	[a]Configured as specified in SOPs
	HDPE, PP tubing	Purging	All parameter groups	[a]Foot valve required
				Polishing required
		Sampling	All but extractable organics, VOCs	[a]Foot valve required
Bailer	Teflon, SS	Purging	All parameter groups	None; Not recommended
	PE, PP	Sampling	All parameter groups	None
	HDPE, PP, LDPE	Purging	All but extractable organics, VOCs	Not recommended
		Sampling	All but extractable organics, VOCs	Must be non-metallic if not stainless steel
Positive pressure filtration units	Teflon, HDPE, PP, positive pressure bailers	Filtration for dissolved constituents	Demands, nutrients, metals, inorganic ions	0.45 µm filter (1.0 µm filter for metals)
Positive pressure filtration units	HDPE, PP, PC, one piece, disposable filter	Filtration for dissolved constituents	Demands, nutrients, inorganic ions	0.45µm Filter, no intermediate vessel, configured as in SOPs
Positive pressure filtration units	HDPE, PP, PC, one piece, disposable filter	Filtration for dissolved constituents	Metals	1.0 µm Filter, no intermediate vessel, configured as in SOPs
Grab	PVC	Sampling	All parameter groups	
Surface Water Sampling				
Kemmerer Type (Niskin w/wout rosette)	SS, teflon or teflon-coated, glass	Specific depth grab sampling	All parameter groups	None
	PVC, PP, PC, Viton Seals	Specific depth grab sampling	All but extractable organics, VOCs	Must be non-metallic or SS for trace metals
Bailer	Teflon, SS	Sampling	All parameter groups	None
	HDPE, LDPE	Sampling	All but extractable organics, VOCs	Must be non-metallic if not stainless steel
Pond Sampler	Clamp non-contaminating, Sample vessel Teflon, SS	Surface grab sampling	All parameter groups	None
	Vessel HDPE, PP, PC	Surface grab	All but extractable organics, VOCs	None
Automatic Sampler (ISCO)	Teflon tubing	Time	All but VOCs	Glass containers necessary composite for extractable organics; refrigeration or ice required for parameters requiring ≤6 °C for preservation (Table 6.7)
	Tygon, HDPE tubing	Time	All but extractable organics, VOCs	Refrigeration or ice required for composite parameters requiring ≤6 °C for preservation (Table 6.7)

Table 6.2 SAMPLING EQUIPMENT - CONSTRUCTION AND APPROPRIATE USE (continued)

Equipment Type	Construction	Use	Parameters	Restrictions/Precautions
Peristaltic Suction Lift Pump	Teflon tubing	Specific depth grab sampling	All but extractable organics, VOCs	[a]Medical grade silicone tubing in pump head
		Specific depth grab sampling	Extractable organics	Configured as specified in SOPs
	Tygon, HDPE tubing	Specific depth grab sampling	All but extractable organics, VOCs	[a]Medical grade silicone tubing in pump head
		Flow proportional sampling	All but extractable organics, VOCs	None
Suction Filtration Units	HDPE, Teflon, glass, SS, PC, PP, Silicone Tygon, disposable filter	Filtration for dissolved constituents	Demands, nutrients, metals, inorganic ions	0.45µm Filter
Positive Pressure Filtration Units	Teflon lined or glass syringe with SS filter lock	Filtration for dissolved constituents	Demands, nutrients, metals, inorganic ions	0.45µm Filter, intermediate vessel may be used
Positive Pressure Filtration Units	HDPE, PP, PC one piece, disposable filter	Filtration for dissolved constituents	Demands, nutrients, inorganic ions	0.45µm Filter, no intermediate vessels, configured as in SOPs
Bucket	PVC, SS, HDPE	Surface grab sampling	All parameter groups	None
Positive Pressure Filtration Units	HDPE, PP, PC syringe	Filtration for dissolved constituents	Demands, nutrients, inorganic ions, phytoplankton	Various filters depending on application
Wastewater/Stormwater Sampling				
Automatic Sampler (ISCO)	Teflon Tubing	Time composite sampling	All but VOC's, oil & grease, TRPH and microbiologicals	Glass containers necessary for extractable organics; refrigeration or ice required for parameters required ≤6°C for preservation (Table 6.7)
		Fw proportional sampling	All but VOC's, oil & grease, TRPH and microbiologicals	Glass containers necessary for extractable organics; refrigeration or ice required for parameters required ≤6 °C for preservation (Table 6.7)
Automatic Sampler (ISCO)	Tygon, HDPE tubing	Time composite sampling	All but extractable organics, VOC's, oil & grease, TRPH and microbiologicals	Refrigeration or ice required for parameters required ≤6°C for preservation (Table 6.7)
		Fw proportional sampling	All but extractable organics, VOC's, oil & grease, TRPH and microbiologicals	Refrigeration or ice required for parameters required ≤6 °C for preservation (Table 6.7)
Suction Filtration Units	HDPE, Teflon, glass, SS, PC	Filtration for dissolved constituents	Demands, nutrients, metals, inorganic ions	0.45µm Filter,
Positive Pressure Filtration Units	Teflon lined or glass syringe with SS filter lock	Filtration for dissolved constituents	Demands, nutrients, metals, inorganic ions	0.45µm Filter; intermediate vessel may be used Various filters depending on application
Positive Pressure Filtration Units	HDPE, PP, PC, one piece, disposable filter	Filtration for dissolved constituents	Demands, nutrients, inorganic ions	0.45µm Filter; no intermediate vessel, configured as in DEP SOPs
Positive Pressure Filtration Units	HDPE, PP, PC syringe	Filtration for dissolved constituents	Demands, nutrients, metals, inorganic ions	0.45µm Filter; intermediate vessel may be used for surface waters
Precipitation Collector	Teflon	Rainwater sampling	All parameters	None
Sediment Sampling				
Push-Type Corer	SS			
	PVC, Aluminum	Sampling	All parameter groups, granulometry	VOC and metals samples taken macroinvertebrates, from interior of core sample
		Sampling	Granulometry macroinvertebrates, all but extractable organics, VOCs	Must be non-metallic if metals are sampled

Table 6.2 SAMPLING EQUIPMENT - CONSTRUCTION AND APPROPRIATE USE (continued)

Equipment Type	Construction	Use	Parameters	Restrictions/Precautions
PONAR and Petite PONAR Grab	SS	Sampling	All parameter groups granulometry	VOC and metals samples taken macroinvertebrates, from interior of core sample
Box Core	SS	Sampling	All parameter groups, macroinvertebrates, granulometry	VOC and metals samples taken from interior of core sample
Vibrating Core	PVC, Aluminum	Sampling	All parameter groups	Core extruded and split VOCs, extractables, and interior of core sampler
Sieves	SS, brass, nylon, teflon	Size fractionation	All but VOCs, macroinvertebrates, granulometry	Must be stainless steel for extractable organics or trace metals
Trowel, Scoop, Spoon, Spatula	SS, teflon coated	Sampling and composting	All parameter groups	No VOCs on composites
	HDPE, PVC, Aluminum	Sampling and composting	Demands, nutrients, metals	Must be non-metallic if metals are sampled
Mixing Pan, Tray, Tub	SS or glass	Composting and homogenizing	All parameter groups	No VOCs on composites
	HDPE, PP, PC, aluminum	Composting and homogenizing	Demands, nutrients, metals	Must be non-metallic if metals are sampled
Soils Sampling				
Trowel, Scoop, Spoon, Spatula	SS or Teflon coated	Sampling and composting	All parameter groups	No VOCs on composites
	PVC, HDPE, aluminum	Sampling and composting	Demands, nutrients, metals	Must be non-metallic if metals are sampled
Mixing pan, Tray, Tub	SS or glass	Composting and homogenizing	All parameter groups	No VOCs on composites
	PP, HDPE, PC, aluminum	Composting and homogenizing	Demands, nutrients, metals	Must be non-metallic if metals are sampled
Biological Tissue Sampling				
Nets, trawls, rakes	Various	Organism collection	All parameter groups	None, minimize organism damage in collection
Cutting board	HDPE, Plexiglass	Tissue dissection	All parameter groups	Glass or SS preferred for trace organics
Knife, scalpel	SS	Tissue dissection	All parameter groups	None
Scoop, spoon, spatula	SS or Teflon coated	Sample transfer	All parameter groups	None
	PP, HDPE	Sample transfer	All parameter groups	Must be non-metallic for trace metals, SS preferred for trace organics
Homogenization chamber	Glass	Tissue homogenizing	All parameter groups	None
Macroinfauna Sampling				
Push-type corer	SS, PVC, or aluminum	Collection	Macroinfauna	None
PONAR & Petite PONAR grab	SS or galvanized	Collection	Macroinfauna	None
Box core	SS or galvanized	Collection	Macroinfauna	None
Sieves	SS, galvanized, nylon, PP	Collection	Macroinfauna	None
Buckets	SS, HDPE, PP	Collection	Macroinfauna	None
Sweep Nets	SS, Wood, Nylon	Collection	Macroinfauna	None

HDPE = High Density Polyethylene
LDPE = Low Density Ployethylene
PP = Polypropylene
PC = Polycarbonate
PVC = Polyvinyl Chloride
SS = Stainless Steel
[a]Delivery tubing must be pre-cleaned and pre-cut at the base of operations or laboratory. See **Section 6.3.10** – Sample Tubing

Table 6.3 ROUTINELY USED FIELD INSTRUMENTATION

Instrument	Use	Parameters
Field Instrumentation		
Hydrolab Minisonde/Surveyor	In *situ* sampling	Temperature, conductivity, pH, oxidation, reduction potential (ORP), depth, DO
YSI Model 57	In *situ* sampling	Temperature, dissolved O_2
YSI Model 556 MPS	In *situ* sampling	Temperature, conductivity, salinity, DO, pH, % Saturation, turbidity, ORP
YSI Model 600 XLM/650 MDS	In *situ* sampling	Conductivity, temperature, depth, pressure
YSI Xylem Pro Series	In situ sampling	Conductivity, temperature, DO, pH
YSI Pro-Quatro	In situ sampling	Temperature, conductivity, pH, salinity, ORP, DO (%, mg/L)
YSI Xylem ProDSS	In *situ* sampling	Temperature, conductivity, DO, turbidity, phycoerythrin, chlorophyll
YSI EXO1	In *situ* sampling	Conductivity, temperature, depth
YSI Professional Plus	In *situ* sampling	Conductivity, temperate, depth (pressure), DO, pH
Sea Bird Electronics(SBE) 55~~v~~ ECO water sampler	In *situ* sampling	Conductivity, temperature, depth (pressure), dissolved oxygen, photosynthetically active radiation (PAR), chlorophyll fluorescence, turbidity, pH
Sea Bird Electronics (SBE) 19 CTD	In *situ* sampling	Conductivity, temperature, depth, relative fluorescence
Seabird CTD	In *situ* sampling	Conductivity, temperature, depth, dissolved oxygen
Seabird SeapHOx	In *situ* sampling	pCO_2, pH, Temperature, Salinity, Oxygen
Nutrient analyzer-SubChem	In *situ* sampling	NO_3, NO_2, Fe (II) PO_4, SiO_2, NH_4
Systea Water In *situ* Analyzer	In *situ* sampling	NO_{2+3}
Flow-Cam	In *situ* sampling	Relative phytoplankton abundance and identification.
Thermo-salinograph	In *situ* sampling	Temperature, conductivity, fluorescence
LiCor Model LI 185B, LI 188B, LI1400 LI1500	In *situ* sampling	Light attenuation in PAR range (400-700 nm)
LiCor Model LI-193SA Spherical Quantum Sensor	In *situ* sampling	Photosynthetically active radiation (PAR)
YSI Model 6600 EDS (extended design system)	In *situ* sampling	Temperature, conductivity, salinity, DO, pH, % Saturation, turbidity, ORP
Onset Thermographs	In *situ* sampling	Temperature
Acoustic current meter	In *situ* sampling	Currents
Turbidimeter WQ770	In *situ* sampling	Turbidity
Nortek Aquadopp acoustic Doppler current profiler	In *situ* sampling	Currents
Ocean Optics Flame Spectrophotometer with HL-2000-FHSA-LL Light Source	In *situ* sampling	Total pH
PAM Fluorometer Walz PhytoPAM-II Compact	In *situ* sampling	Y(II) yield, ETRmax, fast kinetics
Turbidimeter Hach 16800	In *situ* sampling	Turbidity
Turbidimeter Hach 2100P	In *situ* sampling	Turbidity
Turbidimeter Hach 2100Q	In *situ* sampling	Turbidity
Price Model III	In *situ* sampling	Currents
DER*	In *situ* sampling	Phosphorous, Orthophosphate
General Oceanics Digital 7CTS	In *situ* sampling	Current
Field Screening Equipment		
Hach Kits	Sample preservation	Chlorine, miscellaneous
pH Test Strips	Sample preservation	pH
Miscellaneous Field Equipment		
Tape Measures	Station depths, well water level	N/A
Lead lines	Station depths	N/A

Secchi disks	In *situ* sampling	N/A

Table 6.3 ROUTINELY USED FIELD INSTRUMENTATION (continued)

Instrument	Use	Parameters
Buckets	Intermediate containers, compositing containers	N/A
Flow meter MF 315	In *situ* flow measurements	flow
Global Positioning System	Navigation, station location	N/A
Gloves (Powder free latex, Polyethylene, Vinyl, Butyl or composites, Nitrile)	Prevent sample or cross-site contamination, sampler safety	As required
Plastic sheeting	Decontamination	All
Brushes	Decontamination	All
Dispenser containers for: Preservation Cleaning Calibration standards	Preservation, Decontamination, Instrument calibration	All
Sample Storage and Transportation		
Ice Chests (40, 72, 80 qt.)	Sample storage and transport	All
Dewar	Sample storage and transport	All
Buckets	Macroinvertebrate, biological organism transport, storage	All applicable
Plastic zipper bags	Biological sample storage until laboratory dissection	All applicable
Aluminum foil	Biological sample storage until laboratory dissection	All applicable

Table 6.4 REAGENTS USED FOR PRESERVATION, CLEANING AND/OR CALIBRATION

Reagents	Field Transport Container	Method of Storage
Acetone	G,O	Stored in original container in a vented cabinet designated for solvent storage
Acetonitrile	G,O	Stored in original container in vented solvent cabinet
Alkaline Iodide	PD	Stored in original containers on laboratory shelves
Analyte-Free Water	G,O,P,T	Stored in original glass or Teflon containers (organics) or plastic container (metals, etc.) in laboratory cabinets removed from other chemicals
Ascorbic Acid	P	Stored in original container on laboratory shelves
Azide Solution	PD	Stored in original containers on laboratory shelves
Cadmium Nitrate	PD	Stored in original container. Solutions stored in polyethylene on laboratory shelves
Dichloromethane	G,O	Stored in original container in a vented cabinet designated for solvent storage
Ethanol	P,O	Stored in locked, vented solvent cabinet
Ethylenediamintetraacetic acid trisodium salt hydrate (EDTA)	P,G	Stored in original container on laboratory shelves
Formalin	P,O	Stored in vented solvent cabinet
Formazin	G, P	Glass, refrigerated
NTU Gel Standards	G	Glass, shelves
Hydrochloric Acid	PD,G,O,P	Stored in original containers in a vented cabinet designated for acid storage
Isopropanol (pesticide grade)	G,O,T	Stored in original container in a vented cabinet designated for solvent storage
Isopropanol (technical grade)	P	Stored in original drum in bermed secure area
Liquid Nitrogen	M	Store in metal container until processing
Liquinox	G	Stored in original container in a laboratory cabinet removed from other chemicals
~~Utermohl's I2~~ Lugol's iodine solution (for phytoplankton)	PD	Stored in glass or polyethylene containers on laboratory shelves
Manganous Sulfate Solution	PD	Stored in original containers on laboratory shelves
Mercuric Chloride	G,O	Stored in original container In a vented cabinet designated for toxic chemicals
Methanol	G, O	Stored in original container in a vented cabinet designated for solvent storage
Nitric Acid	PD	Stored in original containers in a vented cabinet designated for acid storage
ORP Solution	G	Glass, shelves
pH Buffers (4, 7, 10)	P,O	Stored in original containers on laboratory shelves
Potassium Chloride (KCl) Solutions	P	Stored in glass or polyethylene containers on laboratory shelves
Sodium Hydroxide	PD	Stored in original container. Solutions stored on laboratory shelves.
Sodium Thiosulfate	G,P	Stored in original container on laboratory shleves
Sulfuric Acid	PD	Stored in original containers in a vented cabinet designated for acid storage
Thermometers (Hg in glass)		Protective case, cabinet
Trizma	P,G	Storied in original container on laboratory shelves
Water	G,O	Stored in original container
Zinc Acetate	PD	Stored in original container. Solutions stored in polyethylene on laboratory shelves.
2-Chloroacetamide	P,G	Stored in original container on laboratory shelves

P – Polyethylene containers O – Original container
G – Glass containers T – Teflon container
PD – Polyethylene dispenser M – Metal, insulated container

Table 6.5 SAMPLE CONTAINER CLEANING PROTOCOL

Analysis/Parameter	Container Type	Cleaning Procedure (in order specified)*
Bacteriologicals	P, G	Purchase sterile containers (with or without sodium thiosulfate) or obtain from DEP-approved subcontracted lab
Biotoxicity	P, G	1, 2, 10, 2, 5, 6, 8, 9 (for bioassays use only acetone, and only when containers are glass)
CDOM	G	1, 2, 11, 8, 12, 9
~~Carbonate Chemistry, Spec pH~~ DOC	G	1, 2, 13, 5, 8, 12, 9
Carbonate Chemistry, Spec pH	G	1, 5, 11, 5, 5, 5, 14,12, 5,15, 9
Extractable organics	G	1, 2, 5, 6, 8, 9
Granulometry	P	7, 8, 9
HPLC	P	1, 2, 5, 8, 9
Inorganics, BOD, CBOD, Residues, Minerals, Surfactants, PO_4, Physical Properties	P	1, 2, 5, 8, 9
Macroinvertebrate Species Identification	P	7, 8, 9
Metals and Radionuclides	P	1, 2, 3, 5, 8, 9 (Follow DEP SOP to clean containers for ultratrace metals)
Nutrients for regulatory methods, COD, Phenols, Cyanide	P	1, 2, 4, 5, 8, 9
Nutrients for research methods	P	1, 2, 11, 5, 8, 9
Oils and Grease	G	1, 2, 3, 5, 6, 8, 9
Volatile organics	G	Purchase pre-cleaned and certified containers or obtain from DEP-approved subcontract lab

1. Wash with hot tap H_2O and brush using Liquinox detergent*
2. Rinse with hot tap H_2O*
3. Rinse with 10% HNO_3 solution.
4. Rinse with 10% H_2SO_4 solution (or replace with 25% v/v HCl)
5. Rinse with DI H_2O
6. Rinse with pesticide grade acetone or isopropanol
7. Rinse with tap water and brush. Use detergent as necessary.
8. Invert and air dry in contaminant-free environment.
9. Cap tightly and store in a contaminant-free environment until use.
10. Rinse with 25% (v/v) HCl followed by a sodium bicarbonate solution
11. Rinse with 10% HCl
12. Fire in muffle furnace
13. Soak in 10% HCl bath
14. Air dry in contaminant-free environment
15. Dry in contaminant-free oven

G, Glassware; P, Plastic
*Omit steps 1 and 2 for new containers

Table 6.6 REQUIRED CONTAINERS, PRESERVATION TECHNIQUES, HOLDING TIMES, AND SAMPLE VOLUMES (Aqueous Samples)

Parameter	Container[1]	Preservation[2]	Max. Holding Time	Req Vol (mL)
Acidity	P, G	Cool ≤6 °C, no head space	14 days	200
Alkalinity	P, G	Cool ≤6 °C, no head space	14 days	200
Alkalinity (Total)	G	0.03% $HgCl_2$, Cool ≤6 °C, 1-2% head space	6 months	200
Ammonia, total, unionized	P, G	Cool ≤6 °C, $H_2SO_4$to pH<2	28 days	100
Biochemical oxygen demand	P, G	Cool ≤6 °C	48 hours	300
Biochemical oxygen demand carbonaceous	P, G	Cool ≤6 °C	48 hours	300
Biomass	P, G	Cool ≤6 °C	24 hours	500
Brevetoxin: Field Samples	G	Cool ≤6 °C, extract within 48 hours	48 hours	500
Brevetoxin: Mitigation Projects	G	Extract within 24 hours		
Carbon, Inorganic	G	0.03% $HgCl_2$, Cool ≤6 °C, 1-2% head space	6 months	50
Carbon, Total organic	P, G	Cool ≤6 °C, H_2SO_4 to pH<2	28 days	50
Chemical oxygen demand	P, G	Cool ≤6 °C, H_2SO_4 to pH<2	28 days	100
Chloride	P, G	None required	28 days	100
Chlorine, total residual	P, G	None required	Analyze w/in 15 min	500
Chlorophyll/Phaeophytin	P, G	Cool ≤6 °C, Filter within 48 hours and $MgCO_3$ and freeze	21 days after filtration	1000
Chromium VI	P, G	Cool ≤6 °C, 9.3<pH<9.7	28 days	200
Coliform, fecal and total	P, G	Cool <10 °C[3]	6 hours	200
Color	P, G	Cool ≤6 °C	48 hours	250
Cyanide, total	P, G	Cool ≤6 °C, NaOH to pH>12[4]	14 days[5]	500
Endocrine Disruptors for GC	G	Fix on site, cool ≤6 °C, extract within 48 hours	6 months	500
Enterococci	P, G	Cool <10 °C	8 hours	200
Fecal streptococci	P, G	Cool <10 °C[3]	8 hours	200
Fluoride	P	None required	28 days	300
Hardness	P, G	HNO_3, or H_2SO_4 to pH<2	6 months	100
Kjeldahl and organic nitrogen	P, G	Cool ≤6 °C, H_2SO_4 to pH<2	28 days	200
Metabolic rate	G	Fix on site, dark, water seal	8 hours	300
Metals (except chromium VI and mercury)	P, G	HNO_3 to pH<2	6 months	1000
Mercury (CVAA)	P, G	HNO_3 to pH<2	28 days	200
Microcystin: Field Samples	G	Cool/Freeze ≤4 °C	28 days	500
Microcystin: Mitigation Samples	G	Extract within 24 hours	28 days	500
Nitrate	P, G	Cool ≤6 °C	48 hours	100
Nitrate-nitrite	P, G	Cool ≤ 6 °C, H_2SO_4 to pH<2	28 days	100
Nitrite	P, G	Cool ≤ 6 °C	48 hours	100
Odor	G	Cool ≤ 6 °C	6 hours	500
Oil and grease	G	Cool ≤ 6 °C, H_2SO_4or HCl to pH<2	28 days	1000
Oxygen, Winkler	G	Fix on site and store in dark	8 hours	300
Pesticides for GC and LC/MS	G	Fix on site, cool ≤6 °C, extract within 48 hours	6 months	500
pH	G	None required	Analyze immediately	250
Phenols	G	Cool ≤ 6 °C, H_2SO_4 to pH<2	28 days	1000

* Please see Section 6.0 Amendment which appears at the end of this section. Section 6.0 Amendment includes updated holding time for chlorophyll. 12.12.24 CJW

Table 6.6 **REQUIRED CONTAINERS, PRESERVATION TECHNIQUES, HOLDING TIMES, AND SAMPLE VOLUMES (Aqueous Samples) (continued)**

Parameter	Container[1]	Preservation[2]	Max. Holding Time	Req Vol (mL)
Phosphorous, total	P, G	Cool ≤ 6 °C, H_2SO_4 to pH<2	28 days	200
Phosphorous, hydrolysable	P, G	Cool ≤ 6 °C, H_2SO_4 to pH<2	28 days	200
Phosphorous ortho-	P, G	Cool ≤ 6 °C	48 hours	100
Pigments for HPLC	P, PP	ASAP, Filter within 24 h Liquid nitrogen	365 d	100-250 mL (in highly turbid waters or intense phytoplankton bloom conditions); 250-1000 mL (coastal-deep shelf waters of west Florida shelf)
Phytoplankton counts	P, G	Ütermohls iodine solution	6 mos @ RT 3 yrs @ 0-4°C	20
Radionuclides	P, G	HNO_3 to pH<2	6 months	2000
Silica	P	Cool ≤ 6 °C	28 days	300
Solids, total (TS)	P, G	Cool ≤ 6 °C	7 days	500
Solids, dissolved (TDS)	P, G	Cool ≤ 6 °C	7 days	500
Solids, suspended (TSS)	P, G	Cool ≤ 6 °C	7 days	500
Solids, settable (SS)	P, G	Cool ≤ 6 °C	48 hours	500
Solids, volatile (VS)	P, G	Cool ≤ 6 °C	7 days	500
Specific conductance	P, G	Cool ≤ 6 °C	28 days	200
Sulfate	P, G	Cool ≤ 6 °C	28 days	200
Sulfite	P, G	None required	Analyze w/in 15 min	500
Sulfide	P, G	Cool ≤ 6 °C, Zinc acetate and NaOH, pH<9	7 days	500
Surfactants	P, G	Cool ≤ 6 °C	48 hours	1000
Temperature	P, G	None required	Analyze immediately	200
Turbidity	P, G	Cool ≤ 6 °C	48 hours	100

[1]P = polyethylene, G = Glass, PP = polypropylene

[2]When specified, sample preservation should be performed immediately upon sample collection.

[3]In presence of residual chlorine, use 0.008% $Na_2S_2O_3$ for preservation.

[4]In presence of residual chlorine, use 0.6 g ascorbic acid.

[5]If sulfide is not removed, maximum holding time is 24 hours.

Table 6.7 **REQUIRED CONTAINERS, PRESERVATION TECHNIQUES, HOLDING TIMES, AND SAMPLE VOLUMES (Soils, Sediments, and Tissues)**

Parameter	Container[1]	Preservation[2]	Max. Holding Time	Req Vol (mL)
Ammonia	P,G	Cool ≤6 °C Frozen	7 days 180 days	200
Benthic Chlorophyll	P,G	Frozen	180 days	200
Chromium VI	P,G	Cool ≤6 °C Frozen	24 hours[2]	200
Extractable organics	G, Teflon lined cap	Cool ≤6 °C	14 days[2] until extraction, 40 days after	50
Granulometry	P,G	Cool ≤6 °C Frozen	1 month 1 year	200
Metals – except mercury and chromium VI	P,G	Cool ≤6 °C Frozen	6 months[2]	200
Mercury	P,G	Cool ≤6 °C Frozen	28 days[2] 6 months	200
Nitrate	P,G	Cool ≤6 °C	7 days[3]	200
Nitrite	P,G	Cool ≤6 °C	7 days[3]	200
Nitrate-Nitrite	P,G	Cool ≤6 °C	7 days[3]	200
Oil and Grease	G	Cool ≤6 °C	7 days[3]	200
pH	P,G	Cool ≤6 °C	7 days[3]	200
Phosphorous, total	P,G	Cool ≤6 °C	28 days[3]	200
Phosphorous, ortho-	P,G	Cool ≤6 °C	48 h	200
Solids	P,G	Cool ≤6 °C	6 months	200
Specific gravity	P,G	Frozen No head space	12 months	200
Sulfide	P,G	≤6 °C Inert atmosphere	24 hours[3]	200
Total Kjeldahl Nitrogen	P,G	Cool ≤6 °C	28 days	200
Total organic carbon	P,G	Cool ≤6 °C Frozen	28 days[2] 6 months	200
Volatile organics	G, Teflon septum*	Cool ≤6 °C	14 days[2]	50

[1]P = polyethylene, G = Glass
[2]When specified, sample preservation should be performed immediately upon sample collection
[3]The pH adjustment is not required if acrolein will not be measured. Samples for acrolein receiving no pH adjustment must be analyzed within 3 days of sampling.

Table 6.8 REQUIRED CONTAINERS, PRESERVATION TECHNIQUES, HOLDING TIMES, AND SAMPLE VOLUMES (Waste/Wastewater Samples)

Parameter	Container	Preservation[a]	Max. Holding Time	Req Vol (mL)
Acrolein and acrylonitrile	G, Teflon-lined septum	Cool ≤6 °C, 0.008% $Na_2S_2O_3$ (1), Adjust pH to 4-5 (3)	14 days	2000
Acrylonitrile	G, Teflon-lined cap	Cool ≤6 °C	7 days until extraction, 40 days after extraction	2000
Benzidines (4)	G, Teflon-lined cap	Cool ≤6 °C, 0.008% $Na_2S_2O_3$ (1)	7 days until extraction, 40 days after extraction (5,6)	2000
Chlorinated Hydrocarbons (4)	G, Teflon-lined cap	Cool ≤6 °C	7 days until extraction, 40 days after extraction	2000
Haloethers (4)	G, Teflon-lined cap	Cool ≤6 °C, Na_2S_2O3 (1)	7 days until extraction, 40 days after extraction	2000
Nitroaromatics and Isophorone	G, Teflon-lined cap	Cool ≤6 °C, store in dark, 0.008% $Na_2S_2O_3$ (1)	7 days until extraction, 40 days after extraction	2000
Nitrosamines (7)	G, Teflon-lined cap	Cool ≤6 °C, store in dark, 0.008% $Na_2S_2O_3$ (1)	7 days until extraction, 40 days after extraction	2000
Pesticides (4)	G, Teflon-lined cap	Cool ≤6 °C, pH 5-9	7 days until extraction, 40 days after extraction	2000
Phthalate esters (4)	G, Teflon-lined cap	Cool ≤6 °C	7 days until extraction, 40 days after extraction	2000
Phenols (4)	G, Teflon-lined cap	Cool ≤6 °C, 0.008% $Na_2S_2O_3$ (3)	7 days until extraction, 40 days after extraction	2000
Polynuclear aromatic hydrocarbons (4)	G, Teflon-lined cap	Cool ≤6 °C, store in dark, 0.008% $Na_2S_2O_3$ (1)	7 days until extraction, 40 days after extraction	2000
Purgeable aromatic hydrocarbons	G, Teflon-lined septum	Cool ≤6 °C, 0.008% $Na_2S_2O_3$ (1), HCl to pH<2 (2)	14 days	2000
Purgeable halocarbons	G, Teflon-lined septum	Cool ≤6 °C, 0.008% $Na_2S_2O_3$ (1)	14 days	2000
TCDD	G, Teflon-lined cap	Cool ≤6 °C, 0.008% $Na_2S_2O_3$ (1)	7 days until extraction, 40 days after extraction	2000

G = Glass

[a]When specified, sample preservation should be performed immediately upon sample collection.

(1) Should only be used in the presence of residual chlorine.

(2) Sample receiving no pH adjustment must be analyzed within seven days of sampling.

(3) The pH adjustment is not required if acrolein will not be measured. Samples for acrolein receiving no pH adjustment must be analyzed within 3 days of sampling.

(4) When the extractable analytes of concern fall within a single chemical category, the specified preservative and maximum holding times should be observed for optimum safeguard of sample integrity. When the analytes of concern fall within two or more chemical categories, the sample may be preserved by cooling to ≤6 °C, reducing residual chlorine with 0.008% sodium thiosulfate, storing in the dark, and adjusting the pH to 6-9; samples preserved in this manner may be held for 7 days before extraction and for 40 days after extraction. Exceptions to this optional preservation and holding time procedure are noted in footnote 1 (re: the required for thiosulfate reduction of residual chlorine), and footnotes 5, 6 (re: the analysis of benzidine).

(5) If 1,2-diphenylhydrazine is likely to be present, adjust the pH of the sample to 4.0±0.2 to prevent rearrangement to benzidine.

(6) Extracts may be stored up to 7 days before analysis if storage is conducted under an inert (oxidant-free) atmosphere.

(7) For the analysis of diphenylnitrosomine, add 0.008% $Na_2S_2O_3$ and adjust pH to 7-10 with NaOH within 24 hours of sampling.

Section 6.0 Amendment

This is an amendment to QA Manual Version 2.24 to update the holding time for chlorophyll in Table 6.6.

Table 6.6 REQUIRED CONTAINERS, PRESERVATION TECHNIQUES, HOLDING TIMES, AND SAMPLE VOLUMES (Aqueous Samples)

Parameter	Container[1]	Preservation[2]	Max. Holding Time	Req Vol (mL)
Acidity	P, G	Cool ≤6 °C, no head space	14 days	200
Alkalinity	P, G	Cool ≤6 °C, no head space	14 days	200
Alkalinity (Total)	G	0.03% $HgCl_2$, Cool ≤6 °C, 1-2% head space	6 months	200
Ammonia, total, unionized	P, G	Cool ≤6 °C, $H_2SO_4$to pH<2	28 days	100
Biochemical oxygen demand	P, G	Cool ≤6 °C	48 hours	300
Biochemical oxygen demand carbonaceous	P, G	Cool ≤6 °C	48 hours	300
Biomass	P, G	Cool ≤6 °C	24 hours	500
Brevetoxin: Field Samples	G	Cool ≤6 °C, extract within 48 hours	48 hours	500
Brevetoxin: Mitigation Projects	G	Extract within 24 hours		
Carbon, Inorganic	G	0.03% $HgCl_2$, Cool ≤6 °C, 1-2% head space	6 months	50
Carbon, Total organic	P, G	Cool ≤6 °C, H_2SO_4 to pH<2	28 days	50
Chemical oxygen demand	P, G	Cool ≤6 °C, H_2SO_4 to pH<2	28 days	100
Chloride	P, G	None required	28 days	100
Chlorine, total residual	P, G	None required	Analyze w/in 15 min	500
Chlorophyll/Phaeophytin	P, G	Cool ≤6 °C, Filter within 48 hours and $MgCO_3$ and freeze	~~21~~28 days after filtration	1000
Chromium VI	P, G	Cool ≤6 °C, $9.3 < pH < 9.7$	28 days	200
Coliform, fecal and total	P, G	Cool <10 °C[3]	6 hours	200
Color	P, G	Cool ≤6 °C	48 hours	250
Cyanide, total	P, G	Cool ≤6 °C, NaOH to pH>12[4]	14 days[5]	500
Endocrine Disruptors for GC	G	Fix on site, cool ≤6 °C, extract within 48 hours	6 months	500
Enterococci	P, G	Cool <10 °C	8 hours	200
Fecal streptococci	P, G	Cool <10 °C[3]	8 hours	200
Fluoride	P	None required	28 days	300
Hardness	P, G	HNO_3, or H_2SO_4 to pH<2	6 months	100
Kjeldahl and organic nitrogen	P, G	Cool ≤6 °C, H_2SO_4 to pH<2	28 days	200
Metabolic rate	G	Fix on site, dark, water seal	8 hours	300
Metals (except chromium VI and mercury)	P, G	HNO_3 to pH<2	6 months	1000
Mercury (CVAA)	P, G	HNO_3 to pH<2	28 days	200
Microcystin: Field Samples	G	Cool/Freeze ≤4 °C	28 days	500
Microcystin: Mitigation Samples	G	Extract within 24 hours	28 days	500
Nitrate	P, G	Cool ≤6 °C	48 hours	100
Nitrate-nitrite	P, G	Cool ≤ 6 °C, H_2SO_4 to pH<2	28 days	100
Nitrite	P, G	Cool ≤ 6 °C	48 hours	100
Odor	G	Cool ≤ 6 °C	6 hours	500
Oil and grease	G	Cool ≤ 6 °C, H_2SO_4or HCl to pH<2	28 days	1000
Oxygen, Winkler	G	Fix on site and store in dark	8 hours	300
Pesticides for GC and LC/MS	G	Fix on site, cool ≤6 °C, extract within 48 hours	6 months	500
pH	G	None required	Analyze immediately	250
Phenols	G	Cool ≤ 6 °C, H_2SO_4 to pH<2	28 days	1000

Table 6.6 REQUIRED CONTAINERS, PRESERVATION TECHNIQUES, HOLDING TIMES, AND SAMPLE VOLUMES (Aqueous Samples) (continued)

Parameter	Container[1]	Preservation[2]	Max. Holding Time	Req Vol (mL)
Phosphorous, total	P, G	Cool ≤ 6 °C, H_2SO_4 to pH<2	28 days	200
Phosphorous, hydrolysable	P, G	Cool ≤ 6 °C, H_2SO_4 to pH<2	28 days	200
Phosphorous ortho-	P, G	Cool ≤ 6 °C	48 hours	100
Pigments for HPLC	P, PP	ASAP, Filter within 24 h Liquid nitrogen	365 d	100-250 mL (in highly turbid waters or intense phytoplankton bloom conditions); 250-1000 mL (coastal-deep shelf waters of west Florida shelf)
Phytoplankton counts	P, G	Ütermohls iodine solution	6 mos @ RT 3 yrs @ 0-4°C	20
Radionuclides	P, G	HNO_3 to pH<2	6 months	2000
Silica	P	Cool ≤ 6 °C	28 days	300
Solids, total (TS)	P, G	Cool ≤ 6 °C	7 days	500
Solids, dissolved (TDS)	P, G	Cool ≤ 6 °C	7 days	500
Solids, suspended (TSS)	P, G	Cool ≤ 6 °C	7 days	500
Solids, settable (SS)	P, G	Cool ≤ 6 °C	48 hours	500
Solids, volatile (VS)	P, G	Cool ≤ 6 °C	7 days	500
Specific conductance	P, G	Cool ≤ 6 °C	28 days	200
Sulfate	P, G	Cool ≤ 6 °C	28 days	200
Sulfite	P, G	None required	Analyze w/in 15 min	500
Sulfide	P, G	Cool ≤ 6 °C, Zinc acetate and NaOH, pH<9	7 days	500
Surfactants	P, G	Cool ≤ 6 °C	48 hours	1000
Temperature	P, G	None required	Analyze immediately	200
Turbidity	P, G	Cool ≤ 6 °C	48 hours	100

[1]P = polyethylene, G = Glass, PP = polypropylene

[2]When specified, sample preservation should be performed immediately upon sample collection.

[3]In presence of residual chlorine, use 0.008% $Na_2S_2O_3$ for preservation.

[4]In presence of residual chlorine, use 0.6 g ascorbic acid.

[5]If sulfide is not removed, maximum holding time is 24 hours.

7.0 <u>SAMPLE CUSTODY</u>

7.1 Definition

Samples are considered to be in an individual's custody if:

1) in the individual's physical possession,
2) in sight, after being in the individual's physical possession,
3) or placed by the individual in an intermediate secure area (*i.e*. locked vehicle, other locked storage.)

Sample chain of custody is maintained from sample collection until storage in a secure area of the laboratory. The chain of custody is defined as the documents and records which identify the history of and all persons responsible for the sample from sample collection through receipt at the laboratory, where the sample identity is entered into the laboratory sample tracking system or LIMS. Records of container and sampling kit preparation can also be included when containers are prepared and provided by MML. Any individuals with the samples in their possession (including collection, transport, and receipt) are identified by a signature. Legal chain of custody is not required by MML clients or the DEP QA Rule, but MML is prepared to achieve legal chain of custody in QAPP if the need arises at some future date.

7.2 Interaction of Departments, Other Organizations

Maintenance of chain of custody and proper storage and preservation of all samples are handled on a department basis, with respective department Sample Custodian, or their designate, each receiving samples for various ecology sections. The Sample Custodians are responsible for the correct preparation of sample container kits, sampling equipment, and preservation reagents.

Department Custodians also review, if necessary, the chain of custody procedures and required documentation with field personnel. Sample Custodians or their designates receive samples from the field samplers or transporters, review the completed custody sheets, verify that the correct number of samples are returned, that all samples are identifiable and correctly logged, assess whether any containers are compromised (leaking, air bubbles, etc.), verify adequate sample volume, that ice is present for temperature preserved samples, check temperature blanks and document temperature of the temperature blank, and re-verify that pH values of acid or base preserved samples are appropriate.

Where sampling efforts include parameters to be analyzed by more than one department, each container type is prepared by the department responsible for the analysis. Cleaned containers are transferred to the department responsible for sampling for assembly into sampling kits, sampling, and transport. On return to MML, the Sample Custodian who receives the samples as a group is responsible for transmitting, within the laboratory, the various sample fractions to the Sample Custodians of the other departments. Each department is responsible for verifying the integrity and preservation of the department's respective sample fractions and ensuring subsequent proper storage.

When samples are collected by other approved organizations and transferred to MML for analysis, custody procedures are initiated by the collector when they supply the containers, with MML continuing the chain of custody for transport and/or receiving samples.

When MML provides sampling containers, the sampling organizations are also provided with custody forms to initiate the chain of custody when samples are collected, with MML again continuing the chain of custody for transport and/or receiving the samples. In the event that samples are delivered to the laboratory with no chain of custody or incomplete information, minimal information required for sample acceptance includes the date and time of collection, name of collector, sample origin, name and signature of transporter, field I.D. number, if available, intended analyses, and method of preservation. Laboratory I.D. number will be assigned on receipt.

When MML collects samples and transfers them to other laboratories (by either MML staff or by commercial shipper) for analysis, chain of custody is maintained using custody forms and procedures of either MML or the receiving analytical laboratory, with the final analytical laboratory recording final receipt of the samples.

The originals of all custody sheets are retained by the collecting organization, and, if retained by MML, are stored with project records following entry into the sample tracking system. When MML is not the collecting organization, photocopies of custody sheets, all other shipping documents, and custody forms from other organizations, are made and stored with project records.

7.3 Documentation

Documentation used to maintain and record sample custody include the following:

1) Container cleaning records
2) Sample kit preparation records
3) Sample labels
4) Custody Forms
5) Field notebook or sheets
6) Container status records

Custody documentation is completed in permanent, waterproof ink with any errors corrected according to standard laboratory practice of a single line drawn through the error and initialed by the corrector. Any corrections will be made with a single line drawn through them. The correction will be highlighted and dated. For all corrections, other than a transcription error, the reason for the correction must be provided. (Records prepared on waterproof paper in the field may use pencil if ink pens are not functional due to humidity or rain.)

The documentation is discussed below and examples of some of the various departments appear included as figures.

7.4 Container Cleaning

New sampling containers are either verified to be non-contaminating for the parameter of interest by analyzing a container blank from each manufacturer's lot of containers received (typically 100-200 containers), or are cleaned prior to sampling according to standard protocols (**Section 6.0**). Containers for analysis are cleaned under the direction of the Sample Custodian in large lots. Lot numbers of acids, solvents and other cleaning materials are recorded on the cleaning log (**Figures 7.1 ~~and 7.2~~**), together with the cleaning method reference, and preparers' initials or signature. Records of container cleaning are stored in department-specific laboratory files.

7.5 Sample Kit Preparation

Sample kits are prepared (**Figure 7.2**) under the Sample Custodians' direction, by the department responsible for sampling, according to the analyses requested by the Project Manager. For chemical sampling, blank containers are drawn from the same lot as is used for sample containers. Prepared kits are assigned kit numbers which are recorded by the field crew to permit traceability of field equipment, containers and preservatives. Records of completed sample kit preparation are stored in department-specific laboratory files.

The department Sample Custodian is responsible for ensuring that proper preservatives, instructions for any field processing (filtration, etc.), and holding times are appropriate and transmitted to the sampling department. Typically, all containers required at a single station are pre-labeled and segregated. If clean containers are supplied by other laboratories, they are obtained in advance, pre-labeled, and incorporated into the sample kits with the MML prepared containers. The sample ID numbers assigned to the sampling kits are also recorded on the sample kit preparation record.

7.6 Sample Labels

Sample containers for the Chemical & Physical Ecology Program are labeled with water and freezer proof labels prior to sampling (**Figure 7.3**) using unique Field ID numbers or Tag numbers pre-printed in the format X-YY-# # # #, where X is the fraction designation (generally corresponding to preservative type), YY is the year, and # # # # is assigned in ascending order as containers are needed. The labels explicitly indicate required preservative as well as color coding (red for nitric acid, blue for hydrochloric, etc.). The entire seven-place Tag number is used as both the field and the laboratory ID number. Field logs, custody sheets, and bench sheets record both alphabetical fraction and year, together with the four-digit number for sample tracking and data management. Other information pre-printed on the sample label include project number, and requested analyses. Sample labels are affixed with permanent adhesive directly to the sample containers, and are discarded with the empty containers after sample discard or are removed, or otherwise rendered illegible, if containers are to be washed and reused.

Sample containers for organic chemical analyses are labeled with the following information: project name, station location and/or matrix, ID number, and sampling date (**Figure 7.4**). The ID number is preceded by a letter and two numbers (ex. R-03-3065). The letter represents a designation for a red tide sample and the next two numbers are the last two numbers of the year of the sampling date. The four-digit number is a unique number that is assigned for each sample in ascending order. The unique four-digit numbers are checked out through a label log book maintained by the sample custodian, all of the sample label information is also located in field logs, extraction logs and custody sheets. After samples are extracted and volumes reduced, the samples are put in vials and labels are transferred to vials for storage.

Biological samples (phytoplankton) for phytoplankton ID/abundance and HPLC phytopigment analysis are labeled with a 6-digit custody number (the first two digits indicate the year and the next 4 digits are unique sequential numbers – i.e., 175678) station and date. The custody number is verified to match with the sample log entry. After filtering a water sample for HPLC phytopigment analysis, the filter is wrapped in heavy duty aluminum foil and labeled with the custody number (as described above), date, station, and volume filtered.

Biological samples (macroinfauna) are labeled with both internal and external labels (**Figure 7.5**), on which the unique sample identification code is comprised of collection date, project, station, and replicate number. Internal labels are duplicates of external labels with the exception of having no adhesive. Sampling details (size of coring device, sieve size) are included on label information. Where the material from a single core or sample requires two containers, the same ID code is assigned to both containers, *i.e.*, 1 of 2, and 2 of 2. The internal label is kept with the contents of each sample container during all phases of processing (decanting and sorting) and, once organisms are removed from the sediment and segregated by major taxonomic groups, continues to accompany the vials containing the groups of organisms. In addition, each vial of the major taxonomic groups has an internal label identifying station, replicate, and collection date or unique sampling code. An example of a container label for samples collected in the Environmental Laboratory for Forensics is shown in **Figure 7.6.** Samples for all varieties of analyses are labeled the same with the following information: The first letters of the sample name correspond to the project name, the next two numbers the year the sample was collected, the last numbers are the lab issued sample number and any letters following the sample number indicate what type of sample. Therefore, the unique sample number of NPRA-10-0891S translates to the National Petroleum Reserve Alaska project, collected in 2010 with the sample number of 0891 and is sediment (S). Sample numbers are checked out through our sample identification book and a unique number is assigned to each sample. This sample number is then used for that sample carried through each analytical extraction and analysis and kept in custody sheets, extraction logs and instrument analysis files.

If samples, either chemical or biological, are submitted to the laboratory with an organization's numerical code already in place, then that number forms a part of the station ID information, and MML assigns it's own sequential and unique numerical code number to each individual sample.

7.7 Custody Forms and Transmittal of Samples

The chain of custody for samples for chemical analysis is maintained through custody forms illustrated in **Figures 7.7** and **7.8**, which includes a listing of Analyses to be performed. Fractions to be collected at each station and required preservatives are listed in headings. Custody of biological samples is maintained through similar forms (**Figure 7.9**). ~~Phytoplankton Ecology chain of custody is maintained through custody forms shown in **Figure 7.11**.~~ Chain of custody in the Environmental Laboratory for Forensics is maintained through custody forms shown in **Figure 7. 10**. Red Tide Institute chain of custody is maintained through custody forms and filtration logs shown in **Figures 7.11** and **7.12**. The sampling crew records:

1) Sampling date
2) Sampling kit lot number(s)
3) Crew names and initials
4) Station identification
5) Collection time
6) Collection depth (if applicable)
7) Collection method
8) Sample ID (four digit container numbers)
9) Any pertinent comments on samples

Required chemical analyses are listed on custody forms, on sample labels and in QA Project Plans. The bottom of the custody form is used for signatures of the sampler, as well as all individuals who assume custody of the samples, together with date and time of each transfer.

Following the guidelines in EPA 600/4-79-019, March 1979, "Handbook for Analytical Quality Control in Water and Wastewater Laboratories", groups of samples are transferred together using a single custody form. Each person assuming custody confirms the total number of containers received and notes this quantity in the allowed space. The final signature and date are for the receipt of samples at the Laboratory by the MML Sample Custodian, or their designate, or the Custodian of another laboratory. Following entry into the sample tracking system or LIMS, the custody forms are stored in department project-specific files.

7.8 Sample Transport

Samples are typically returned by the sampling crew or a transporter (generally an MML staff member) directly to MML. Samples requiring temperature preservation are stored during fieldwork (and during transport) on ice in insulated coolers or in liquid nitrogen containers when appropriate. Where temperature preservation is required, coolers are iced prior to collection and sufficient ice is maintained in the cooler until receipt at the laboratory. ~~A temperature blank is also included.~~ Preserved biological samples do not require temperature preservation and are typically accumulated and transported in crates or coolers at ambient temperature.

Samplers follow identical procedures whether delivering samples to MML or to a subcontracted laboratory. In the event that holding times permit, samples scheduled for subcontracting may be returned to MML initially, logged into the MML tracking system, stored appropriately, and then transported to the subcontracting laboratory at a later time. Transport under these conditions is identical, with samples and a temperature blank maintained on ice in insulated containers.

If shipped immediately following collection, shipping coolers are filled with wet ice ~~and a temperature blank~~ if temperature preservation is required, sufficient packing material to prevent breakage of any glass containers, and sealed with strapping tape before release to the shipping company. Samples already chilled to ≤ 6 °C in the laboratory cold room (i.e., sampled, placed on wet ice, received at the laboratory, stored in the cold room, and transferred to another laboratory at a later date) may be shipped on reusable, frozen, gel ice packs to maintain temperature. Frozen samples may be shipped on dry ice, so long as transportation regulations are adhered to.

When samples are shipped via common carrier to another laboratory, the original custody sheet is retained by the sampler and a photocopy is sealed in the shipping container with the samples. In place of the signature of a transporter, the carrier is identified and all shipping documents are retained by the sampler for inclusion in project files. In the event that photocopying facilities are unavailable, a duplicate custody form will be prepared for transport with the samples, with sampler again retaining the form originally prepared. Shipping coolers are filled with wet ice ~~and a temperature blank~~ if temperature preservation is required, sufficient packing material to prevent breakage of any glass containers, and sealed with strapping tape before release to the shipping company.

Samples, sample extracts, or biological specimens shipped or delivered to another laboratory after receipt at MML may alternatively have a shipping record accompany them which is a custody form in which the custody of samples or extracts originates at MML and ends at the receiving laboratory. Information recorded on this form duplicates the collection date, time, and depth, station identification, and container ID number for field and lab ID from the original field custody form. Date of any sample preparation and requested analyses are also included. Samples already chilled to ≤6 ºC in the laboratory cold room (i.e., sampled, placed on wet ice, received at the laboratory, stored in the cold room, and transferred to another laboratory at a later date) may be shipped on blue ice to maintain temperature. Frozen samples may be shipped on dry ice, so long as transportation regulations are adhered to.

MML occasionally subcontracts analyses or sampling to other laboratories. For analyses that are required to be conducted by labs holding NELAC certification, MML only utilizes approved laboratories for such analyses. Florida DEP publishes a database of laboratories holding current certification through the DOH Environmental Laboratory Certification Program. This database can be accessed at https://fldeploc.dep.state.fl.us/aams.

7.9 Field Logs

Field logs are bound, waterproof volumes or field sheets of waterproof paper. Formats for data recording are designed for each individual project (**Figure 7.13** and **Figure 7.16**) and match the logical flow of work in the field. An example of RTI field log is in **Figure 7.14**. Required information is listed for each station to be visited and blanks left for samplers to record field data.

Data required for inclusion in field records include the following, as applicable for the various sampling types:

1) Specific project plan if applicable.
2) Analyses for each sample fraction collected
3) Sampling platform (boat, truck)*
4) Date of sampling
5) Names and initials of sampling crew
6) Field meter serial numbers
7) Sampling equipment and serial numbers (including use of gasoline powered pumps or other fuel powered units)
8) Field calibration results
9) Sampling kit lot number
10) Station location, ID number, or address
11) Field conditions (weather, currents, etc. as applicable)
12) Material of plumbing* and tap*, if in place
13) Any field decontamination performed
14) Depth to ground, water table, and bottom of well from top of casing, well diameter*, composition*, drilling method* and mud used* (if known)
15) Purge volumes, calculations, time, equipment, and technique (3 vols. plus <5%, 5 min readings, or 5 vols.)
16) Date of well purging, if different from sampling.
17) Purge flow rate, purge times, and flow rate for sample collection (500 ml/min)
18) *In situ* field data (including for purge monitoring)
19) Depth of sample or horizon of sediment collected
20) Time of sample collection (time range for composite samples)
21) Sample ID number
22) Number of organisms per sample (for tissue collections)
23) Fractions collected (in order of collection)
24) Preservation (pH) checks and any additional reagents required
25) Signature of sampler

*May be reported in project plan if known in advance of sampling.

Collection of QC samples (field duplicates, equipment blanks, surrogate samples) are treated identically to samples, assigned an ID number, recorded in the field log and on the custody form. Original field logs are retained with the sample custody forms in project files.

7.10 Laboratory Receipt

Immediately upon receipt of samples at MML, sample integrity is assessed (broken containers, leaking containers, bubbles in fractions which require no head space to be present). Any comments as to sample integrity are noted on the custody forms as well as being entered into the sample tracking system or LIMS to accompany the resultant data on that batch. The Sample Custodian, or their designate, also verifies that holding times have not expired, appropriate sample containers have been used, and sufficient sample volume to perform the necessary tests is present.

The total number and ID number of each fraction is verified against the custody form accompanying that sample batch. No samples from that batch are distributed for analysis until all have been verified in this manner. Any anomalies, transcriptional or transpositional errors are noted on the custody sheet and tentatively rectified by the Sample Custodian and finalized after review of the field log and consultation with the crew leader who collected the sample in question. All record-keeping errors are made by one line marked through the error. The individual making the corrections signs (or initials) and dates the corrections. For all errors other than transcription errors, an explanation for the correction is also included.

The pH of each sample requiring pH adjustment is checked with narrow range pH indicator paper by the Sample Custodian, and the results are noted on the sample custody sheet. Additional acid or base is added if required, and the date and lot number of this addition is recorded on the sample custody sheet and in the sample tracking system. Biological samples are checked for proper preservation and staining when decanted after at least 72 hours of preservation. Again, if any additional formalin or stain is required, it is added by the Sample Custodian and noted on the sample custody form.

Whether ice is present in coolers of samples requiring ≤6 °C for preservation is also noted on the sample custody sheet. ~~If the required ice is not present, the temperature of the melt water or of a sample aliquot is recorded to determine if any reduction of temperature from ambient has occurred or been maintained.~~ Where thermal preservation of samples is required, the laboratory shall verify the temperature of samples upon receipt. All samples that require thermal preservation shall be considered acceptable if the arrival temperature of a representative sample container is either within 2 °C of the required temperature of the method specified range. For samples with a specified temperature of 4 °C, samples with a temperature ranging from just above the freezing temperature of water to 6 °C shall be acceptable. Samples that are delivered to the laboratory on the same day they are collected may not meet the required temperature. In these cases, the samples shall be considered acceptable if the samples were received on ice. Thermal preservation is not required in the field if the laboratory receives and refrigerates the sample within fifteen (15) minutes of collection.

Once received at MML, samples are tracked through the sample logging system which generates sample preparation and analysis work orders, complete with expiration dates and required preservation and storage conditions. Individual analysts are assigned parameters and are responsible for completing the analyses within the specified holding times.

7.11 Sample Acceptance Policy

The following text outlines the circumstances under which samples shall be accepted in order to meet NELAC requirements. Samples will be accepted only if the following criteria are met. Data from any samples which do not meet the following criteria will be flagged unambiguously to define the reason the samples did not meet acceptance criteria.

Acceptance criteria:

1. The sample must include full and complete documentation to include sample identification, location, date and time of collection, collector's name, preservation type, sample type, and any special remarks concerning the sample.
2. The sample must be labeled with a unique identifier written on water resistant labels with indelible ink adhered to each container with a link to the chain-of-custody documentation for the samples.
3. Samples must be placed in appropriate sample containers and stabilized with chemical preservatives and ice as appropriate for the analysis and method being conducted.
4. Specified holding times must be adhered to.
5. Adequate sample volume must be present, to include sufficient sample volume to perform the necessary tests.
6. If samples show signs of damage, contamination, or inadequate preservation, these conditions must be documented on the sample custody form and laboratory receipt documents.

If a sample does not meet acceptance criteria, a decision will be made by Technical Directors whether to proceed with the analysis of samples not meeting acceptance criteria or to reconstruct the sample from another intact fraction collected from the same location. The decision to proceed with analyses or to reconstruct the sample will be fully documented on the sample custody form. The condition of these samples will be documented on the chain of custody or transmittal form and laboratory receipt documents. Data will be qualified in the final report using appropriate Data Qualifier codes (**Table 12.1**).

Samples are rejected for analysis:

If recollection is possible and

1) Source of container cannot be documented
2) anomalous container identification cannot be resolved
3) integrity is compromised,
4) holding times have expired, or
5) the sample has obviously been contaminated (container broken, leaking container in contact with ice melt water)
6) there is insufficient sample volume to perform the necessary tests

Where no recollection is possible, project managers are consulted as to the desirability of either:

1) proceeding with analyses of the submitted samples, which are compromised through either identity, condition, or holding time, or
2) reconstructing compromised sample fractions from other intact fractions by aliquoting, and/or filtering as required, an unpreserved sample and adding appropriate preservatives at the laboratory rather than in the field.

Any data generated from compromised samples in the above manner will be reported as screening or provisional data, fully accompanied by a description of the problems and techniques used.

7.12 Container Receipt and Status Records

For Chemical & Physical Ecology, sample containers are tracked through field and lab with a unique alphabetic fraction designation and four digit code (Tag Number) in the format X-YY-# # # #, (where X is the sample preservation fraction, YY is the year, and # # # # is a unique sequential sample number referring to a date-time-station-depth. The same Tag Number is used as both the field and lab container ID number.

On receipt by the Chemical & Physical Ecology Program, samples are entered into the sample login segment of the LIMS and entries proofed. The LIMS then generates electronic work orders and tracks associated status records of all required pretreatment and analytical requests.

The LIMS-assigned Work Order number is in the format YYMM # # #. In addition the LIMS assigns a unique sample ID in the format of YYMM # # # -nnnX, where YY is the two digit year, MM is the month, # # # is the three digit sequential batch of samples received, nnn is the sequential number of the sample (and all of its associated aliquots) within the batch, and X is the letter designation of the sample fraction (which generally corresponds to a preservation type). While individual analytical data are stored in the LIMS by LIMS ID, the shorter Tag number facilitates analyses and the alignment of final data products.

Information incorporated by the LIMS entry includes:

1) Work Order number
2) Sampling date
3) Project number or name
4) Client ID (optional)
5) Sampler
6) General sampling or QA notes
7) Date data required (optional)
8) Date and time received
9) Sample matrix
10) Sample fractions collected
11) Fraction preservative/storage
12) Fraction QA notes (*i.e.* additional acid for field preservation)
13) Analyses requested
14) Station ID
15) Collection time
16) Collection depth (if applicable)
17) Container QA notes (additional preservative added at laboratory, integrity)

18) Tag Number (field and lab Container ID)
19) Sample and fraction LIMS ID

Some of these aspects are illustrated for a single sample in **Figure 7.15**. Other screens identify samples pending for selected parameters, holding times, and dates of analyses, QA computations, supervisor validation, work order completion, reporting, and sample discard.

Samples for biological analyses (macroinfaunal samples) are tracked through a similar process, again using the unique sample identifier comprised of collection date, project, station, and replicate number. Following the receipt of the sample custody forms, the status of samples is indicated by sorting logs (**Figure 7.17**), indicating the sorter and sorting dates of the rough sorting of organisms from the sediments into major taxonomic groups. Identification logs (**Figure 7.18**) again document the taxonomists and dates during which the organisms of each group were identified, while resort logs (**Figure 7.19**) document the status and results of any resorts of residual sediment. Custody forms and sorting and identification logs for biological samples are maintained in project files.

Samples for HPLC phytopigment analysis are tracked through sample processing by recording information from the sample container and completed processing steps on a processing log. Analysis of phytoplankton samples for identification and enumeration of *Karenia brevis* and other *Karenia* species is documented in the *Karenia* sp. enumeration log (**Figure 7.20**), which includes collection and count dates, station/sample ID information, count volume, and taxonomist.

Samples for Suspended Particulate Matter are tracked through the in-house SPM filter/weighing custody log (**Figure 7.21**).

7.13 Sample Storage

Samples are stored according to preservation requirements which are listed on sample labels, container status records, standard operating procedures, and analytical work orders. Sample Custodians, or their designate, are responsible for ensuring prompt appropriate storage after receipt. Chemical samples are typically stored either at ≤6 ºC in the laboratory cold room (aqueous, some sediments, some tissues), or frozen (some sediments, some tissues), dependent on scheduled analyses. Samples within the cold room and freezer are stored in designated areas by fraction or analysis type. Each analyst removing samples from storage is responsible for returning any unused sample to appropriate storage conditions, generally a secure cold room held at ≤6 °C.

Some parameters do not require lowered temperatures for preservation (radionuclides, most metals, etc.) and are stored at room temperature in air-conditioned areas of the laboratory. Preserved biological samples are also stored at ambient temperatures, but not necessarily in air-conditioned space.

Regardless of storage conditions, all samples are stored in secure areas either within the laboratory building (accessible to MML staff alone) or in locked storage. Sample extracts and digestates awaiting analysis are similarly stored in designated areas of the cold room. Standards and reagents are stored separately from samples in department specific locations, either in refrigerators or on laboratory shelving, dependent on storage condition requirements. Food is not permitted in the sample or standards storage areas.

Figure 7.1 CHEMICAL AND PHYSICAL ECOLOGY CLEANING LOG

CLEANING LOG
Mote Marine Laboratory, 1600 Ken Thompson Parkway, Sarasota, FL 34236

Date: ____________________ **Preparer:** ____________________

Reagents	RO	Tap Water	Liquinox	____% HCl	____% H_2SO_4	Solvent	Analyte free Water
Lot # Prep Date							
Exp Date							

Lot #	Quantity	Item	Method Reference	Storage

Date: ____________________ **Preparer:** ____________________

Reagents	RO	Tap Water	Liquinox	____% HCl	____% H_2SO_4	Solvent	Analyte free Water
Lot # Prep Date							
Exp Date							

Lot #	Quantity	Item	Method Reference	Storage

clean log.doc Revised: June 23, 2008

Figure 7.2 CHEMICAL AND PHYSICAL ECOLOGY SAMPLE KIT PREPARATION

Sample Kit Preparation Log **Page _______**

Mote Marine Laboratory, 1600 Ken Thompson Parkway, Sarasota, FL 34236

Kit # 181-_______________ Project: ________________ Comments: ___________________

Date:________________ Preparer: _______________ Number of Kits: ________________

Id #s: _______________ to _______________

Containers

Letter Designation	Quantity per Kit	Container Type	Analyses	Total Number	Lot Number

Preservation

Reagents	Lot #	Container Type	Exp Date

Sampling Gear

Quantity	Item	Lot # / SN

KIt-log-180103.doc December 18, 2018

Figure 7.3 **CHEMICAL AND PHYSICAL ECOLOGY SAMPLE CONTAINER LABELS (FIELD AND LABORATORY CONTAINER ID)**

NH4N NO23N PO6
F 24- 3464
112-342 FILT FREEZE

NH4N NO23N PO6
F 24- 3465
112-342 FILT FREEZE

NH4N NO23N PO6
F 24- 3466
112-342 FILT FREEZE

NH4N NO23N PO6
F 24- 3467
112-342 FILT FREEZE

Figure 7.4 **ECOTOXICOLOGY SAMPLE CONTAINER LABELS**

FL Keys

RT-18-8843

11/26/18

Summerland Key

Sk-2

P-17-1682

7/12/17

Barnacle Stop

Stick 1

C-17-1440

5/15/17

EPA

Station 5

EDC-17-1492

6/7/17

R=Red Tide C=Capsaicin

P=Pesticides EDC=Endocrine Disrupting Compounds

Figure 7.5 **BENTHIC SAMPLE CONTAINER LABELS**

Mote Marine Laboratory
1600 Ken Thompson Parkway
Sarasota Fl. 34236
(941)388-4441 ext.447

AJB
04/05/2006

10S Rep 2 **02/06**

111.635 Venice RO
Collectors: AJB, LJ Feb. 14, 2006

Mote Marine Laboratory
1600 Ken Thompson Parkway
Sarasota Fl. 34236
(941)388-4441 ext.447

AJB
03/29/06

5N Rep 2 **02/06**

1 11.635 Venice RO
Collectors: AJB, LJ Feb. 14, 2006

Mote Marine Laboratory
1600 Ken Thompson Parkway
Sarasota Fl. 34236
(941)388-4441 ext.447

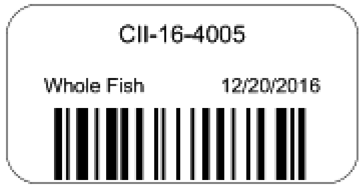
AJB
04/07/06

10S Rep 3 **02/06**

111.635 Venice RO
Collectors: AJB, LJ Feb. 14, 2006

Figure 7.6 ENVIRONMENTAL LABORATORY FOR FORENSICS CONTAINER LABELS

Sample:



Standard:

Inventory:

Figure 7.7 CHEMICAL AND PHYSICAL ECOLOGY SAMPLE CUSTODY SHEET

MOTE MARINE LABORATORY 1600 Ken Thompson Parkway, Sarasota, FL 34236 (941) 388-4441 Page _____ of _____
CUSTODY SHEET- SBMN Kit #____________ Prject No. 112-618 (SB)
Sampling Date _____________ Log Book Pg #s __________ Work Order # _____________
Samplers: Name (Initials) ____________________( ) ____________________( ) ____________________( )
Mode of Sampling: Niskin - SN: ________DI Lot #: ______________________Temp Blank: Filled _____Time: __________

STATION DESIGNATION	TIME (EST)	SAMPLE DEPTH	H – 22 P, Br 250/500 m DARK, ICE	R - 22 G, 20 ml 2 drops Utermohls	B – 22 P, 125 mL ICE	D - 22 P, ½ gal ICE	A - 22 P, 250 ml 2 ml 1:4 H_2SO_4 pH <2, ICE	pH ✔ FLD	pH ✔ LAB
Cnt Blank									
Eqp Blank									
		1.0m / Mid							
		1.0m / Mid							
		1.0m / Mid							
		1.0m / Mid							
		1.0m / Mid							
		1.0m / Mid							
		1.0m / Mid							
		1.0m / Mid							
		1.0m / Mid							
		1.0m / Mid							
		1.0m / Mid							
		1.0m / Mid							
		1.0m / Mid							
		1.0m / Mid							
		1.0m / Mid							
		1.0m / Mid							
		1.0m / Mid							
ANALYSES	A: NH_4N, $NO_{23}N$, TKN, TOTP, B: PO_4P, D - BOD_5, Color-T(Spec), Turb, R - Cell Counts (*K. brevis*) H - Chl-a (Fluoro)								

Matrix: Est/Marine, Surface Water, _______ **CONTAINER COUNT, THIS PAGE ONLY _____**

RELINQUISHED BY: (SAMPLER'S SIGNATURE)	RECEIVED BY:(TRANSPORTER'S SIGNATURE)	DATE/TIME:	COUNT VERIFIED:
RELINQUISHED BY:	RECEIVED BY:	DATE/TIME:	COUNT VERIFIED:

Ice: Y / N Temp Blk:Contn: ____________, Temp: ____°C, T meter SN: _______________ Contn verified 100% ___
Comments:____

SB-618-211208.doc Revised: December 8, 2021

Figure 7.8 ECOTOXICOLOGY CUSTODY SHEET

MOTE MARINE LABORATORY
12300 Fruitville Road, Sarasota, FL 34240
CUSTODY SHEET

Project Name:____________________ Lot #:______________________________
Sampling Date:___________________ Culture Strain:______________________
Samplers:_______________________ Cleaning #:_________________________
Extractors:______________________ **T=** Target Analytes:___________________

Row	MML ID	Sample ID	Extr. Instr. & Position	Extr'd Volume/ Weight	Solvent	Final Volume	Comments	Method Code
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								

Relinquished By: (Samplers Signature)	Received By: (Transporter's Signature)	Date/Time:	Count Verified
Relinquished By:	Received By:	Date/Time:	Count Verified

Sample Disposal: (circle, date and initial)	depletion haz waste	neutralization other

Legend:	**P** = Presto **C** = Chrom	**Sample Status:** (Initial & Date)	Extracted:	Evaporated:	Filtered:	Analyzed

Notes:

Figure 7.9 BENTHIC ECOLOGY CUSTODY SHEET

MOTE MARINE LABORATORY
1600 THOMPSON PARKWAY, SARASOTA, FLORIDA 34236

CUSTODY RECORD FOR BIOLOGICAL SAMPLES

PROJECT NAME:__________ PROJECT NO. __________

SAMPLING DATE:________ CUSTODY SHEET #:________ KIT #:________

SAMPLING CREW:________ ________ ________ ________ ________

STATION	REPLICATE	# CONTNS	CONTN ID #	TIME	COMMENTS

PRESERVATIVE CHECKED________ CONTAINER COUNT________ (THIS PAGE ONLY)

RELINQUISHED BY	RECEIVED BY	DATE/TIME	COUNT VERIFIED
SAMPLER	TRANSPORTER 1		
TRANSPORTER 1	TRANSPORTER 2		
TRANSPORTER 2	LAB		

DECANT DATE/INIT
ISOPROPYL ALCOHOL PREP. DATE

SAMPLE CHECKED 100% ____________ (signature)
STORAGE/DISPOSAL OF ANIMAL LOTS: DATE ______ BY ________
DISPOSAL OF RESIDUAL SEDIMENT: DATE ______ BY ________
RETURN OF RESIDUAL SEDIMENT: DATE ______ BY ________TO________

Figure 7.10 **ENVIRONMENTAL LABORATORY FOR FORENSICS SAMPLE CUSTODY SHEET**

Mote Marine Laboraory Chain of Custody Form							COC Form _____ of _______
Sampler/Shipper Information				Receiver Information			
Mote Marine Laboratory, Environmental Laboratory for Forensics Email@mote.org 1600 Ken Thompson Parkway, Sarasota, FL, USA 34236 (941) 388-4441							
MML ID#	Sample collection Date	Treament/Tank	Matrix	Project Name			
	mm/dd/yyyy			Field ID	Species	Test ID	Comments

Test ID	Test Start Date	Test End Date		

Relinquished by				Received by			
Date	Time	Signature	Printed Name/Org.	Date	Time	Signature	Printed Name/Org.

FIGURE 7.11 RED TIDE INSTITUTE CUSTODY FORM

Mote Marine Laboratory, Ken Thompson Parkway, Sarasota, Fl 34236. (941)-388-4441 Page _______ of ______

CUSTODY SHEET- RT Kit #______________________ Project No. 193-549

Sampling Date ____________________Work Order #__________________

Samplers/(Initials):____

Mode of Sampling: Rosette / Niskin / Pump / Other _____________________

STATION EH-XX-X	TIME (GMT/Local)	DEPTH (circle one)			Cubitainer 150uM mesh, 4L Ambient, Dark (✓)	C – 24 150uM mesh, 1/2 gal Ambient, Dark (24-7XXX)	Scint vial Whole water, 10mL Ambient, Lugol's (✓)	Cryovial whole water, 1mL Ice, Dark (✓)
		S	M	B				
		S	M	B				
		S	M	B				
		S	M	B				
		S	M	B				
		S	M	B				
		S	M	B				
		S	M	B				
		S	M	B				
		S	M	B				
		S	M	B				
Comments								

Matrix: Estuarine/Marine CONTAINER COUNT, THIS PAGE ONLY

RELINQUISHED BY: (SAMPLER'S SIGNATURE)	RECEIVED BY: (TRANSPORTER'S SIGNATURE)	DATE/TIME:	COUNT VERIFIED:
RELINQUISHED BY:	RECEIVED BY:	DATE/TIME:	COUNT VERIFIED:

Containers verified 100%

NOAA-20231208 C & D.doc December 8, 2023

FIGURE 7.12 RED TIDE INSTITUTE FILTRATION LOG

Mote Marine Laboratory, 1600 Ken Thompson PKWY, Sarasota, FL 24236
Page _____of ______
Filtration Log - ECOHAB ___________

Project code: 193-549

Analysts:______________________________ **Date:**_______________

Filter type	25mm GF/F Fired	25mm GF/F non-fired	25 mm fired GF/F							0.4uM membrane filter		0.2uM Supor
Station EH-XX-X	HPLC Record volume (mL)	Chl a Record volume (mL)	$\delta 15$ N Record volume (mL)	DON Complete? (✓)	INORG complete? (✓)	Urea complete? (✓)	TDP 24- Etched vial #	PP 24- Etched vial #	PP volume (mL)	DSi Complete? (✓)	PSi Record volume (mL)	qPCR Record volume (mL)

Figure 7.13 CHEMICAL AND PHYSICAL ECOLOGY FIELD LOG

MOTE MARINE LABORATORY, 1600 Ken Thompson Parkway, Sarasota, FL 34236 (941) 388-4441 Page___ of___

Physical/Chemical Characterization Field Sheet - SB Monitoring Project # 112-618

Date ______________

Samplers (Initials) __________________(_______), ____________________(_______), _________________ (_______)

SEGMENT				STA		TIME	EST	STA		TIME	EST
US	10	11	13	LAT				LAT			
14	16	DR	LB	LON				LON			

FIELD CONDITIONS	INI				INI			
CLOUD PERCENT								
WIND DIR (from DegM)								
WIND VELOCITY (MPH)		0 5 10 15 20				0 5 10 15 20		
WAVE HEIGHT (FT)		0 0.5 1 2 3				0 0.5 1 2 3		
RELATIVE TIDAL STAGE		Fld Ebb Slk-H Slk-L NV				Fld Ebb Slk-H Slk-L NV		
WATER DEPTH (M)		Station:		Flow: Mid /1m		Station:		Flow: Mid /1m
FLOW		Time (sec)		Dir (from) DegM		Time (sec)		Dir (from) DegM
		Count (I)				Count (I)		
		Count (F)				Count (F)		
D.O. AIR CAL (% SAT)		@		°C		@		°C
HYDROLAB MEASUREMENTS		0.2M	1M(>2M) / MID (<2M)	B -0.2M		0.2M	1M(>2M) / MID (<2M)	B -0.2M
SALINITY (PSU)								
TEMP (°C)								
pH (SU)								
SPEC COND (MS/CM)								
DO (MG/L)								
% SAT DO								
WQ SAMPLE TAG NUMBER		DEPTH: 1M(>2M) / MID (<2M) METHOD: NISKIN				DEPTH: 1M(>2M) / MID (<2M) METHOD: NISKIN		
ORDER OF FILLING: H, B, D, A		#		CUSTODY Y/ N		#		CUSTODY Y / N
SECCHI DEPTH (M)		DN :	UP:	MEAN		DN :	UP:	MEAN
IN SITU LIGHT MEASMNT (STORE 3) ($\mu E/M^2/SEC$)		UPPER @ ≥0.2M				UPPER @ ≥0.2M		
		LOWER				LOWER		
SHORELINE DESCRIPTION		BEACH / BOAT BASIN / COMMERCIAL/ DOCKS / ISLAND / MARINA / MANGROVE / OPEN BAY / SEA WALL / RESIDENTIAL (LOW / MEDIUM / DENSE) / RIP RAP / VEGETATION /				BEACH / BOAT BASIN / COMMERCIAL/ DOCKS / ISLAND / MARINA / MANGROVE / OPEN BAY / SEA WALL / RESIDENTIAL (LOW / MEDIUM / DENSE) / RIP RAP / VEGETATION /		
BOTTOM TYPE		MUD SAND GRASS NV				MUD SAND GRASS NV		
DESCRIPTION OF STATION LOCATION								
COMMENTS:								

Log-SB-618-P&C-201218 .doc, Date: December 21, 2020

FIGURE 7.14 RED TIDE INSTITUTE FIELD LOG

CTD Log

Date:________________________ ECO________________________
Vessel:________________________ CTD #:________________________
Mode of Sampling: Rosette / Niskin / Pump / Other: ____________________
Samplers: ____

Station #	Time start (EST)	Time end (EST)	Latitude (DD) XX.XXXXX	Longitude (DD) XX.XXXXX	Cast #	Depth M	CTD Type (R or H)	Start of Descent (EST)	Comments

Figure 7.15 **<u>CHEMICAL AND PHYSICAL ECOLOGY SAMPLE RECEIPT/STATUS TRACKING FORM</u>**

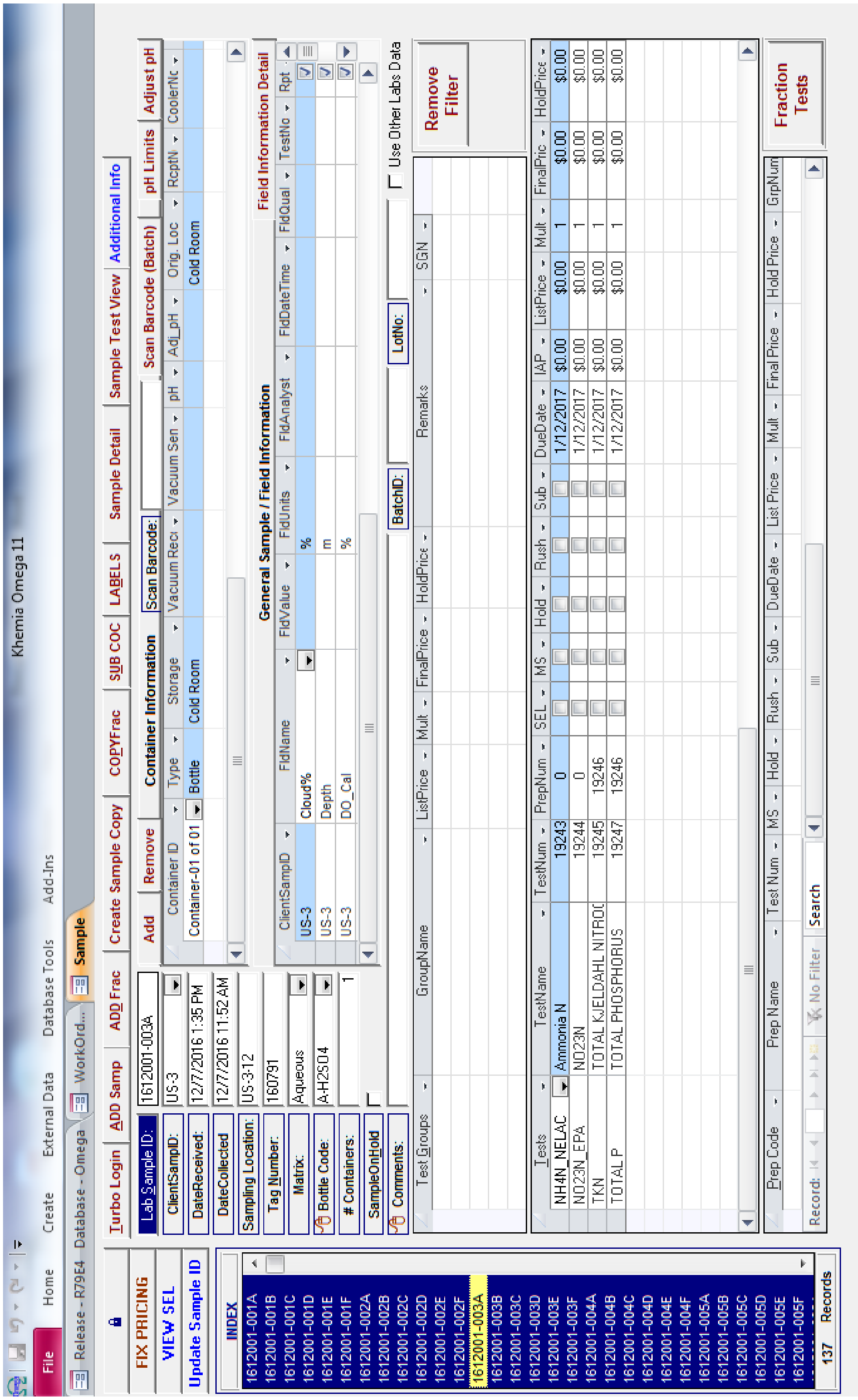


FIGURE 7.16 PHYTOPLANKTON CTD FIELD LOG

Mote Marine Laboratory, Ken Thompson Parkway, Sarasota, Fl 34236. (941)-388-4441 Page ____ of ____

CTD-LOG- RT

Project No. 112-315 RT

Sampling Date: _________________ Cruse: _________________ CTD SN: ________________

Operator(s) /Initials _______________________ (______) _______________________ (______)

Handheld GPS SN: _______________________ Logging? Yes / No

Station	Depth (m / ft)	Time (GMT)	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)	Comments

Figure 7.17 BENTHIC ECOLOGY SORT LOG

MOTE MARINE LABORATORY
1600 THOMPSON PARKWAY
SARASOTA, FLORIDA 34236

SORTING LOG

PROJECT NAME:____________________________
PROJECT #:__________

COLLECTION DATE:____________________________

STATION	REP	BY	HRS (.25)	DATE START/COMPLETE	RESORT BY DATE
	1				
	2				
	3				
	4				
	5				
	6				
	7				
	8				
	9				
	10				
	1				
	2				
	3				
	4				
	5				
	6				
	7				
	8				
	9				
	10				

Figure 7.18 BENTHIC ECOLOGY IDENTIFICATION LOG

Project Name: ______________
Project Number: ______________

Mote Marine Laboratory
1600 Ken Thompson Parkway
Sarasota, Florida 34236

IDENTIFICATION LOG

Sample Date:		SIGN OUT					SIGN IN (Return)				
Station:											
Replicate		Annelida -Pollychaeta	Crustacea	Mollusca	Echinoderms	Miscellaneous	Annelida -Pollychaeta	Crustacea	Mollusca	Echinoderms	Miscellaneous
1	Initial										
	Date										
2	Initial										
	Date										
3	Initial										
	Date										
4	Initial										
	Date										
5	Initial										
	Date										
6	Initial										
	Date										
7	Initial										
	Date										
8	Initial										
	Date										
9	Initial										
	Date										
10	Initial										
	Date										

Identification Log Revised June 2023

Figure 7.19 BENTHIC ECOLOGY RE-SORT LOG

Mote MarineLaboratory
1600 Ken Thompson Parkway
Sarasota, Florida 34236
(941) 388-4441

Benthic Sample Re-Sort Log

Project Name: ____________________

Project Number: ____________________

Collection Date: ____________________

Sample	Sorter Initials	Re-Sorted by	Number of Organisms Found	Total No. Original	Percentage Error	Remedial Action Taken

Revised June 2023

Figure 7.20 *Karenia* sp. Identification and Enumeration Log

MML - Phytoplankton Ecology Program - *Karenia sp*. Enumeration log Year: ________ Project: ________

Collect Date	Count Date	Station/ Sample ID	Count Volume (mL)	*K. brev*	*K. miki*	*K. pap*	*K. selli*	*K. aster*	*K. long*	*K. umb*	other *K* sp.	*Pyro. baha*	*P-n (A/P/H)*	Notes	Initials

Comments:

proofed by: ________

proofed date: ________

Mote Marine Laboratory, 1600 Ken Thompson Pkwy, Sarasota, FL
version PE-KCL-1.6 Date: 230714

Count verification (10%,as required) ________________
(signature)

Figure 7.21 <u>In-House SPM Filter/Weighing Custody Log</u>

Cruise Date: IN-HOUSE SPM FILTER/WEIGHING CUSTODY LOG Filter Prepper:

Date Filtered: Sample Filterer:

Filter ID	Station	Date/Time (GMT)	Tare Wt. (mg)	Tare Wt. (mg)	Tare Wt. (mg)
			1.	2.	3.
Time Filtered	Volume Filtered (mL)	Date/Time (GMT)	Wt. 1 (mg)	Wt. 1 (mg)	Wt. 1 (mg)
			1.	2.	3.
Notes:		Date/Time (GMT)	Wt. 2 (mg)	Wt. 2 (mg)	Wt. 2 (mg)
			1.	2.	3.
Sample ID:		Date/Time (GMT)	Final Wt. (mg)	Final Wt. (mg)	Final Wt. (mg)
			1.	2.	4.
Filter ID	Station	Date/Time (GMT)	Tare Wt. (mg)	Tare Wt. (mg)	Tare Wt. (mg)
			1.	2.	3.
Time Filtered	Volume Filtered (mL)	Date/Time (GMT)	Wt. 1 (mg)	Wt. 1 (mg)	Wt. 1 (mg)
			1.	2.	3.
Notes:		Date/Time (GMT)	Wt. 2 (mg)	Wt. 2 (mg)	Wt. 2 (mg)
			1.	2.	3.
Sample ID:		Date/Time (GMT)	Final Wt. (mg)	Final Wt. (mg)	Final Wt. (mg)
			1.	2.	4.

8.0 ANALYTICAL PROCEDURES

8.1 Field Procedures

Approved methods for field parameters are addressed by DEP in DEP SOP-001/01 (January 2017, effective 4/16/2018) as listed on https://floridadep.gov/dear/quality-assurance/content/dep-sops). These field methods are employed as applicable for the project intent and data quality objectives.

8.1.1 Field Screening

No field screening equipment is operated by the Laboratory. Field screening methods employed include Hach-type test kits and pH test strips to determine appropriate sample preservation.

8.2 Laboratory Operations

8.2.1 Laboratory Methods

Laboratory methods are similarly selected to support project data quality objectives, agency requirements, or applicable agency rules, contracts, orders or permits. When methods are specified by a permitting agency rule, contract, order or permit, only those methods shall be used. Applicable method references for FDEP are addressed in DEP-SOP-002/01 (January 2017, effective date 4/16/2018) and appear at https://floridadep.gov/dear/quality-assurance/content/dep-sops. Laboratory procedures for the Red Tide Institute are described in Section 5.

Parameters not addressed by FDEP or alternate methods can be developed according to “New and Alternative Analytical Laboratory Methods (DEP-QA-001/01/ January 2017), F.A.C. 62-160-330, or are drawn from analytical methods described in:

ASTM Annual Book of ASTM Standards Volume 4.08, Soil and Rock, American Society for Testing and Materials, 1991.

DEP-SAS-002/10. 2001. Applicability of Chlorophyll methods, DEP-SAS-002/10. Applicability of Chlorophyll a Methods, DEP-SAS-002/10. Florida Department of Environmental Protection, Division of Environmental Assessment and Restoration, October 24, 2011

Dickson, A. G., C. L. Labine, and J. R. Christian. 2007. Guide to best practices for ocean CO_2 measurements. North Pacific Marine Science Organization.

EPA1 EPA 600/4-79-020. 1979. Methods for Chemical Analysis of Water and Wastes, EPA 600/4-79-020. US EPA, Washington, D.C. 431 p.

EPA2 SW-846. 1990. Environmental Protection Agency. 1990. Test Methods for Evaluation of Solid Waste, Physical/Chemical Methods. EPA SW-846, 3rd Edition, Update VI, May 21, 2019. Washington, D.C. 4 Volumes.

EPA 544 Shoemaker, J., Dan Tettenhorst, AND A. Delacruz. METHOD 544. DETERMINATION OF MICROCYSTINS AND NODULARIN IN DRINKING WATER BY SOLID PHASE EXTRACTION AND LIQUID CHROMATOGRAPHY/TANDEM MASS SPECTROMETRY (LC/MS/MS). U.S. Environmental Protection Agency, Washington, DC, 2015.

EPA 600-R-93-100. 1993. Methods for the Determination of Inorganic Substances in Environmental Samples, EPA 600-R-93-100, Revision 2. US EPA, Cincinnati, OH.

EPA4 Arar, E.J. and G.B. Collins September 1997 Method 445.0, *In vitro* Determination of Chlorophyll a and Pheophytin a in Marine and Freshwater Algae by Fluorescence. Revision 1.2. National Exposure Research Laboratory, Office of Research and Development, U.S. EPA, Cincinnati, Ohio 45268.

EPA/CE. 1981. Procedures for Handling and Chemical Analysis of Sediment and Water Samples, EPA/CE-81-1. R.H. Plumb, Jr., US EPA/Corps of Engineers, Buffalo, NY.

EPA Environmental Protection Agency. 1991. 40 CFR Part 136 Guidelines establishing test procedures for the analysis of pollutants under the Clean Water Act, Tables IA, IB, IC, ID, and IE. (October 8, 1991). Washington, D.C, Methods Update Rule (MUR) 2017.

FDEP Florida Department of Environmental Protection. 1984. Estuarine Sample Preparation and Analysis -- Deepwater Ports Maintenance Dredging and Disposal Manual (Revision 4). FDEP Coastal Zone Management, Tallahassee, Florida. 100 p.

Hallegraeff, G. M., Anderson, D. M., Cembella, A. D., & Enevoldsen, H. O. (2004). Manual on Harmful Marine Microalgae. UNESCO.

NOAA Standard Analytical Procedure of the NOAA Analytical Facility, Extractable Organic Compounds. Commerce Department (NOAA/NMFS) Status and Trends Program. Seattle, Washington, 1984.

Pierce, R.H., Henry, M.S., Proffitt, L.S., de Rosset, A.J. (1992). Evaluation of solid sorbents for the recovery of polyether toxins (brevetoxins) in seawater. Bull Environ Contam Toxicol 49: 479-484.

Pierce RH, MS Henry, PC Blum, SL Hamel, B Kirkpatrick, YS Cheng, Y Zhou, CM Irvin, J Naar, A Weidner, LE Fleming, LC Backer, DG Baden. 2005. Brevetoxin composition in water and marine aerosol along a Florida beach: assessing potential human exposure to biotoxins. *Harmful Algae* 4(6):965-972.

SM20 *Standard Methods for the Examination of Water and Wastewater*, American Public Health Association, American Water Works Association, Water Environment Association, 20th Edition, 1998.

SM21 *Standard Methods for the Examination of Water and Wastewater*, American Public Health Association, American Water Works Association, Water Pollution Control Federation 21st Edition, 2005.

SM22 *Standard Methods for the Examination of Water and Wastewater*, American Public Health Association, American Water Works Association, Water Pollution Control Federation 22nd Edition, 2012.

SM23 *Standard Methods for the Examination of Water and Wastewater*, American Public Health Association, American Water Works Association, Water Pollution Control Federation 23rd Edition, 2017.

SM24 *Standard Methods for the Examination of Water and Wastewater,* American Public Health Association, American Water Works Association, Water Environment Federation, 24th Edition, 2023.

Stein-Taylor, J. R. (1973). *Handbook of Phycological Methods: Culture Methods and Growth Measurements, edited by JR Stein* (Vol. 1). Cambridge University Press.

Twiner, M.J., Bottein Dechraoui M.-Y., Wang, Z., Mikulski, C.M., Henry, M.S., Pierce, R.H., Doucette, G.J. (2007). Extraction and analysis of lipophilic brevetoxins from the red tide dinoflagellate *Karenia brevis*. Anal Biochem 369: 128-135.

Wright, SW, S Jeffrey, R Mantoura, C Llewellyn, C Bjornland, D Repeta, N Welschmeyer. 1991. An improved HPLC method for the analysis of chlorophylls and carotenoids from marine phytoplankton. Mar Ecol Prog Ser 77, 183-196.

Laboratory procedures for benthic biological sample processing follow the guidelines suggested by the two references below. Details of laboratory processing, not outlined by these manuals, are provided in **Appendix I.**

> Office of Research and Development. 1990. Macroinvertebrate Field and Laboratory Methods for Evaluating the Biological Integrity of Surface Waters. ORD, Washington, D.C.
>
> SM17 Standard Methods for the Examination of Water and Wastewater, American Public Health Association, American Water Works Association, Water Pollution Control Federation, 17th edition, 1989.

Specific methods employed for individual parameters are listed in **Section 5.0**.

~~Laboratory procedures for Phytoplankton Ecology are described in the following reference. Additional details are provided in **Appendix IV.**~~

> ~~Wright, SW, S Jeffrey, R Mantoura, C Llewellyn, C Bjornland, D Repeta, N Welschmeyer. 1991. An improved HPLC method for the analysis of chlorophylls and carotenoids from marine phytoplankton. Mar Ecol Prog Ser 77, 183-196.~~

8.2.2 Laboratory Glassware

Whenever available, Class A volumetric glassware is purchased and used for standards and in all NELAC certified analyses. Class A glassware is verified upon receipt and before use. Records of verification are maintained. Non-Class A glassware or plasticware with volumetric markings are verified once prior to use. Records of verification are maintained. Disposable plasticware is verified once per lot prior to use.

8.2.3 Cleaning Procedures for Laboratory Glassware

The following describes the cleaning and storage procedures for laboratory glassware:

A. General

Marking -

Glassware marking is performed with china or indelible markers directly on the glass or on tape affixed to the glassware. Labels are removed with acetone as necessary.

Drying -

Volumetric glassware is not oven-dried or boiled on a hot plate.

Laboratory Water -

Refers to water produced by a reverse osmosis, deionizing system with product conductivity of <2 μmhos/cm or >18.2 MΩ. May be polished at point of use to higher purity with cation removal cartridges, 0.22 micron filters, and/or activated charcoal filters for organic removal.

Detergent -

Liquinox is suitable for all analytical procedures.

Detergent is not used for glassware reserved for laboratory water solutions of inorganic standards (*i.e.* metals, nutrients, major ions, minerals).

B. Parameter Specific

Volatile Organics -

As VOCs are not analyzed at the Laboratory, no glassware cleaning is performed. Sample containers are supplied by the subcontracting laboratory, or purchased as precleaned and certified. Sample containers are stored in sample coolers, for a minimal time prior to sampling.

Semi-volatile (Extractable) Organics -

Heavily contaminated glassware is first rinsed with wash grade acetone. Glassware is then washed with hot water, liquinox and a brush followed by a hot water and then laboratory water rinse. A solvent rinse of pesticide grade isopropanol or acetone is followed by air drying. Glassware is then stored inverted, capped, or in a dust free environment. A solvent rinse with the extracting solvent is performed immediately before analysis.

Nutrients, TOC, COD -

Glassware is washed with hot water, liquinox and a brush followed by a hot water rinse. Glassware is then rinsed with 10% HCl or H_2SO_4 solution, with laboratory water, allowed to air dry, and stored inverted, capped, or in a dust-free environment. Glassware for TOC and COD has an additional final rinse with low-organic (carbon-free) water before drying.

Total Alkalinity, Total Dissolved Inorganic Carbon –

Glassware is washed with RO water, liquinox, and a brush, except glassware too small or narrow for a brush, in which they are shaken vigorously. Glassware is then rinsed with RO, rinsed with 10% HCl, then rinsed three times with RO. Glassware is allowed to air dry and stored in laboratory cabinets. Additionally, sample bottles are furnace at 450 deg C for 4 hours, rinsed with RO, then allowed to dry in a drying oven set to 60 deg C before being cooled and stored capped.

Orthophosphate, nitrite-nitrogen -

Glassware is washed with hot water and a brush, and then rinsed with laboratory water, allowed to air dry, and stored inverted, capped, or in a dust-free environment. New or contaminated glassware for phosphate analysis is washed with dilute acid prior to the above procedure.

Inorganic ions, Minerals, BOD, CBOD, Residues, Surfactants -

Glassware is washed with hot water, liquinox and a brush followed by a with laboratory water. Bottles used for the incubation of BOD or CBOD samples are then rinsed with 10% H_2SO_4 and bottles used for CBOD have an additional rinse with acetone to remove nitrification inhibitor. After a final rinse with laboratory water, the glassware is allowed to air dry, and stored inverted, capped, or in a dust-free environment.

Granulometry -

Glassware is scrubbed with tap water and a brush, using detergent as necessary to loosen any dried deposits. A final rinse with laboratory water is followed by air drying. Glassware is stored inverted.

Species Identification -

Glassware is rinsed with tap water. Dried sediments or other materials may be soaked and scrubbed free with detergent, as necessary. Glassware is stored in laboratory cabinets.

In the Phytoplankton Ecology Research Program, if needed to be reused, glassware for phytoplankton analysis is emptied, rinsed with tap water and soaked in a mixture of water and liquinox in the sink. The glassware is then scrubbed with a brush and rinsed thoroughly with tap water with a final rinse with laboratory (RO) water. Glassware is thoroughly air-dried and stored in laboratory cabinets.

Parameter groups not analyzed by the laboratory utilize suitable, clean, sampling containers supplied by the analytical laboratory and demonstrated as acceptable by the other laboratory's QA/QC protocols and appropriate field and container blanks.

8.2.4 Reagent Purchase, Receipt, and Storage

Reagents received at the Laboratory are entered into the reagent inventory system of each respective program (**Section 9.0**), as are all standard materials. Compound name, manufacturer, date of receipt, expiration date, lot number, concentration or purity, date opened, and date of disposal are recorded. If the compound was accompanied by a Certificate of Analysis, this is also recorded and certificates maintained on file. Individual containers are also dated on receipt and on opening. Only analytical grade reagents are purchased, with the exception of isopropyl alcohol and formalin for infaunal preservation, some biological stains and dyes, some indicators which are not available in analytical grades, technical or wash grade solvents in 5 gallon drums for cleaning of heavily contaminated equipment or glassware, and technical grade sodium hydroxide or sodium bicarbonate for neutralization of expired samples.

For services and supplies that may affect the quality of environmental tests, providers of these services or supplies are investigated prior to purchase to ensure specifications defined in the methods for environmental tests are met. Only providers that have been verified to supply items of sufficient quality are used. A list of these approved providers is maintained. Before items are purchased, the project manager signing the purchase order will review and approve the items. Before items are used, they are inspected and verified as complying with standard specification or requirements defined in the methods for the environmental tests concerned. Suppliers and critical consumables used in testing and calibration are evaluated by signing the packing lists upon arrival.

Laboratory reagents are stored in accordance to manufacturer's instructions and/or method guidelines (**Table 8.1**). Reagents are segregated according to compatibility groups (solvents, bases, acids, and highly reactive chemicals). Where reagents are purchased in bulk, *i.e*. case lots of acids or solvents, storage of the unopened portion is in vented solvent or acid storage cabinets in designated areas separate from the main laboratory. Working quantities of these reagents are kept in the analytical laboratory. Bulk lots of isopropyl is obtained in drum quantities and stored in a hazardous materials shed.

Laboratory records of reagent preparation are maintained by department on forms illustrated in **Figures 8.1 and 8.2**. These records document date, preparer, balance used, balance calibration, compound(s) and amounts weighed, solvent used, lot numbers of compound and solvent, final volume, whether a volumetric or graduated cylinder was used. If an aqueous solution is prepared, the source and quality (i.e., HPLC water, Nanopure water, DI H_2O, or RO water) of water used is documented. Reagent name and intended analysis is also documented. For standards, the final concentration of the constituents of interest is also recorded.

Expiration dates of all prepared reagents are documented as follows:

- If a reagent expires on the day that it is prepared, the preparation date is documented on the container as the expiration date.
- If a reagent expires in one week from the day it is prepared, the same day of the following week (i.e., Thursday – Thursday, or the 8^{th} day) is documented on the container as the expiration date.
- If a reagent expires in a month(s), the same date of the following month(s) is documented, irrespective of the length of the months.
- If a reagent is made with a combination of multiple components, the reagent will be assigned the expiration date of the component which expires earliest, irrespective of the established holding time of the final product.

8.2.5 <u>Sample Preparation and Analysis Records</u>

For Chemical & Physical Ecology, upon entry of a group of samples for a project, the LIMS also generates analytical work orders in a format of YYMMnnnn which includes all required sample pretreatment (liquid-liquid extraction, digestion, etc.) and all requested analyses. Analyses pending are accessed in the Backlog Report (**Figure 8.3**), which is sorted on days remaining of holding time to identify needed activities.

Preparation or analytical Backlog reports are exported to electronic bench sheets or incorporated into sample tables for automated instrumentation. Electronic benchsheets provide real-time evaluation of QA criteria success or failure. (Any manual data entry onto benchsheets are proofed at 100% for the final electronic version.) Excel cells with formulas or calculations are locked to protect from accidental editing. Any individual making changes to data records should enter a comment in the cell that includes the original value, the reason for changing other than transcription error, date of change, and name.

On analysis completion, electronic analytical runs are created for upload to the LIMS. Following upload, QA criteria for the analytical runs are calculated again by the LIMS and stored, and the data are reviewed and acknowledged by the analyst. The analytical run is then validated by the Laboratory Manager (QA approved). The author(s) of all LIMs transactions (including any corrections, changes, analytical run deletions or reloads) are identified and maintained in an electronic log. Paper versions of benchsheets or preparation logs with manual entries are stored in department files. When created on workstations, electronic benchsheets are maintained on the workstation as well as copied to department server at the end of each analytical run. The same benchsheets formatted for LIMS upload are also stored on the separate LIMS server as attached files to permit later access as needed.

The preparation of biological samples (decanting, rough sorting) is documented on the custody form and the sorting log, respectively. Analysis of biological samples (i.e., species identification and enumeration) is documented in the identification log (**Figure 8.3** above) on which the taxonomist and inclusive dates of sample analysis are recorded by major taxonomic groups. Residual sediments from sample processing are disposed of on completion and approval of final report, upon approval of the project manager, or upon other contractually specified conditions. Disposal of sediments are documented on the custody form for biological samples.

Organisms removed from samples, and in excess of those added to the laboratory voucher collection may be donated to FFWCC-FWRI Florida Fish & Wildlife Conservation Commission – Florida Wildlife Research Institute, or the Smithsonian Museum of Natural History, Oceanographic Sorting Center, Washington, DC. In the event that neither of these organizations can use the samples they may be disposed of or returned to the client on the direction of the project manager.

The Ecotoxicology Program uses the Custody Sheet form in **Figure 7.7** to record sample extraction process ~~to record the sampling data~~, sample matrix, ~~tissue weight, and moisture content of shellfish samples~~, sample mass, and final extraction volume. Sample preparation form in **Figure 8.4** is additionally used to record sample preparation for microcystin water sample extraction

8.2.6 Laboratory Waste Disposal

Wastes are considered hazardous and regulated by the Resource Conservation and Recovery Act (RCRA) if:

1) The wastes are listed in 40 CFR Part 261.
2) The material has characteristics of ignitability, corrosivity, reactivity, or TCLP toxicity.

3) The waste is listed in 1) or 2) and is not excluded under 40 CFR 260, 261, or 260.22.

Acutely hazardous wastes are also further identified in 40 CFR Part 261.

Mote Marine Laboratory is a small quantity generator, generating no more than 1,000 kg of hazardous wastes or 1 kg of acutely hazardous wastes during a month and accumulating no more than 6,000 kg of hazardous wastes at any one time. The Laboratory has no wastes which are excluded by 40 CFR 261. Laboratory generated wastes listed in Subpart D of 40 CFR 261 include spent solvents, both halogenated and non-halogenated, some solutions of materials listed in 40 CFR 261, and some materials which are considered either ignitable, corrosive, or toxic.

The specific categories of wastes generated by the Laboratory include:

1) solvents from expired organic standards or sample extracts,
2) solutions of metallic salts from expired metals standards, COD analyses, Kjeldahl digestions,
3) phenolic reagents from ammonia analyses,
4) acidic or basic wastes of excess samples, and some analytical process wastes,
5) formalin and isopropyl alcohol from biological samples,
6) Bouin's fixative (picric acid), and
7) Maintenance shop
   a. paint
   b. fiberglass resin/acetone
   c. spent glycol-based coolant
   d. fluorescent bulbs
   e. solvent
   f. water-contaminated fuels

Wastes which are classified as hazardous due to corrosivity alone (pH <2 or >12.5) are neutralized and disposed of by the sanitary system. Wastes considered toxic due to metallic content are either precipitated to remove trace metals, or are disposed of via a commercial disposal service. Ignitable wastes and spent solvents are not evaporated, but also disposed of commercially, as are phenolic wastes. Isopropyl and formalin wastes are diluted to less than 1% by volume and disposed of via the sanitary system.

Hazardous wastes stored for commercial disposal are segregated by type or classification (solvents, phenols, toxic metals) into Department of Transportation-approved containers. Accumulation containers are dated with the initial and final dates of accumulation, and the amounts recorded on a central log to ensure that accumulation amounts do not exceed 1000 kg. The wastes are disposed of by a commercial firm licensed to perform removal, transport, and treatment or disposal services. The commercial firm ensures that wastes are manifested, packed, labeled, marked, and placarded in accordance with 40 CFR 262, 49 CFR, and 29 CFR requirements.

The Laboratory does not routinely analyze samples of hazardous wastes, and so expired samples are neutralized as necessary and disposed of via the sanitary system. Sample disposal is documented. Of the ambient samples which the Laboratory analyzes, those which might be classified as hazardous are most likely to be so based on toxicity characteristics (rather than ignitability, corrosivity other than sample preservation, or reactivity). Supervisors are familiar with the applicable tables of 40 CFR 261 ~~(**Table 8.2**)~~ in which maximum contaminant levels for TCLP toxicity are defined. Supervisors review unusually contaminated sample results against applicable tables for appropriate disposal measures.

A copy of Mote's Chemical Hygiene Plan and Laboratory Requirements is found in Appendix IV.

Figure 8.1 REAGENT AND STANDARD PREPARATION FORM

Mote Marine Laboratory, 1600 Ken Thompson Parkway, Sarasota, FL 34236
Reagent and Standard Preparation
Date: ________________ **Analyst:**________________ **Project(s):**________________

Balance	AE163	AE163-2	PX2202/E	XD400DD	
Balance SN:	B70784	81009	C014260755	58038	
Calibrated?					

Initial compound / reagent & Lot #	**Amount & units**	**Equipment(s) used**	**Reagent & Analysis**	**Batch #**	**Exp Date**
COMPOUND:	WEIGHT:	AE163 / AE163-2 / PX2202/E / XD400DD/___________			
LOT# / PREP DATE:	VOLUME:	Volumetric / Pipette:_______ / Grad Cylinder: _________			
COMPOUND:	WEIGHT:	AE163 / AE163-2 / PX2202/E / XD400DD/___________			
LOT# / PREP DATE:	VOLUME:	Volumetric / Pipette:_______ / Grad Cylinder: _________			
COMPOUND:	WEIGHT:	AE163 / AE163-2 / PX2202/E / XD400DD/___________			
LOT# / PREP DATE:	VOLUME:	Volumetric / Pipette:_______ / Grad Cylinder: _________			
COMPOUND:	WEIGHT:	AE163 / AE163-2 / PX2202/E / XD400DD/___________			
LOT# / PREP DATE:	VOLUME:	Volumetric / Pipette:_______ / Grad Cylinder: _________			
COMPOUND:	WEIGHT:	AE163 / AE163-2 / PX2202/E / XD400DD/___________			
LOT# / PREP DATE:	VOLUME:	Volumetric / Pipette:_______ / Grad Cylinder: _________			
COMPOUND:	WEIGHT:	AE163 / AE163-2 / PX2202/E / XD400DD/___________			
LOT# / PREP DATE:	VOLUME:	Volumetric / Pipette:_______ / Grad Cylinder: _________			
COMPOUND:	WEIGHT:	AE163 / AE163-2 / PX2202/E / XD400DD/___________			
LOT# / PREP DATE:	VOLUME:	Volumetric / Pipette:_______ / Grad Cylinder: _________			
COMPOUND:	WEIGHT:	AE163 / AE163-2 / PX2202/E / XD400DD/___________			
LOT# / PREP DATE:	VOLUME:	Volumetric / Pipette:_______ / Grad Cylinder: _________			
COMPOUND:	WEIGHT:	AE163 / AE163-2 / PX2202/E / XD400DD/___________			
LOT# / PREP DATE:	VOLUME:	Volumetric / Pipette:_______ / Grad Cylinder: _________			

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FIGURE 8.2 ECOTOXICOLOGY STANDARD PREPARATION FORM

Ecotoxicology
Standard Preparation Log Book

Data Prep.	Analyst	Compound Name	MML/Lot #	Solvent	Amount Added	Final Volume	Final Concentration	Exp. Date	Storage Location	MML#

Table 8.1 REAGENT STORAGE

CHEMICAL	METHOD OF STORAGE
Acids	
Mineral Acids	Stored in original container in vented cabinet designated for acid storage. Working quantities maintained in the laboratories.
Organic Acids	Stored in original container in vented cabinet designated for acid storage. Working quantities maintained in the laboratories.
Solvents	
Organic Solvents (pesticide/HPLC grade)	Stored in original containers, in vented cabinet designated for solvent storage. Working quantities maintained in the laboratories.
Organic Solvents (technical grade)	Stored in original containers, in vented cabinet designated for solvent storage. Working quantities maintained in the laboratories. Only solvent received in 5 gallon drum and clearly marked "FOR WASH ONLY"
Ethanol	Stored in original containers. In vented locked cabinet designated for solvent storage.
Ethyl Ether	Stored in original containers, in vented locked cabinet, in section of cold room (<6 °C) designated for solvent storage. Receipt added to preventative maintenance schedule to ensure use or disposal within 1 year.
Isopropyl Alcohol	Stored in original drums, in hazardous materials building until transferred to working containers.
Dry Reagents	Stored in original containers, in cabinet designated for reagent storage in air conditioned area of the laboratory. Small quantities of primary standards (suitably labeled with lot # and other pertinent information) are maintained in covered secondary containers within a desiccator. Highly reactive compounds are segregated. Reagents requiring refrigeration by manufacturer's recommendations are stored in a refrigerator designated for chemical storage.
Liquids and Solutions	Liquid compounds are stored as dry reagents, according to manufacturer's recommendations. Prepared solutions of compounds, whether purchased or prepared at the laboratory, are stored by method or manufacturer's recommendations. Analytical reagents are typically segregated by analysis at the point of use.

Figure 8.3 EXAMPLE OF PENDING ANALYSES FOR CHEMICAL & PHYSICAL ECOLOGY

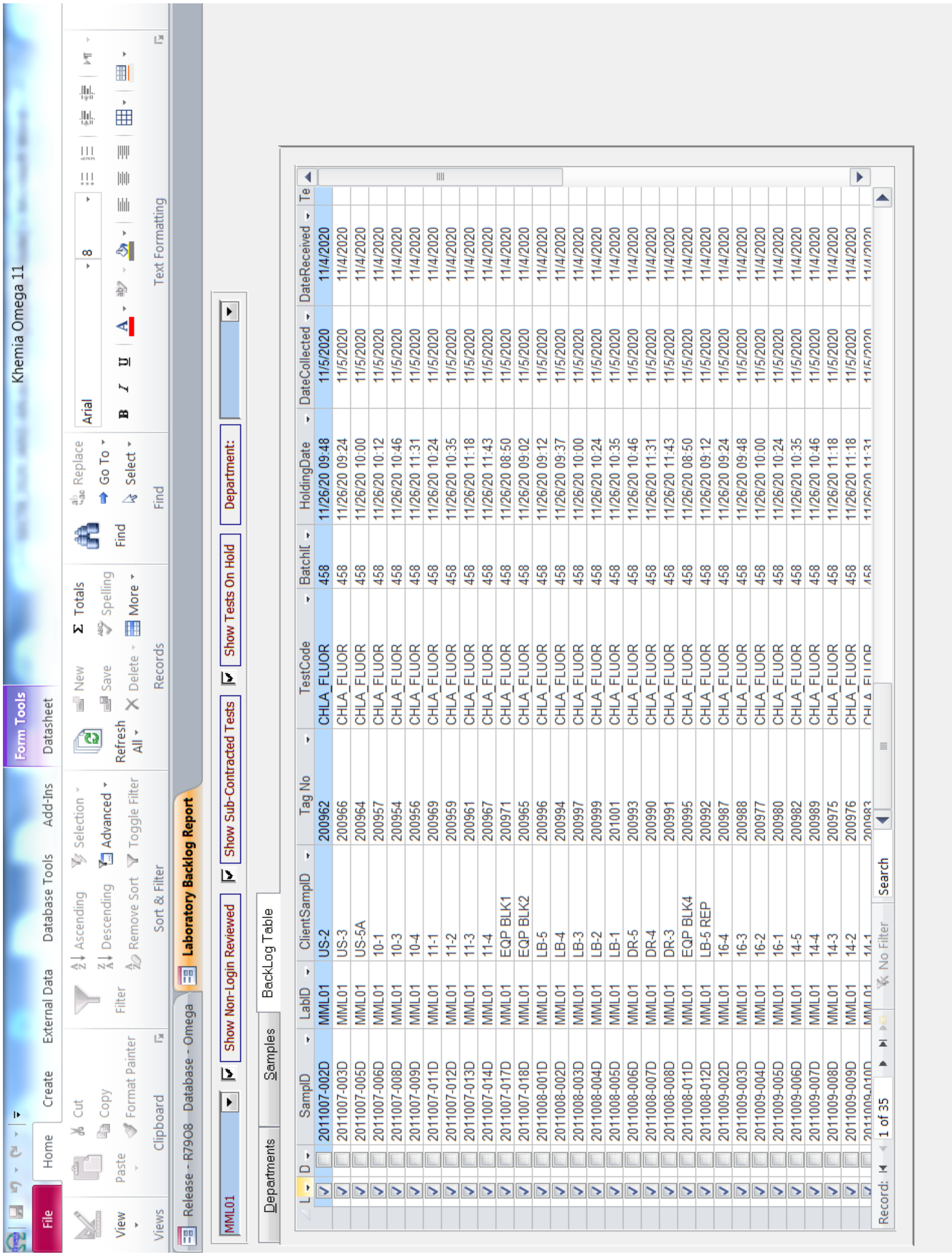

Figure 8.4 ECOTOXICOLOGY MICROCYSTIN SAMPLE PREPARATION LOG

MOTE MARINE LABORATORY
12300 Fruitville Road, Sarasota, FL 34240
Mycrocystin Sample Bottle Prep Record

Date Prepared: ________________ Trizma Lot #:______________________________
2-Chloroacetamide Lot #:____________________
Prepared by: __________________ Ascorbic Acid Lot #:________________________
EDTA Lot #:____________________________

Row	MML ID	Sample ID	Trizma	2-Chloroacetamide	Ascorbic Acid	EDTA
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						

Additive compound	**Amount to add**
Trizma	7.75 g/L (3.875 g/500mL)
2-Chloroacetamide	2 g/L (1g/500mL)
Acorbic Acid	100 mg/L (50 mg/500mL)
EDTA-Trisodium salt	0.35 g/L (0.175 g/500mL)

9.0 CALIBRATION PROCEDURES AND FREQUENCY

9.1 Instrumentation Lists

Instrumentation for field and laboratory measurements, together with ancillary equipment required for analyses listed in **Section 5.0**, appears in **Table 9.1** (field) and **Table 9.2** (laboratory).

9.2 Standard Receipt and Traceability

Standard chemicals and solutions are received into the laboratory's inventory control, as are all chemicals. Inventories are specific by departments, i.e., organics, inorganics, biological. Inventory procedures include dating each container with the date of receipt plus a record of the following information:

Compound name
Date of receipt
Manufacturer/supplier
Concentration
Lot number
State purity or grade
Note of any accompanying certifications
Expiration date
Date of first use
Recommended storage conditions

Any accompanying certifications are dated and retained for a minimum period of five (5) years or until chemical is depleted or expired. Expiration dates of solutions, unless specified by the manufacturer, are assigned at 1 year. Standard salts known to be hygroscopic are assigned expiration times of 6 months from date of receipt.

Standards purchased as solutions are certified by the manufacturer to be traceable to NIST standards. Dry reagents such as inorganic salts for standards preparation are of primary grade, if available, are manufactured to American Chemical Society (ACS) specifications, or are certified by the manufacturer (if there are no ACS specifications for the compound). If the manufacturer indicates that the purity of neat reagents is less than 99.99% (as for some organic compounds), than standards preparation takes this value into account for computing final concentration of primary standard stocks. All subsequent preparation of parent, intermediate, and working stock standards are traceable to the lot numbers of the manufacturers' solutions or dry reagents.

Standard compounds and solutions are stored at either room temperature, ≤6 °C, or -15 °C, dependent on manufacturers' or method recommendations, lability of the compound, or susceptibility to bacterial growth.

9.3 Standard Sources and Preparation

Working standards are prepared through serial dilutions of primary or stock standard solutions, which are either purchased as certified solutions or prepared in-house from inorganic salts or neat liquid compounds. Sources of the purchased material, typical preparation of intermediate and working standards, storage of solutions, and the frequency with which the standards are prepared are listed in **Table 9.3**. Reagents are purchased from approved providers according to lists maintained by department.

Documentation of the preparation of standards is accomplished with the same forms used for the preparation of reagents (**Section 8**) or with standard-specific form (**Figures 9.1 and 9.2)**. Forms are maintained in program-specific laboratory notebooks. The daily preparation of intermediate and working standards from the primary solutions is documented on analysis-specific Standard Preparation Forms. The record of working standard preparation accompanies the individual bench sheets for a particular analysis.

Multicomponent mixtures with more than two analytes (*i.e*. organics standard solutions) are further assigned a tracking number to ensure traceability of working stocks to source standards.

9.4 Instrument Calibration

9.4.1 Field Instrument Calibration
Field instruments are bench calibrated against standards or alternate methodologies prior to fieldwork and percent accuracy assessed. Bench calibration records are maintained in a laboratory file specific to instrumentation type and are traceable to individual units by serial number. Example calibration protocols and recording formats are described in **Tables 9.4** and **9.5** and **Figure 9.3**. If field sampling continues on subsequent days then bench calibrations are repeated for each sampling day.

Continuing calibrations (through the analysis of standards) are performed at the beginning of sampling and at the completion of sampling. If historically generated data demonstrate that a specific instrument remains stable for longer periods of time, the time interval between calibration verifications may be increased. Meters or instrument subsections so treated include pH, and conductivity/salinity. Dissolved oxygen meters are verified against Winkler titrations during bench calibrations and then air-calibrated at every station during fieldwork. The results of all field calibrations, air calibrations, and the identifying lot numbers and/or dates of standards are recorded in the field logbook and maintained with the field data. These standards must agree with DEP SOP guidelines for individual instrument subsections in order for sampling to proceed, or a full calibration must be performed.

Instruments designed for extended deployment and remote data logging, as well as photometers, are calibrated according to manufacturer's specifications. Data logging devices include equipment serial numbers in header files, or in filenames for traceability. Volumes pumped by automated samplers are calibrated via graduated cylinder prior to each site installation if samples are to be automatically composited. Automated sampler programming permits the calibration and then verification that sample volumes are correct within manufacturer's specifications.

9.4.2 Laboratory Instrument Calibration
Calibration protocols for laboratory instruments are listed in **Table 9.6** and include numbers of standards and specified frequencies of initial and continuing calibrations by instrument group. The listed protocols should meet or exceed the minimum required by the methods detailed in **Section 5.0**. In all cases, however, method calibration protocols will be followed if more stringent than those listed. Calibration results are recorded on bench sheets or in analytical logs.

9.4.2.1 Removal and Replacement of Calibration Standards

This protocol is to be followed when removing and/or replacing calibration standards.

- Multiple calibration standards from the lowest and/or highest levels of the curve may be removed for individual analytes, but removal of interior levels is not permitted.
- An entire single standard calibration level from the interior of the calibration curve may be removed only when the instrument response demonstrates that the standard was not properly introduced to the instrument, or an incorrect standard was analyzed.
- If a calibration standard is removed from the interior of the calibration, that particular standard calibration level should be removed for all analytes. The removal should be documented, have a technically valid reason, and should not be used to compensate for lack of maintenance or repair to the instrument.
- The number of calibration standards remaining should be sufficient to meet the minimum requirements for the number of initial calibration points mandated by the standard (see table below), the method or regulatory requirements.

For regression or average response/calibration factor calibrations, the minimum number of non-zero calibration standards

Type of Calibration Curve	Minimum Number of Calibration Standards[b]
Threshold Testing[a]	1
Average Response	4
Linear Fit	5
Quadratic Fit	6

[a]The initial one-point calibration shall be at the project-specified threshold level.
[b]Fewer calibration standards may be used only if equipment firmware or software cannot accommodate the specified number of standards. Documentation detailing that limitation shall be maintained at the laboratory.

- A single standard can be replaced if:
  - The standard was analyzed within 24 hours from the original calibration standard analysis for that particular calibration level.
  - If interior, all analytes of the calibration standard must be replaced.
  - Document a technically valid reason for either removal or replacement of any interior calibration point.

- If standards are removed from the lowest or highest ends of the calibration range, the LOQ/reporting limits and quantitation range will be adjusted based on the initial calibration range.
  - The lowest calibration standard shall be at or below the lowest concentration for which quantitative data are to be reported without qualification.
  - The highest calibration standard shall be at or above the highest concentration for which quantitative data are to be reported without qualification.
  - Sample results shall be quantitated from the initial calibration and may not be quantitated from any continuing calibration verification unless otherwise required by regulation, method or program.

All mass spec analyses are done on either an Agilent or Thermo Electron single quadrapole instrument or an Agilent 5975C with Triple-Axis detector. Mass calibration is done using DFTPP (decafluorotriphenylphosphine). Tuning is done on a daily basis prior to analytical runs. The tuning criteria for decafluorotriphenylphosphine (DFTPP) are as follows:

Methods 625 & 8270.

MASS	**m/z Abundance Criteria**
51	30-60 percent of mass 198
68	Less than 2 percent of mass 69
70	Less than 2 percent of mass 69
127	40-60 percent of mass 198
198	Base peak, 100 percent relative abundance
199	5-9 percent of mass 198
275	10-30 percent of mass 198
365	Greater than 1 percent of mass 198
441	Present but less than mass 443
442	Greater than 40 percent of mass 198
443	17-23 percent of mass 442

9.4.3 Equipment Monitoring

Auxiliary equipment is also routinely calibrated or monitored for proper functioning (**Table 9.7**). Refrigerators, incubators, and cold room are equipped with direct reading thermographs which display temperature constantly, as well as recording temperature at set intervals. Thermograph records are downloaded routinely and stored in laboratory files. Oven temperatures are similarly confirmed with a thermometer in addition to any oven display. Analysts record temperature daily or on each opening, whichever is less frequent, confirm that it is within the posted allowed range, and take appropriate action if not. Thermometers and thermographs are calibrated against a thermometer traceable to NIST on an annual basis.

Balances are serviced annually, after which servicing, standard weights (traceable to NIST) are immediately weighed. Values obtained are posted. Analysts calibrate both analytical and top loading balances daily or with each use, whichever is less often. The analytical balance has an internal calibration weight which is used for initial calibration, followed by the use of a standard weight. Standard weights must agree with the posted weights within allowed limits. Top loading balances are calibrated directly to standard weights. Automatic pipettors are serviced and gravimetrically calibrated on an annual basis using multiple replicates of laboratory water at a known temperature. The calibration is gravimetrically confirmed on a quarterly basis. Burettes, and other non-class A glassware or plasticware are calibrated before first use using gravimetric methods. Thermometers are verified annually against NIST traceable thermometers and correction factors are established at the typical usage temperature(s) for the thermometer. The records of the established correction factors are maintained in laboratory calibration records and also displayed for easy access to the application (incubator, oven, etc.).

9.4.4 Software

Instrument specific software versions (GC/MS, AA, Autoanalyzer) and any updates installed are documented in the instrument maintenance log. Software manuals are maintained with the instrument instruction manuals. Errors and failures of software are similarly recorded in the instrument maintenance log. Where failures are determined to be produced by incorrect instrument set-up or operator actions, the instruction manual for the software is annotated.

The impact on resultant data of any major programming flaws observed (variable performance, performance contrary to manual specifications, consistent error messages) would be evaluated. Flaws resulting in incorrect or missing final data would be referred immediately to the vendor for correction and documented in the instrument maintenance log as well. Existing data produced with that software version would be reviewed, recalculated if possible, and revised data reported to all affected clients. As analytical data incorporate verifications of calibrations with alternate materials of known composition (QC samples), precision and accuracy assessments for samples, and continuing calibration checks (CCV), it is unlikely that software failures would be undetected and unlikely that erroneous data reported.

In-house or custom software packages for sample tracking and QA data compilation, applications software, or other project specific data entry routines, are dated and maintained as uncompiled code listings in laboratory files, together with printouts of structure and field contents of required files and examples of user interactive screens and printouts. Any revisions are similarly dated and maintained with a description of the impact of any changes. Each new application program or calculation routine is tested before use with a test set of data. Both final and intermediate values generated must agree with a hand or reference calculation. A record of this testing is maintained with the hard copy of the coding routine.

9.5 Standardization of Titrating Solutions

Solutions used for titrimetric analyses are purchased as solutions certified traceable to NIST. Manufacturers also typically specify expiration dates. Solutions are used until expiration with periodic, usually semiannual, restandardization against appropriate solutions. Continuing accuracy of solutions is verified during each analysis with the titration of standards and acceptable recoveries. Unacceptable recovery of standards would result in the restandardization or discard of the titrant solution. Standardizations and recovery of standards are performed according to method specifications (**Section 5.0**).

Figure 9.1 CHEMICAL AND PHYSICAL ECOLOGY REAGENT AND STANDARD PREPARATION

Mote Marine Laboratory, 1600 Ken Thompson Parkway, Sarasota, FL 34236
Reagent and Standard Preparation
Date: ________________ **Analyst:**________________ **Project(s):**________________

Balance	AE163	AE163-2	PX2202/E	XD400DD	
Balance SN:	B70784	81009	C014260755	58038	
Calibrated?					

Initial compound / reagent & Lot #	Amount & units	Equipment(s) used	Reagent & Analysis	Batch #	Exp Date
COMPOUND:	WEIGHT:	AE163 / AE163-2 / PX2202/E / XD400DD/___________			
LOT# / PREP DATE:	VOLUME:	Volumetric / Pipette:_______ / Grad Cylinder: _________			
COMPOUND:	WEIGHT:	AE163 / AE163-2 / PX2202/E / XD400DD/___________			
LOT# / PREP DATE:	VOLUME:	Volumetric / Pipette:_______ / Grad Cylinder: _________			
COMPOUND:	WEIGHT:	AE163 / AE163-2 / PX2202/E / XD400DD/___________			
LOT# / PREP DATE:	VOLUME:	Volumetric / Pipette:_______ / Grad Cylinder: _________			
COMPOUND:	WEIGHT:	AE163 / AE163-2 / PX2202/E / XD400DD/___________			
LOT# / PREP DATE:	VOLUME:	Volumetric / Pipette:_______ / Grad Cylinder: _________			
COMPOUND:	WEIGHT:	AE163 / AE163-2 / PX2202/E / XD400DD/___________			
LOT# / PREP DATE:	VOLUME:	Volumetric / Pipette:_______ / Grad Cylinder: _________			
COMPOUND:	WEIGHT:	AE163 / AE163-2 / PX2202/E / XD400DD/___________			
LOT# / PREP DATE:	VOLUME:	Volumetric / Pipette:_______ / Grad Cylinder: _________			
COMPOUND:	WEIGHT:	AE163 / AE163-2 / PX2202/E / XD400DD/___________			
LOT# / PREP DATE:	VOLUME:	Volumetric / Pipette:_______ / Grad Cylinder: _________			
COMPOUND:	WEIGHT:	AE163 / AE163-2 / PX2202/E / XD400DD/___________			
LOT# / PREP DATE:	VOLUME:	Volumetric / Pipette:_______ / Grad Cylinder: _________			
COMPOUND:	WEIGHT:	AE163 / AE163-2 / PX2202/E / XD400DD/___________			
LOT# / PREP DATE:	VOLUME:	Volumetric / Pipette:_______ / Grad Cylinder: _________			

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Figure 9.2 <u>ECOTOXICOLOGY STANDARDS PREPARATION LOG</u>

Date Prep	Analyst	Compound Name	MML/Lot # Ref.	Solvent	Amount Added	Final Volume	Final Concentration	Exp. Date	Storage Location	MML #

Figure 9.3 HYDROLAB CALIBRATION

Hydrolab Minisond – Calibration - Mote Marine Laboratory, 1600 Ken Thompson Parkway, Sarasota, Fl 34236

Analyst(s): ______________, ______________, ______________ Date: ______________ Time: ________ P=Pass, F=Fail

	0.5N KCl 55.74-61.60 ms/cm	0.1N KCl 12.25-13.53 ms/cm	pH 7.00 Buffer 6.8 - 7.2 SU	pH 10.00 Buffer 9.8 - 10.2 SU	pH 4.00 Buffer 3.8 - 4.2 SU	Manganous Sulfate (Fix I)	Alkaline Iodide (Fix II)	Sulfuric Acid	Sodium Thiosulfate (0.0375N)	Starch / Thyodene	Thermometer
Lot #/SN											
Exp Date											

Calibration	Post / Pre	Post / Pre	Post / Pre	Post / Pre	Post / Pre	Post / Pre
SN Sonde						
DO Membrane Check	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N
Membrane Changed	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N
% Saturation of DO from →to	→ @ °C	→ @ °C	→ @ °C	→ @ °C	→ @ °C	→ @ °C
Bucket HL T °C (RT & +/-10) *						
True Temp °C; Mtr SN:						
Δ Temp <0.5 °C	P/F P/F	P/F P/F	P/F P/F	P/F P/F	P/F P/F	P/F P/F
DO - Hydrolab mg/L						
DO- Winkler Ave mg/L						
Δ DO <0.3 mg/L	P/F	P/F	P/F	P/F	P/F	P/F
Cond Sensor Cleaned	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N
0.5N KCl (58.670 mmhos/cm)	→	→	→	→	→	→
0.1N KCl (12.890 mmhos/cm)						
% Accuracy (95-105%)	P/F	P/F	P/F	P/F	P/F	P/F
pH pH 7.00 from →to (SU)	→	→	→	→	→	→
pH 10.00 from →to (SU)	→	→	→	→	→	→
pH 4.00 (Reading) (SU)						
Accuracy +/- 0.2 SU	P/F	P/F	P/F	P/F	P/F	P/F

Winkler Titration – Burette SN: ______________

Burette Reading			Burette Reading			Burette Reading			Average DO mg/L
Initial	Final	DO mg/L	Initial	Final	DO mg/L	Initial	Final	DO mg/L	

HL-minisond cal-141030.doc Date: October 30, 2014

*= Two point check; Use Room temperature and ~ + 10 °C in summer, ~-10 in winter

Table 9.1 **INSTRUMENTATION / EQUIPMENT LIST - FIELD**

Instrument Group	Manufacturer	Model Number/Name
Dissolved Oxygen Meters	YSI	57
pH Meters Beckman Oakton	Orion 21 WD-00605-45	230A
Refractometers	Aquafauna	-
Thermometers/Thermographs	Ertco Ryan	2462 RTM
Multiparameter Meters (Temp, Cond, DO) (Temp, Cond, DO, pH, ORP, Depth) (Temp, Cond, DO (optical), pH, ORP, Depth) (DO, Temp, Cond) (Temp, Cond, Depth) (Temp, Cond, Depth), DO, chlorophyll, turbidity, PAR, pH (Temp, Cond, Depth, DO, Chlorophyll, Turbidity, PAR) (Temp, Cond, DO, pH)	 Hydrolab Hydrolab Hydrolab YSI SBE-SeaBird SeaBird, Wet Labs, Satlantic YSI YSI	 Datasonde 4 Minisonde 4A/Surveyor Minisonde 5/Surveyor 185 19-03 SBE 55 ECO Water Sampler (SBE 19plus-V2, SBE 43, ECO-FLNTUrt, SBE 18, Cosine PAR) ProDSS ProDSS
(Fluorescence)	Wet Labs	WetStar
(DO)	SBE	SBE 43
(Photosynthetically active radiation)	Satlantic	PAR1020
(NO_3, NO^2, Fe(II), PO_4)	Sub Chem Pak Analyzer	J018
(relative *K. brevis* abundance)	Web Glider Payload	Serial 1
(Temp, Cond, Depth, relative chlorophyll fluorescence, DO)	YSI	1656M
(DO, Salinity/Cond, OrP, TDS)	YSI	556 MPS
(Cond, Sal, Temp, Depth, Press)	YSI	600 XLM, YSI 650MDS
Photometers ~~LI-192SA~~ ~~LI-193SA~~ ~~LI-1000~~ ~~LI-185B~~ ~~LI-188B~~ ~~LI-1400~~ LI-1500	Licor	LI-190 LI-192SA LI-193SA LI-1000 LI-185B LI-188B LI-1400 LI-1500 LI-250A
Spectrophotometer	Ocean Optics	Flame-S-VIS-NIR-ES
Turbidimeters (field)	Hach Hach Hach	16800 2100P 2100Q
Niskin Samplers GO-FLO 5.0	General Oceanics	GO-FLO 2.0
Automatic Samplers/Flowmeters	ISCO	3700/4230
SubChemPack Analyzer	Sun Chem Systems Inc	Multi Channel
Water In Situ Analyzer (NO2+3)	Systea	WIZ probe
SeapHOx In Situ Analyzer	Seabird	SeapHOx V2
Flow	Sea-Gear Corporation	MF 315

Table 9.2 INSTRUMENTATION / EQUIPMENT LIST – LABORATORY

Instrument Group	Manufacturer	Model Number/Name	Room No.
Alkalinity Titrator	Metrohm	OMNIS advanced titrator	134
Alkalinity Titrator	Metrohm	Ti-touch	134
Analytical Balance	Mettler Mettler Mettler Ohaus Ohaus ~~A & D~~	AE-163 H10 B5 Explorer Pioneer Precision ~~FX-200~~	252 328 327 ~~327~~
Autoclave	Market Forge Market Forge Yamato	STM-E STM-EL ~~SM52~~ SN510C	137 126 ~~137~~ 137
Automatic Pipettes	Fisher VWR	5-40 microliters 40-100 microliters 200-1000 microliters 100-1000 microliters 1-5 milliliters 2-10 milliliters	250, 252 246, 254 244, 243
Automatic Pipettes 1-10 Positive displacement	 Eppendorf ~~BioHit~~	 Maxipettor 4720 ~~ePet 0.2-10 µl~~	 243 ~~325A~~
Balances	Accuris Instruments Ohaus DTL Fisher/Denver Sartorious ~~Precisca~~ Ohaus	W3300-500 EP2102 2500S XD-400D EA15DCE-1 ~~310C~~ Scout Pro portable Adventurer AX124 SC2020 Scout SPX222	140 RTMTDI Lab F 252 244, 248 251 ~~325A~~ 228 305 140
Bioanalyzer	Agilent	2100	305
Biosafety cabinet	ESCO	Class II 4' Class II Type A2 Class II 6'	325A 400 RTMTDI Lab F
Block Digestor	Technicon Seal	BD-40 BD-50	252 2524
Cell Analyzer	Millipore	Muse	305A
Centrifuge	Eppendorf ThermoScientific VWR Sorvall	5425 Legend xFR Clinical 50 Legend XFR	~~325A~~ 327 328 243
CN Analyzer	Thermo Electron Corp	Flash EA 112 Series	254
Conductivity Meter	YSI	32	250
Conductivity Meter	Orin Fisher Scientific Orion Fisher Scientific	Star A112 Star A212	250 250
DIC Analyzer	Apollo SciTech	AS-C6	134

Table 9.2 INSTRUMENTATION / EQUIPMENT LIST – LABORATORY (continued)

Instrument Group	Manufacturer	Model Number/Name	Room No.
Dissolved Oxygen Meters	YSI YSI YSI	57 58 Multilab 4010-1W	246 246 246
ELISA System	Dynex	DS2 Automated ELISA System	305A
Fluorometer Fluorometer, Pulse Amplitude Modulation	Turner Designs Walz	10-AU-005-CE TD-700 PhytoPAM-II Compact	243 400 325B
GC/Mass Spectrometer	Agilent	7890A/5975C	305
High Performance Liquid Chromatography	Shimadzu Agilent	LC-40 Nexera 40 series SPD-M10Avp 1100	328 328 305
Hydrometers	Gilson	151H	252
Imagine Particle Analyzer	Fluid Imagine Technologies	Flow Cam 8000	325B
Incubators, BOD	Thermo Scientific	3990LT	246
Incubator, Bacteriological	Precision Scientific	4EM	
Incubator, Diurnal Photo Chamber	Percival Powers Scientific	I-36LLVL DS27SD DS26SD	~~325A~~400 128 140
Laser Particle Sizer	Coulter	LS-13 320	244
LC/Mass Spectrometer	~~LC/MSD SL~~Agilent	~~G1956B~~1260 Infinity II/6460 LC/TQ	305
Microplate Reader	BMG LabTech	SpectroStar Nano	~~325A~~ 327
Microplate Reader	BioTek Agilent	EPOCH2 BioTek Synergy H1	134 305
Microscopes	Olympus Olympus Olympus Laxco AmScope Accuscope Zeiss	CK40 Inverted / epifluorescence BH-2 compound BX-51 LMC3000-RC6 IN480 inverted EXI – 310 Primo Vert Inverted Primo Star HAL/LED	326 326 326 326 ~~326~~ 140 RTMTDI Lab F, 326 RTMTDI Lab F
Muffle Furnace	ThermoScientific	F6018	136
Multiplex	Bio-Rad	Bio-Plex Magpix	305A
Ovens	Fisher Precision Scientific ~~Precision~~ Quiney Precision Scientific Fisher	630G 144-A ~~51221129~~ Model 10 25EG 116G	136 137 ~~250~~ ~~327~~ 325A 250 136
Fluorometer	Turner Designs	8000-010	305
pH Meters	Orion ~~Fisher Scientific, Inc.~~	230, Star A211 ~~Accumet 925~~	250/252,328, 134 ~~250~~

Table 9.2 INSTRUMENTATION / EQUIPMENT LIST – LABORATORY (continued)

Instrument Group	Manufacturer	Model Number/Name	Room No.
Pipettors	Thermo~~-Fisher~~ Scientific ~~VWR~~ Sartorius Brandtech Sartorius Thermo Scientific Eppendorf Thermo Scientific VWR VWR VWR Eppendorf Sartorius Thermo Scientific Gibson Fisher Scientific Thermo-Scientific	20 µL ~~2-~~20 µL 200 µL 200 µL 200 µL 1000 µL 1000 µL 1000 µL ~~100-~~1000 µL 1000 µL 5000 µL 5000 µL Multi-Channel 100 uL 2-5000 µL 0.2-1000 µL Multipipettor 300 µL	~~325A~~ 326 ~~325B~~ 326 326 326 326 140 326 322 ~~325B~~ 326 328 400 325B 327 305A 305A 305A
Segmented Flow Analyzer	SEAL	AA3	252, 254
Spectrofluorometer	PTI		246
Spectrometer	Perkin Elmer Perkin Elmer VWR Shimadzu	Lambda 850 UV/Vis Lambda 35 UV/Vis UV-3100 PC UV-2700	244 328 305 327
Spectrometer - Flame	Ocean Optics	Flame-S-VIS-NIR-ES	134
Standard Sieves	Gilson Tyler	- -	136
Thermocycler/detector	Bio-Rad/Chromo4	DNA Engine/Continuous Fluorescence Detector	305A
Thermometers	Ertco Fisher Hoake Precision Ace VWR	J,G,D,F, PG, N, R 15165 70 031485, 307055 1186, 643 IR Temp Gun	136,243,244,246, 250,252,253,254, cold room
Thermometer – MinMax	~~THERMCO~~VWR	~~ACC895DIG~~62344-914	246
Temperature Loggers	Escort Data Logger Inc	MP-OE-D-8-L, MU-OE-D-16-L	254, cold room, 246, 248
TOC	Shimadzu	TOC-L	246
Turbidimeter	Hach Hach Turner Designs	18900, 2100Q 2100P AquaFluor handheld	250, 246 305A ~~325A~~ 400
-80 °C Freezer	Revco	ULT1786-3-A40	133
Vortexer	VWR	Analog Vortex Mixer	252, 254
Water Baths	Blue M	MW-1110A-1	246,254
IC2R3 OA Lab			
Automatic titrator	Metrohm	905 Titrando/800 Dosino	IC2R3-340
Spectrophotometer	Ocean Insight	Flam-S-VIS-NIR-ES	IC2R3-340
Dissolved Inorganic Analyzer	Apollo SciTech	AS-C3	IC2R3-340
Spectrophotometer (UV/VIS)	PerkinElmer	LAMBDA 365	IC2R3-340

Water Baths	VWR		IC2R3-340
Pipettors	Eppendorf	20-200 µL (2) 10-100 µL 2-20 µL 100-1000 µL 0.5-5 mL 300 multichannel	IC2R3-340
Muffle Furnace	Thermo Scientific	Thermolyne	IC2R3-340
Water, Laboratory (18.2 mΩ)	Barnstead	E-pure (D4641)	IC2R3-340
Balances	Ohaus AND	Adventurer Adventurer-pro GH-300	IC2R3-340
Multiparameter Meters (Temp, Cond, DO)	YSI	Professional Pro	IC2R3-340
PAR Meter	LI-COR	LI-1500	IC2R3-340
~~Segmented Flow Analyzer~~	~~SEAL~~	~~AA3~~	~~252, 254~~
Thermometers (handheld, gun)	VWR – Handheld VWR – Gun	Digital thermometer Infrared thermometer	IC2R3-340
ECOTOXICOLOGY LABORATORY EQUIPMENT			
Analytical Balance	Ohaus	EORR80/Explorer	MAP 881
Automated SPE System	Promochrom	SPE-03 Presto	MAP 881
Centrifuge	DLAB Eppendorf	Palm 9031004012 5415D	MAP 881 MAP 881
Evaporator	Biotage	Turbovap	MAP 881
GC/Mass Spectrometer	Thermo Electron	ISQ Lt	MAP 881
LC/Mass Spectrometer	TSQ Quantis	TSQ02-10001	MAP 881
Microplate Reader	Molecular Devices	SpectraMax iD3	MAP 881
Q-TQF/Mass Spectrometer	Agilent		MAP 881
Muffle Furnace	Vulcan	A-550	MAP 881
Nitrogen Generators	Peak Scientific	Genius XE	MAP 881
Orbital Shaker	VWR	Orbital Shaker	MAP 881
pH Meter	Mettler Toledo	FiveEasy F20	MAP 881
Pipette controllers	T-stereo	EP-PRO	MAP 881
Pipettors	Eppendorf	10 mL 5 mL 1000 µL 300 µL 100 µL 10 µL	MAP 881
-80 °C Freezer	K2 Scientific	KDW0128F52009003	MAP 881
Vortexer	Scientific Industries	Vortex Genie 2	MAP 881
Water Baths	Lab World	Sonic Bath ID9745	MAP 881

Table 9.3 CALIBRATION STANDARD SOURCES AND PREPARATION PROTOCOL

Instrument Group	Standard Source*	How Received	Storage	Standard Preparation from Source	Lab Stock Storage	Prep Frequency
Alkalinity Titrator	Commercial Lab Supplier	Seawater reference material	Room Temp	Source is used	Room Temp	N/A
DIC Analyzer	Commercial Lab Supplier	Seawater reference material	Room Temp	Source is used	Room Temp	N/A
Gas chromatograph	Commercial Lab Supplier	Neat/Concentrated Solutions	20°C	Primary stocks prepared from source (>500 µg/mL)	20°C	Annually
				Intermediate stocks prepared from source or primary (100-500 µg/mL)	20°C	Quarterly
				Working stocks prepared from intermediate (0.02-10 µg/mL)	20°C	Weekly
Mass Spectrometer	Commercial Lab Supplier	Neat/Concentrated Solutions	20°C	Source is used	20°C	Annually
High Pressure Liquid Chromatograph	Commercial Lab Supplier	Neat/Concentrated Solutions	-80°C long term storage	Standard stock short term (Max 36 hrs) = 80 °C	-80°C	As needed
High Pressure Liquid Chromatography for Pigments	Commercial Lab Supplier	Liquid	-80 °C	Source is used	-80 °C	As needed
LC/MS Spectrometers (ELF)	Commercial Lab Supplier	Neat/Concentrated Solutions	-20°C	Working stocks prepared from source (5 µg/mL)	20°C	Annually
Segmented Flow Analyzer	Commercial Lab Supplier	Neat Reagents	Room temp.	Primary stocks prepared from source (1000 mg/L or 100 mg/L)	4°C	Semi-annually (Quarterly NO_2-N)
				Intermediate stocks prepared from primary (1-100 mg/L)	4°C	Monthly
				Working stocks prepared from intermediate (<10 mg/L)	N/A	Daily
Hi Performance Liquid Chromatograph (ELF)				Working stocks prepared from source	-20°C as needed	
Spectrophotometer (UV/Vis)	Manufacturer	Software version #	N/A	Slit, Wavelength, 0%	N/A	Every 60 days
	Milton Roy or equivalent	Optical Glass	Room Temp	Use as received, SRE Absorption, wavelength	Room temp	Semi-annually
	Commercial Lab Supplier	Didymium glass	Room Temp	Use as received Absorption	Room temp	With each use

Table 9.3 **CALIBRATION STANDARD SOURCES AND PREPARATION PROTOCOL (continued)**

Instrument Group	Standard Source*	How Received	Storage	Standard Preparation from Source	Lab Stock Storage	Prep Frequency
Spectrophotometer (UV/Vis) (continued)	Commercial Lab Supplier	Neat Reagents	Room temp	Primary stocks prepared from source (100 mg/mL)	4°C	Semi-annually
				Intermediate stocks prepared from primary (10-100 mg/L)	4°C	Monthly
				Working stocks prepared from intermediate (<10 mg/L)	N/A	Daily
Spectrophotometer (Chlorophyll)						
	Manufacturer	Software version #	N/A	Slit, Wavelength, 0%T	N/A	Every 60 days
	Commercial Lab Supplier (Sigma)	Neat Reagents	Freezer (-20°C)	Solution from source verified with alternative method	Freezer (-20°C)	Annually
	Milton Roy or equivalent	Optical Glass	Room Temp	Use as received, SRE Absorption	Room Temp	Semi-annually
	Commercial Lab Supplier	Didymium Glass	Room Temp	Use as received Absorption, wavelength	Room Temp	With each use
	Commercial Lab Supplier	Didymium Glass	Room Temp	Use as received Calculate equivalent chl a	Room Temp	With each use
Spectrophotometer (pH-Total)	None required					
Conductivity Meter	Commercial Lab Supplier	Neat Reagents	Room Temp	Primary stocks prepared from source (0…0.1, 0.2, 0.5 N)	Room Temp	Semi-annually
pH Meters	Commercial Lab Supplier	Buffer Solutions (4, 7, 10 SU)	Room Temp	Source is used	Room Temp	Buffers replaced semi-annually or per manufacturer's expiration date
Specific Ion Meters (Ammonia, Fluoride)	Commercial Lab Supplier	Neat Reagents	Room Temp	Primary stocks prepared from source (100 mg/L)	4°C	Semi-annually
				Intermediate stocks prepared from primary (100 mg/L)	4°C	Monthly
				Working stocks prepared from intermediate (100 mg/L)	N/A	Daily
Turbidimeter	Commercial Lab Supplier	Solution (4000 NTU)	20°C	Primary stocks prepared from source (>400 NTU)	20°C	>1 year
				Working stocks prepared from primary (20-400 Ntu)	20°C	Monthly
				Working stocks prepared from primary (2-20 Ntu)	20°C	12-24 H

Table 9.3 CALIBRATION STANDARD SOURCES AND PREPARATION PROTOCOL (continued)

Turbimeter (continued)				Working stocks prepared from primary (<2 NTU)	Room Temp	1 h
	Commercial Lab Supplier	Gel Standards Sealed Liquid Standards	Room Temp	N/A	Room Temp	N/A As needed
Laser Particle Sizer	Commercial Lab Supplier	Dry Standards	Room Temp	Source is used	Room Temp	N/A
Fluorometer (Chlorophyll)	Commercial Lab Supplier	Neat Reagent	Freezer -20°C	Primary Stock Standard Solution (SSS) prepared from source	Freezer -20°C	As needed
				Working Primary Dilution Standards (PDS) prepared from SSS (20-200 µg/L)	4°C	As needed, standardized daily
				Quality Control Sample (QCS)	4°C	As needed, standardized daily
IC2R3 OA Lab						
Alkalinity Titrator	Commercial Lab Supplier	Seawater reference material	Room Temp	Source is used	Room Temp	N/A
DIC Analyzer	Commercial Lab Supplier	Seawater reference material	Room Temp	Source is used	Room Temp	N/A
Spectrophotometer (pH Total)	Starna	Neat cuvettes	Room Temp	Source is used	Room Temp	N/A
Spectrophotometer (UV/Vis)	-	-	-	-	-	-
Multiparameter Meters (Temp, Cond, pH, ORP) (Temp, Cond, DO)	Commercial Lab Supplier	Buffers (4,7,9)	Room Temp	Source is used	Room Temp	N/A

*Commercial Lab Suppliers include Fisher, VWR, Supelco, Aldrich, Chem Services, Coulter, Turner Designs
**Acid concentrations added to match sample preservation and pre-treatment.

Table 9.4 **CALIBRATION FOR HYDROLAB MINISONDE 4, 4A, 5 -- DISSOLVED OXYGEN, CONDUCTIVITY, TEMPERATURE, pH, SUBSECTIONS**

Hydrolab Minisondes are designed to provide a record of Dissolved Oxygen (D.O.), Temperature, Conductivity and Salinity using sensors on a multiprobe designed for either profiling or near continuous unattended data monitoring with a power source in the field.

When performing unattended data monitoring lengths of deployment are selected to minimize probe calibration drift and biological fouling. Post-Calibration data, with readings before and after membrane cleaning, are used to determine the extent to which probe performance is affected by fouling and drift. If necessary, correction factors based on a linear or logarithmic accumulation of probe impacts can be computed and applied to the raw data logged.

Before deployment batteries must be replaced. Before any fieldwork probes are cleaned of any fouling and D.O. membranes replaced if necessary.

For D.O. a manufacturer's calibration in air is performed. This calibration is performed on a thermally stable probe, with readings electronically adjusted to the oxygen concentration specific for 100% water saturated air, and the ambient conditions of temperature and altitude. To check this calibration the probe is immersed in a reservoir of deionized water (or tap water if deionized water is not available) and dissolved oxygen is measured in mg/L. A Winkler titration is performed on the same water. The measured and Winkler values must agree within +/-0.3mg/L.

For a check of temperature two reservoirs of water are measured. One a room temperature and the other +/-10°C of room temperature (+10°C in summer and -10°C in winter). These values must agree within +/-0.5°C of a NIST tractable thermometer.

For conductivity a manufacturer's calibration is performed. Probes are immersed in a 0.5N standard KCL solution and the readout is electronically adjusted to the known specific conductivity (temperature compensated) of the solution. A second standard solution of 0.1N KCL is used as a calibration check. This measured value must be within 95-105% recovery of the standard value.

For pH a manufacturer's calibration is performed with pH 7.00 and pH 10.00 or 4.00 (depending on the expectant pH of sample water). Probes are calibrated electronically as in the above conductivity calibration. The remaining standard is used as a calibration check. This measured value must agree within +/-0.2 units of the true standard value.

Table 9.5 <u>CALIBRATION CHECK FOR Escort Temperature LOGGER</u>

Downloading-
- Connect Escort logger to computer via USB Port and open ‘Escort Console’ program (can be downloaded from CD along with ComPort configuration).
- ***In the software settings, make sure the temperature display is in ^{o}C. Under Edit, Options, Select ^{o}C for display options.***
- When Escort is connected, select Download Information and follow the prompts.
- Select download when the logger has been successfully identified by the program.
- Make sure ‘Do not upload any new start conditions to the logger(s)’ is selected and click Finish.
- Save the data as a Logger Compact File under F:\apps\escort\’location’. Save the file as ‘Escort name-location-YYMMDD’ (i.e. MHCC-0217-0177-0005-Cold Room-130906)
- Save the file as .csv to the same location named ‘Location YYMMDD’ (i.e. Cold Room 130906).
- Open the .csv file and save as a .xls file under the same location and name.
- Plot the data by month and print. Place the graph printout in the Escort Datalogger binder under the correct SN.

Setup-
- With temperature logger attached to computer via USB port, select ‘Program and Configure’.
- Follow the prompts and make sure the following information is entered correctly:
    - Description: ‘Location’ (i.e. Cold Room)
    - Sensor: Air Temp (in Celsius)
    - Time: allow the logger to update to computer time
    - Duration of trip: User defined, Interval between each reading: 20 mins
- Check provided summary and click ‘Program’
- Select ‘Finish’ when the program has been sent.
- ***Return Escort logger to location and hit the ‘**START**’ button. This starts the instrument logging. The instrument is recording when the temperature is displayed on the logger screen***
- The loggers need to be downloaded every 90 days. Make sure enough water is in the beaker to cover the sensor.

Temperature Verification-
- Temperature verification should be done annually with a NIST certified thermometer.
- Download the data logger and save data as described above
- Follow the same procedure as in setup but set the interval to 1 second
- Measure temperature of a water bath at three different temperatures as compared to the NIST thermometer and record in calibration log book. Readings should be within +/- 1 °C.
- After verification is complete, connect the logger to the computer and click the setup icon. Change the interval back to 20 minutes. You do not need to save the calibration data.

Table 9.6 MINIMAL INITIAL AND CONTINUING CALIBRATION PROTOCOLS, ACCEPTANCE CRITERIA AND FREQUENCY*

Instrument	Standard Source	# Standards Initial Calibration	Acceptance/Rejection Criteria-Initial Calibration	Frequency	# Standards Continuing Calibration	Acceptance/Rejection Criteria-Continuing Calibration	Frequency
Gas chromatograph	Commercial Lab Supplier	4 + Blank	Correlation Coefficient >0.995	Quarterly or failure of continuing calibration	1	Mid-range concentration within 85-115%	Every 10 samples
GC/MS Spectrometer	Commercial Lab Supplier	4 + Blank	Correlation Coefficient >0.995	Quarterly or failure of continuing calibration	1	Mid-range concentration within 80-120%	Every 10 samples
High Pressure Liquid Chromatography/MS	Commercial Lab Supplier	4 + Blank	Correlation Coefficient >0.995	Quarterly or failure of continuing calibration	1	Mid-range concentration within 85-115%	Every 10 samples
Segmented Flow Analyzer	Commercial Lab Supplier	4+PQL+blank (linear) 5+PQL+blank (quadratic)	Correlation Coefficient >0.995 Relative error < ± 5% or Δ ± 2*MDL 0 Std < ± 1*MDL	Daily (each use) or failure of continuing calibration	1	Mid-range concentration within 85-115% (or 3 limits of detection) of value	Initial and every 20 samples
Laser Particle	Size Commercial Lab Supplier	1 (500 µm)	95-105% Accuracy or within manufacturer specifications	Daily (each use)	1	15 µm standard within 90-110% of nominal value or within manufacturer specifications	Initial and every 20 samples
Spectrophotometer (UV/VIS)	Commercial Lab Supplier	4+PQL+Blank (linear)	Correlation Coefficient >0.995	Daily (each use) or failure of continuing calibration	1	Mid-range concentration within85-115% (or limits of detection) of value	Initial and every 20 samples
Spectrophotometer (Chlorophyll)	Commercial Lab Supplier	Wavelength abs standards (Didymium)	Absorption 98-102% Wavelength ± 1 nm	Daily (each use)	1	High-range concentration within 85-115% (or 3 limits of detection) of value	Initial and every 20 samples
Spectrophotometer (pH-Total)	None required						

Table 9.6 MINIMAL INITIAL AND CONTINUING CALIBRATION PROTOCOLS, ACCEPTANCE CRITERIA AND FREQUENCY* (continued)

Instrument	Standard Source	# Standards Initial Calibration	Acceptance/Rejection Criteria-Initial Calibration	Frequency	# Standards Continuing Calibration	Acceptance/Rejection Criteria-Continuing Calibration	Frequency
Conductivity Meter	Commercial Lab Supplier			Semi-annually	1	Mid-range concentration within 95-105% (or 3 limits of detection) of value	Initial
		5 KCl Stds (0.0001M-0.5M)	95-105% recovery				
		STD Seawater	90-110% recovery	Daily (each use)			
		2 + Blank + PQL	95-105% Accuracy (or within 3 MDLs) Blank <2 µmhos/cm	Daily (each use)	1	Mid-range concentration within 95-105% of value	Initial and every 20 samples
pH Meter	Commercial Lab Supplier	~~2~~3	Reading within 0.1 SU of buffer values	Daily (each use) or failure of continuing calibration	1	Buffer nearest samples within 0.1 SU of buffer value	Initial and every 20 samples
Specific Ion Meter	Commercial Lab Supplier	4+PQL+Blank (linear)	Correlation coefficient >0.995	Daily (each use) or failure of continuing calibration	1	Mid-range concentration within 85-115% (or 3 limits of detection) of value	Initial and every 20 samples
Turbidimeter	Commercial Lab Supplier	3+PQL+Blank (Formazin)	Correlation coefficient >0.99, slope 0.95-1.05	Semiannually			
		1+Formazin+Zero (2 Gels)	90-110% accuracy	Daily (each use) or failure of continuing calibration	1	Mid-range concentration within85-115% (or 3 limits of detection)	Initial and every 20 samples
Balances	Commercial Lab Supplier	5 Std Wts after manufac. Calib.	Within 0.5 mg or 0.5% of value	Annually			
		TARE and 1	Within 0.5 mg or 0.5% of standard weight value	Daily (each use) or failure of continuing calibration	1	Calibration weight within 0.5 or 0.5% of value	Initial and every 20 samples
Pipettes	Laboratory Water	Weights of 10 aliquots	95-105% accuracy	Initial Quarterly	1 3	Low-Med & Hi volume within 95-105% of literature value	Annually Quarterly
Fluorometer (Chlorophyll)	In house verified with alternate methods	5+PQL 2.8-400 µg/L	90-110%	Change in ±3°C Every 2 months	1	Liquid or solid (H/L) Standards 85-115%	Initial and every 20 samples
CN Analyzer	Commercial Lab Supplier	3+PQL+Blank	Correlation coefficient >0.995	Daily (each use) or failure of continuing calibration	1	Mid-range concentration within 85-115% (or 3 limits of detection)	Initial and every 10 samples

Table 9.6 MINIMAL INITIAL AND CONTINUING CALIBRATION PROTOCOLS, ACCEPTANCE CRITERIA AND FREQUENCY* (continued)

Instrument	Standard Source	# Standards Initial Calibration	Acceptance/Rejection Criteria-Initial Calibration	Frequency	# Standards Continuing Calibration	Acceptance/Rejection Criteria-Continuing Calibration	Frequency
Spectrofluorometer	Commercial Lab Supplier	3+PQL+Blank	Correlation coefficient >0.995	Annually or following manufacturer's service (whichever comes first) or failure of continuing calibration	1	Mid-range concentration within 85-115% (or 3 limits of detection)	Initial and every 10 samples
Disposable 1 time use volumetric devices	Laboratory Water	Weights of 1 aliquot	95-105% accuracy	1 Per lot number			
Class A volumetrics and burettes	Laboratory Water	Weights of 1 aliquot	95-105%	Initial			
Plastic and non-Class A graduated volumetric devices	Laboratory Water	Weights of 1 aliquot	95-105%	Initial			
Alkalinity Titrator	Commercial Lab Supplier	1	Correlation coefficient >0.995	Daily (each use)	1	99.3-100.6%	Initial and every 10 samples
DIC Analyzer	Commercial Lab Supplier	3	99.4-100.6%	Daily (each use)	1	99.3-100.6%	Initial and every 10 samples
Benthos							
Occular Stage Micrometer	Commercial Lab Supplier	Occular gradations given unit values	Annually or after scope maintenance				
IC2R3 OA Lab							
Alkalinity Titrator	In house verified with commercial supplier/Commercial Lab Suppler	1		Daily (each use)	1	99.5-100.5	Initial, every 10 samples and ending

DIC Analyzer	In house verified with commercial supplier/Commercial Lab Supplier	2		Daily (each use)	1	r = 0.999997 to 1.000000	Initial, every 10 samples and ending
Spectrophotometer (pH Total)	Laboratory Water/Commercial Supplier	3		Daily (each use)	1	N/A	Initial

Table 9.7 SUPPORT EQUIPMENT CALIBRATION PROTOCOLS

Equipment	Calibration	Frequency	Acceptance/Rejection
Cold Room/Refrigerators	Check temperature	Daily (each use)	4°C ± 2°C
Incubators	Check temperature	Daily (each use)	20°C ± 1°C
Water Baths	Check temperature	Twice daily (each use)	Analysis dependent
Ovens	Check temperature Check temperature	Daily (each use) Daily (each use)	104°C ±1°C 180°C ± 5°C
Digestion Blocks	Check temperature	Annually	Analysis Dependent 160°C ± 5°C 380°C ± 10°C 150°C ± 5°C
Autoclave	Sterility indicators or tape	Daily (each use)	Darkening or melting
Balances	Standard weights Service calibration	Daily (each use) Annually	± 0.5% or 0.005 g Manufacturer's specs
Analytical Balance	Standard weights Service calibration	Daily (each use) Annually	± 0 0.5% or 0.0005 g Manufacturer's specs
Thermometers	Check temperature against NIST-certified thermometer	Annually	± 2°C; Establish correction factor
NIST Thermometers	Send out for recertification	Every ~~10~~ 5 years	± 2°C

10.0 PREVENTATIVE MAINTENANCE

Most preventative maintenance (PM) activities are a routine part of instrument calibrations and are performed by analysts during the daily calibration procedures (**Section 9.0**). Less frequent PM protocols are assigned due dates according to stated frequencies and form a part of the overall laboratory scheduling of activities. Service contracts or vendor support is retained for many critical pieces of instrumentation (GC, GC/MS, HPLC, analytical balance).

10.1 Routine Maintenance Activities

Routine maintenance activities for field and laboratory instrumentation appear in **Tables 10.1** and **10.2**. Full instrument manuals are maintained in a central location by department or, for major equipment, kept adjacent to the instruments.

10.2 Documentation

Non-routine repairs are documented in instrument, instrument type, or manufacturer specific files. Repairs and service calls are traceable to individual units by serial or model number as appropriate. Routine preventative maintenance activities are checked, as appropriate, in the instrument logs.

10.3 Contingency Plans

Contingency plans to accommodate instrument downtime are as follows:

10.3.1 Field Instruments

Except during large synoptic sampling events involving many field crews, sufficient instrumentation is on hand to provide properly functioning meters, together with spares. During smaller sampling efforts, all crews frequently take back-up instrumentation in case of instrument failure. Cooperative agreements with local city and county governments have provided additional meters for large samplings on occasion. Private firms or leasing companies can also provide similar equipment.

Any instrumentation borrowed or leased for a sampling event is subjected to a full bench calibration prior to use. As all field instrumentation is always bench calibrated before each sampling, postponing the sampling in the event of a single instrument failure is usually not required.

In the field, if the continuing calibration check of field instrumentation and any required field calibration fails, back-up instrumentation can be employed instead. Additionally, grab samples can be analyzed as appropriate (**Section 6.0**) for specific conductance and salinity on return to the Laboratory. Data so generated are noted in the sampling report. Depending on the instrumental parameters required and project requirements, the sampling may be repeated.

10.3.2 Laboratory Instruments

Contingency plans for replacing laboratory instrumentation follow a tiered approach and are executed based on the holding times of the particular analytes and/or the possibility of a meaningful re-collection effort for a single parameter.

A. Repair or recalibration of equipment in-house or by a service representative,

B. the use of alternate equipment,
C. the use of alternate methods (from the approved methods listed in **Section 5.0**) with project officer approval,
D. subcontracting analyses to another certified laboratory (also with project officer approval), or
E. invalidation of samples and
F. re-collection if possible.

Gas and liquid chromatographs are maintained on service contract and duplicate detectors on other instruments allow for some flexibility in the event of delayed repairs. The most time critical extractions do not depend on instrumentation and the 40-day holding time for most organics instrumental analyses is sufficient to allow for repairs. Subcontracting of analyses can be done with Project Officer approval.

The segmented flow analyzer has a full backup of samplers, pumps, reagent modules, and colorimeters in-house. Selected parameters also have alternate manual methods (spectro-photometric or titrimetric) available with Project Manager approval.

There is always at least one alternate UV/Vis spectrophotometer, block digestor, turbidimeter, conductivity, pH, specific ion meter, dissolved oxygen meter, BOD bottle D.O. probe, autoclave/sterilizer, ~~BOD incubator,~~ water bath, oven, thermometer, balance, analytical balance, muffle furnace, refrigerator, hydrometer, sieve, pipettor, and microscope for use as backups within the Laboratory.

Records are also kept for all service, maintenance, and quality of the laboratory reverse osmosis/deionized water generation and distribution system. Maintenance activities of the base reverse osmosis unit include scheduled salt (for water softener), filter exchange, and deionizing tank exchange. Point of use deionizers and filtration units report quality during each use (≥18.2 mΩ). Maintenance activities include replacement of filters (0.2 µm), deionizing cartridges, UV lamps when quality falls below this threshold. Spare components are maintained in house for use as needed.

Table 10.1 FIELD EQUIPMENT PREVENTATIVE MAINTENANCE ACTIVITIES

Instrument Group	Activity	Frequency
Automatic Samplers	Check internal humidity indicator Check power source Replace pump tubing when indicated Perform full programming with diagnostics Calibrate volumes delivered Test trigger mechanism	Each deployment (1,2) Each deployment (1,2) Each deployment (1,2) Each deployment (2) Each deployment (2) Each deployment (2)
Dissolved Oxygen Meters	Check/replace membrane Check/replace batteries Clean exterior, lubricate adjustment knobs Rinse cables, probes	Daily (each use) (1,2) Daily (each use) (1,2) As needed Daily (each use) (3)
Flow meter	Rinse exterior	Daily (each use) (3)
Multiparameter Meters (Temp, Cond, pH, ORP) (Temp, Cond, DO)	Check/replace o-ring seals Check/replace membrane Check reference junction on pH probe Clean exterior Rinse cables, probes	Each deployment (1,2,3) Each deployment (1,2) Daily (each use) (2) Daily (each use) (3) Daily (each use) (3)
pH Meters	Check reference junction Clean probe	Daily (each use) (2) Daily (each use) (2)
Photometers	Rinse cables, probes Clean sensor face, cosine corrector Zero display	Daily (each use) (3) Daily (each use) (3) Daily (each use) (2)
Refractometers	Clean exterior, lubricate adjustments	Daily (each use) (3)
Salinity/Conductivity/Temperature	Check/replace batteries Check internal humidity indicator Clean exterior Rinse cables, probes	Daily (each use) (1,2) Daily (each use) (1,2) Daily (each use) (3) Daily (each use) (3)
Spectrophotometer	Check light bulb and light intensity Clean cell compartment Protect from water sources	Daily (each use) (1,2) Daily (each use) (3) Daily (each use)
SubChemPak-Analyzer	Check fittings Check fluid lines	Daily (each use)
Thermometers/Thermographs	Encase field thermometers in protective case Check/replace o-ring seals (thermographs) Clean exterior, dry (thermographs)	Daily (each use) (2) Each deployment (1,2,3) Each deployment (3)
Turbidimeters	Clean optics Check/charge/replace battery	Daily (each use) (2) Daily (each use) (2)

(1) Replace as necessary
(2) Prior to sampling
(3) After sampling

Table 10.2 <u>LABORATORY EQUIPMENT PREVENTATIVE MAINTENANCE ACTIVITIES</u>

Instrument Group	Activity	Frequency
Alkalinity Titrator	Calibrate pH probe Check/replace pH probe Check/replace tubing Check reference junction	Daily (each use) As needed As needed Daily (each use)
Analytical Balance	Clean pan/compartment Check with NIST traceable weights Service cleaning and calibration	Daily (each use) Daily (each use) Annually
Autoclave	Gasket check Interior rinsed and drained Sterility indicators Temperature monitored Timer accuracy verified	Daily (each use) Daily (each use) Daily (each use) Daily (each use) Annually
Balances	Clean pan/compartment Check with NIST traceable weights Service cleaning and calibration	Daily (each use) Daily (each use) Annually
Block Digestor	Exterior and cables cleaned Temperature verified	Quarterly Annually
Burette	Weight of 1 aliquot	Initial
Centrifuge	Clean off corrosive material Check inside of bucket for stress corrosion Check for film of silica Grease oil bucket shoulder and pins	Each use Each use Weekly Weekly
CN Analyzer	Check leaks Check reactor Check water trap	Every 100 samples or as needed
Conductivity Meter	Clean cell Replatinize cell	(4) (4)
Data systems	Check battery backups Clean ventilation fans Confirm back-ups are current	Quarterly Quarterly Weekly
DIC Analyzer	Check/replace carrier gas, in-line filters Check/replace tubing Zero licor analyzer Replace pink filter	Annually or as needed If crystal build-up is visible When baselines > 10 If H_2O vapor/droplets visible in lines
Dissolved Oxygen Meters	Check/replace membrane Check/replace stirrer boot Check/replace batteries	Daily (each use) (1) Daily (each use) (1) Daily (each use) (1)
Evaporator	Check/replace carrier gas Check operation of fume hood Check/apply heat sink compound to base of transistor case	Daily (each use) Daily (each use) Monthly
Flow cam	Clean flow cell/tubing Check/replace flow cell/tubing Check/clean optics	Between samples/after use Daily (each use) As necessary
Fluorometer	Clean off corrosive material including saltwater Check inside sample compartment for evidence of moisture	Each use At each change of cuvette
~~-80°C Freezer~~	~~Clean condenser~~	~~Monthly~~
Gas Chromatograph (GC)	Check/replace carrier gas, in-line filter Check for leaks Change septa, clean injector, clean ECD Remove ends of column Replace column Check electronics ECD wipe test Factory cleaning, re-foil FID clean Replace FID flame tip	Daily (1) psi<500lbs, color When gases changed Monthly (6) On poor peak separation On poor peak separation or when end of column fails Annually Tri-annually (6) (6) (6)

Table 10.2 LABORATORY EQUIPMENT PREVENTATIVE MAINTENANCE ACTIVITIES (continued)

Instrument Group	Activity	Frequency
GC/Mass Spectrometer	Clean source Change filament Change oil in vacuum pump Check ion source, analyzer Check mass calibration	DFTPP response degraded 50% On failure (1) Biannually Daily (each use) Daily (each use)
High Pressure Liquid Chromatograph	Check/replace solvents Replace guard columns Replace columns	As needed (less frequent with daily use) On high pressure or poor peak shape When guard column replacement does not improve separation
Hydrometers	Check again published densities*	Annually
Incubators, BOD	Temperature monitored Interiors cleaned	Daily (each use) Annually
LC/Mass Spectrometer	Check/replace solvents Check oil level in vacuum pumps Check O-rings Change oil in vacuum Replace guard column Clean cone and disrupter pin Replace column	Daily (each use) Daily (each use) Daily (each use) Biannually On high pressure or poor peak shape On high pressure or poor peak shape When guard column replacement does not improve separation
Laser Particle Sizer	Monitor electronic background Clean optics	Daily (each sample) Monthly
Microscopes	Clean optics Wipe down stage	Semi-annually Daily (each use)
Muffle Furnace	Temperature monitored Clean interior	Daily (each use) Annually
Multiparameter Meters (Temp, Cond, pH, ORP) (Temp, Cond, DO)	Check/replace o-ring seals Check/replace membrane Check reference junction on pH probe Clean exterior Rinse cables, probes Calibration	As needed As needed Daily (each use) Daily (each use) Daily (each use) Annually
Ovens	Temperature monitored Interior cleaned	Daily (each use) Annually
PAR Meter (LI-COR)	Rinse cable and probes Calibration	Daily (each use) Every 2 years
pH Meters	Check probe filling level Check reference junction Clean probe	Daily (each use) (1) Daily (each use) (4)
Pipettors	Gravimetric calibration verification Lubricate shaft Check/replace o-rings	Quarterly, annually As needed As needed
Refrigerators/Cold Room	Temperature monitored Clean interior/defrost	Daily (each use) Annually
Segmented Flow Analyzer	Flush all tubing, check for leaks Check all tubing for wear, discoloration, solids Check/change pump tubes Clean platen Oil pump rollers, slides Clean colorimeter filters and optics	Daily (each use) Daily (each use) (1) Daily (each use) (1) Daily (each use) Weekly Semi-annually
Specific Ion Probes	Verify electrode response	Daily (each use)
Spectrofluorometer	Maintenance check by PTI tech	Semi-annually
Spectrophotometer	Clean sampler cell and sample compartment Calibration of slits UV/Vis wavelength Calibration for 0% T Replace lamp Check electronics, lamp alignment Check photomultiplier sensitivity	Daily (each use) 28 days 28 days 28 days (3) (4) (4)

Table 10.2 LABORATORY EQUIPMENT PREVENTATIVE MAINTENANCE ACTIVITIES (continued)

Instrument Group	Activity	Frequency
Spectrophotometer (UV/VIS) - Flame	Clean sampler cell and sample compartment Replace lamp Check electronics, lamp alignment	Daily (each use) As needed Daily (each use)
Standard Sieves	Clean exterior and interior Calibrate against NIST traceable	Daily (each use) Annually
TOC/DOC	Replace Catalyst Replace peristaltic pump Replace syringe (Teflon plunger or whole syringe) Halogen scrubber	Annually or as needed
Thermometers (handheld, gun)	Encase field thermometers in protective case Clean exterior, dry (handheld)	Daily (each use) Each deployment
Thermometers/Thermographs	Check for break in mercury/alcohol column Calibrate against NIST traceable	Daily (each use) Annually
Turbidimeter	Clean sample cell Check instrument linearity, stray light Clean optics	Daily (each use) Daily (each use) As needed
Ultrasonic Processor	Check that amplitude is <40% Check there Is no liquid spill on the converter Wipe down ultrasonic tip with RO water Check for amount of tip wear	Daily (each use) Daily (each use) Daily (each use) Weekly
Water Baths	Drained when not in use Temperature monitored	Daily (each use) Daily (each use)
Water, Laboratory (18.2 mΩ)	Filter replacement Deionizing cartridge replacement Cleaning solution UV Lamp replacement	(2) or visible discoloration (2) With cartridge replacement (2)
Water, Reverse Osmosis	Salt replacement Filter replacement Deionizing tank transfer/replacement	Monthly Every 4 months Every 4 months
Water Baths	Drained and cleaned Temperature monitored	As needed Daily (each use)
Water, Laboratory (18.2 mΩ)	Filter replacement (4 filters)	As needed

*-CRC Handbook of Chemistry and Physics (CRC Press, Inc. 1982)

(1) Replace as necessary
(2) On QC failure
(3) On component failure
(4) On erratic response, loss of sensitivity

11.0 QUALITY CONTROL CHECKS

11.1 Field Quality Control Checks

11.1.1 Blanks and Replicates

Required numbers of equipment and trip blanks, and field replicates are specified in **Table 11.1** for varying numbers and types of chemical samples. For blanks and replicates, different matrices of samples are treated as separate samplings or groups, i.e., two sediment and two aqueous samples are not four samples, but two groups of two each. In all cases, blanks and replicates are treated identically to samples.

Equipment blanks are prepared in the field by using collection equipment to 'sample' analyte-free water, place the analyte-free water into the various containers of a sample kit, and adding the same preservatives used for samples. The blanks are used to evaluate the cleanliness of sample containers, adequacy of equipment pre-cleaning measures, and the general absence of contamination during all phases of collection, preservation, transport, storage, and analysis. Blanks are collected and processed for all parameters requested for a sampling and are transported, processed, and analyzed as blind samples, i.e., identically to all other samples. Equipment blanks on field decontaminated equipment are collected after the equipment has been used and field cleaned.

Field replicates of aqueous samples are collected from successive casts or grabs of sampling equipment, collected as closely together in time and space as is possible to permit a <u>combined</u> assessment of natural system, sampling, and analytical variability. Each of the two is treated as an entirely separate sample with unique sample ID code, custody, and analytical record. Sediment field replicates are similarly collected from successive casts of the sampling equipment.

Where particular projects have routine sampling and monitoring requirements, alternate blank and replicate collections may be considered. If less than the requirements listed above, the justification, specified frequency, and procedures will be detailed in the QA Project Plan.

11.1.2 Field Measurements

Field instruments are calibrated in the laboratory against standards or alternate methodologies prior to fieldwork (**Section 9.0**). Bench calibration records are maintained in a laboratory file specific to instrumentation type and are traceable to individual units by serial number. Instrument serial numbers are recorded in the field logs. If field sampling continues on subsequent days then field calibration checks are repeated for each sampling day.

Continuing calibration checks of field instrumentation are performed with standard solutions during the sampling day, and at the end of each sampling day. If historically generated data demonstrate that a specific instrument remains stable for longer periods of time, the time interval between calibration verifications may be increased. Meters or instrument subsections so treated include pH, conductivity/salinity, and turbidity. Dissolved oxygen meters are verified against Winkler titrations during laboratory calibrations and then air-calibrated at every station during fieldwork. The results of the continuing calibrations, air calibrations, and the identifying lot numbers and/or dates of standards are recorded in the field logbook and maintained with the field data. Standards must meet continuing calibration criteria specified in FDEP SOPs.

11.2 Laboratory Quality Control Checks – Chemistry

Quality control checks performed in the laboratory consist of the listing below, or the method requirements if more stringent. Analytical groups consist of samples of a single matrix, processed by a single method. For example, sediment and aqueous samples from the same site, or two groups of sediment samples which each receive different digestion procedures, are considered to be two analytical groups and must each contain the minimum QC checks at the rates detailed below. Some methods may require more frequent QC checks. Refer to individual SOPs for each method.

11.2.1 QC Check Standards

QC check standards (standards prepared from an alternate source than used for the calibration standards) are analyzed once per analytical group to verify the standard curve (initial calibration verification or ICV).

11.2.2 Continuing Calibration Verification

Continuing calibration verification standards (CCV) are run at a minimum rate of 5%, or a minimum of one for every 20 analyses or portion thereof. CCV standards may consist of the QC check standards described above, one of the calibration standards, as the calibration standards have been verified by the QC check standard, or a different preparation of specific CCV standard from the same source used for the calibration standards. One of the CCVs, preferably at the beginning of the run, must be 1-2X (4-8X MDL) the PQL for that analyte.

11.2.3 Method Blanks

Method blanks or procedure blanks, consist of reagent water taken through all sample preparation, digestion, and analytical processes, and are performed at a minimum rate of one per sample set. Sample sets are defined as all samples processed as a group.

11.2.4 Laboratory Duplicates

Laboratory duplicates are two aliquots (aqueous, sediment, or tissue) processed from a single sample container, and are also performed at a rate of 10%, or one for every 10 samples or portion thereof.

11.2.5 Matrix Spikes

Matrix spikes, or the addition of known quantities of analyte to a sample, are performed at a minimum rate of 5%, or one for every 20 samples or portion thereof (*i.e*. 20 samples - 1 matrix spike, 21 samples - 2 matrix spikes). Sample sets by definition, consist of similar matrices. Refer to individual SOP’s for method-specific matrix spike requirements.

11.2.6 QC Check Samples

When required and available, QC check samples obtained from external sources are analyzed semi-annually as blind samples for all certified parameters.

11.2.7 Additional QC Checks

The following QC checks are optional, but may be specified by the method reference or included at the analyst's discretion. Reagent blanks typically accompany most analyses, forming the 0.0 concentration point of the standard curve. Reagent spikes (standards) accompany most digestion procedures at a minimum rate of 5% or at least 1 for every 20 samples or fraction thereof. Internal standards (quantitation standards) or surrogate spikes (recovery surrogates) may also be included for GC and GC/MS analyses.

11.3 Laboratory Quality Control Checks - Species Identification

If necessary, identifications of the more difficult or occult species may be verified by external experts. New taxa found by Laboratory staff may be sent to external reviewers for agreement as to genus and species (or to the LPL, Lowest Practical Taxonomic Level).

A client voucher collection may be prepared during the course of a project and shipped to the client on request.

11.4 Routine Measures to Assess Precision and Accuracy

For NELAC-certified analyses, and except where specified in individual methods, the QA targets for all inorganic analyses are within the range of 80 – 120% for accuracy and <20% relative percent difference (RPD) as the upper control limit for precision, unless laboratory generated data indicate that tighter control limits can be routinely maintained (See Section 5.0). Warning limits are established at one half of the state precision criteria. Additionally, data quality objectives for precision are considered to be met either if the RPD is within stated control limits or if the individual analytical values differ by 3* method limit of detection or less. This convention was adopted due to the fact that the distribution of historical RPD data are typically non-normal and highly concentration dependent. Although log transformations of RPD plus a constant achieve near-normalcy, warning and control limits computed as mean ± 2 s.d. and mean ± 3 s.d. are typically much less stringent than historical data would imply.

Relative percent difference (RPD) is calculated as follows, where V1 = value 1 and V2 = value 2:

$$RPD = (V1 - V2)*100/(\text{mean of V1 and V2})$$

Some departments assess precision of both field and laboratory data with the percent relative standard deviation statistic (%RSD), computed as the sample standard deviation (s.d.) of the field readings or laboratory duplicates divided by the mean of the readings and expressed as percent:

$$\%RSD = \frac{s.d.}{Mean} \times 100\%$$

with s.d. defined as:

$$\text{s.d.} = \left[\frac{\sum_{i=1}^{n} (x_i - \bar{x})^2}{n-1} \right]^{1/2}$$

Control limits for precision of analyses using %RSD are computed by calculating the mean ($\%RSD_{mean}$) and sample standard deviation (s.d.) of historical %RSD values for the particular parameter. The upper warning and control limits (based on an assumed normal distribution) are then computed as:

Warning Limits = $\%RSD_{mean}$ + 2 * s.d.

Control Limits = $\%RSD_{mean}$ + 3 * s.d.

For precision quality objectives, the lower control limit is set at zero, no initiating data can fall outside of the mean ± 3*s.d., and 68% of the initiating data should fall within the mean ± 1*s.d. As both the %RSD and RPD are concentration dependent, more than one control limit may be utilized for some analyses, each applicable to a specific concentration range.

Accuracy of field instrumentation and of standards is evaluated through the percent recovery (%R) of known standards (observed value of a standard or check sample divided by the known value, V_{known}, and expressed as percent). Laboratory accuracy is computed by the percent recovery of matrix spikes, spiked sample concentration, $V_{spiked\ sample}$, less unspiked sample concentration, 2, quantity divided by the amount added for the spike, $V_{spike\ added}$, and expressed as percent.

$$\%R = \frac{\text{Observed}}{V_{known}} * 100\% \quad \text{for standards.}$$

$$\%R = \frac{V_{spiked\ sample} - V_{unspiked\ sample}}{V_{spike\ added}} * 100\% \quad \text{for spikes.}$$

The precision and accuracy for a field data set or laboratory analytical group is evaluated against either target data quality objectives or compared to a historical record of precision and accuracy for the specific parameter (**Section 5.0**). Warning and control limits for accuracy (of standards or of matrix spikes) are computed similarly to those for %RSD, using $\%R_{mean}$ ± 2*s.d., and ± 3*s.d. Similarly, initiating data sets from which the mean and s.d. are computed can have no values outside of ± 3*s.d. and 68% of the initiating data must fall within the mean ± 1*s.d.

Once the precision of an analytical group exceeds the upper control limits, corrective actions described in **Table 13.1** are sequentially performed. If accuracy results (evaluated by recoveries of continuing calibration and verifications) exceed stated control limits, corrective actions are again performed per **Table 13.1** and the samples analyzed since the last acceptable accuracy measurement must be repeated. Accuracy results (evaluated by spike recoveries) are designed primarily to confirm suitability of method for the sample matrix, and there must be a sufficient number of acceptable spikes for the analytical matrix. Data which exceeds the warning limits are examined to prevent analytical precision and accuracy from becoming worse.

Results of precision and accuracy measures are required to be evaluated (and identified as outside of warning or control limits) by the analyst before data entry or supervisor review of data can occur. For NELAC-certified analyses, initial evaluation of precision and accuracy typically occurs on electronic bench sheets and are subject to immediate analyst review. QA information for the analytical run accompanies the raw data through the review process, is uploaded into the LIMS, automatically recalculated, is validated by the Laboratory Manager, and is available in parameter specific files or laboratory notebooks. The compilation of QA data permits the review of both precision and accuracy measures for trend analysis (8 points on the same side of the mean, or 3 successive points outside of either the upper or the lower warning limits). New warning and control limits are reviewed following a change in instrumentation, annually, or every six months as required for some NELAC analyses.

After sorting sediments are resorted (both for new analysts and at a set percentage for all projects) and original sorting efficiency must consist of 90% or better before data is released for data entry. Resorting percentages are 10% of the samples for each sampling or one from each sorter, whichever is greater. The results of sorting efficiency are documented on forms illustrated in **Figure 11.1**.

11.5 Method Detection Limits

Chemical and Physical Ecology and NELAC certified analyses – Method detection limits (MDLs) are used rather than criteria or action levels and are the minimum concentration of an analyte that can be identified, measured, and reported with a 99% certainty that the analyte concentration is greater than zero. MDLs are determined by the methodology listed in 40 CFR 136, Appendix B (MUR 2017), "Definition and Procedure for the Determination of the Method Detection Limit - Revision 2".

MDL’s are determined through a two-step process: 1) estimating the initial MDL; and 2) determining the initial MDL. Detection limits are first estimated at three times the standard deviation between replicate instrumental measurements of spiked blanks. A standard in reagent water is prepared at 2-10 times the level of the estimated detection limit. A minimum of seven spiked samples and seven method blank samples are processed through all steps of the method. Samples used for MDL must be prepared in at least three batches on three separate calendar dates and analyzed on three separate calendar dates. Preparation and analysis may be on the same day. Calculate the sample standard deviation (S) of the replicate spiked sample measurements and the sample standard deviation of the replicate method blank measurements from all instruments to which the MDL will be applied. Calculate the MDLs (MDL based on spiked samples) as follows:

$MDL_S = t_{(n-1,\ 1-\alpha=0.99)} S_S$ where MDL_S = MDL based on spiked samples.

Compute the MDL_b (MDL based on method blanks) as follows:
If none of the method blanks give numerical results for an individual analyte, the MDL_b does not apply. If some, but not all, of the method blanks for an individual analyte give numerical results, set the MDL_b equal to the highest method blank result. If more than 100 method blanks are available, set MDL_b to the level that is no less than the 99^{th} percentile of the method blank results. If all the method blanks for an individual analyte give numerical results, then calculate MDL_b as:

$MDL_b = X + t_{n-1,\ 1-\alpha\ =\ (0.99)} S_b$ where MDLb – MDL based on method blanks; X = mean of method blank results (use zero in place of mean if negative); S_b = sample standard deviation of the replicate method blank sample analyses.

Recovery of the known concentration is also computed.

The practical quantitation limit (PQL) is defined as 4 times the MDL unless stated differently in individual method SOPs. Data quality objectives of **Section 5.0** consist only of MDLs.

Method detection limits are updated when new instrumentation or methodologies are brought on-line, or when analytical conditions are varied significantly (*i.e.* new GC column, detectors, background correction) and are typically determined annually or more often if required by the cited method. Instrument detection limits or IDLs (computed from the 3*standard deviation of duplicate analyses of a single low-level standard or sample) are determined for each analytical group and must be better than the stated MDLs.

Ongoing Annual Verification
At least every 13 months, or as at a frequency specified by method, whichever is shorter, recalculate MDL_S and MDL_b from collected spiked samples and method blanks results. Include data from the last 24 months that has the same spiking level. Only documented instances of gross failures (e.g., instrument malfunctions, mislabeled samples, cracked vials) may be excluded from the calculations. If the laboratory believes the sensitivity of the method has changed significantly, then the most recent data available may be used, maintaining compliance with the requirement for at least seven replicates in three separate batches on three separate days. Include initial MDL spiked samples if data were generated within 24 months. The verified MDL is the greater of the MDL_S or MDL_b. If the verified MDL is within 0.5 – 2.0 times the existing MDL, and fewer than 3% of the method blank results (for the individual analyte) have numerical results above the existing MDL, then the existing MDL may be left unchanged. Otherwise adjust the MDL to the new verification MDL.

Environmental Laboratory for Forensics – NIST Method. In the Environmental Laboratory for Forensics, method detection limits (MDL) are determined by the methods listed in Yordy et al. (2010). MDLs are sample/matrix and congener specific and are determined by the mass of analyte in the lowest detectable calibration solution divided by the sample mass.

MDL is defined as:

(lowest detectable calibration solution * extract volume * split factor)/wet wt (g).

11.6 Initial and Continuous Demonstration of Capability

For NELAC certified analyses, an initial demonstration of capability (IDOC) will be made prior to using any test method and any time there is a significant change in instrument type, personnel, or test method. Continuous Demonstration of Capability (CDOC) is conducted annually for ongoing proficiency demonstration. If CDOC is not performed within 12 months, an IDOC will be performed. In addition, for analytes which do not lend themselves to spiking, the demonstration of capability (DOC) will be performed using quality control samples. For methods which are calculations of other analytical data, IDOC and DOC will consist of successful calculation of results using test data sets to validate software or arithmetic procedures. Calculation method IDOC (Initial Demonstration of Capability) and DOCs employ test data sets for software validation. All DOCs will be documented using the form in **Figures 11.2 and 11.3** and kept in personnel files. The DOC form also includes certification that each analyst has read, understood, and agreed to follow the most recent approved version of the test method.

11.6.1 Initial Demonstration of Capability

The following steps (adapted from EPA test methods published in 40 CFR Part 136, Appendix A) will be performed if required by mandatory test method or regulation. Initial Demonstration of Capability (IDOC) will be documented on the form in **Figure 11.2.** Successful completion of the IDOC authorizes the analyst completing the IDOC to conduct the method.

1. Quality control samples will be obtained from an outside source. If not available, the QC sample will be prepared by the laboratory using stock standards that are prepared independently from those used in instrument calibration.
2. The analyte(s) will be diluted in a volume of clean matrix sufficient to prepare four aliquots at the concentration specified, or if unspecified, to a concentration approximately 10 times the method-stated or laboratory-calculated method detection limit.
3. At least four aliquots will be prepared and analyzed according to the test method either concurrently or over a period of days.
4. Using all the results, the mean recovery (x) in the appropriate reporting units (such as µg/L) and the standard deviations of the population sample (n-1) (in the same units) for each parameter of interest will be calculated. When it is not possible to determine mean and standard deviations, such as for presence, absence, and logarithmic values, the laboratory will assess performance against established and documented criteria.
5. The information from (4) above will be compared to the corresponding acceptance criteria for precision and accuracy in the test method (if applicable) or in laboratory-generated acceptance criteria (if there are not established mandatory criteria). If all parameters meet the acceptance criteria, the analysis of actual samples will begin. If any one of the parameters do not meet the acceptance criteria, the performance is unacceptable for that parameter.
6. When one or more of the tested parameters fail at least one of the acceptance criteria, the analyst will proceed according to a) or b) below.
    a. Locate and correct the source of the problem and repeat the test for all parameters of interest beginning with (3) above,
    b. Beginning with (3) above, repeat the test for all parameters that failed to meet criteria. Repeated failure, however, will confirm a general problem with the measurement system. If this occurs, locate and correct the source of the problem and repeat the test for all compounds of interest beginning with (3).

11.6.5.2 Continuous Demonstration of Capability

For ongoing proficiency demonstration, analysts will choose annually from the following acceptable methods to maintain their DOC. Continuous Demonstration of Capability (CDOC) will be documented on the form in **Figure 11.3**. Successful completion of the CDOC authorizes the analyst to conduct the method.

1. Acceptable performance of a blind sample (single blind to the analyst);
2. Another initial demonstration of capability;
3. Successful analysis of a blind performance sample on a similar test method using the same technology (e.g., GC/MS volatiles by purge and trap for Methods 524.2, 624 or 5035/8260) would only require documentation for one of the test methods.
4. At least four consecutive laboratory control samples with acceptable levels of precision and accuracy.
5. If 1-4 cannot be performed, analysis of authentic samples with results statistically indistinguishable from those obtained by another trained analyst.

Table 11.1 <u>REQUIRED FIELD SAMPLING BLANKS AND REPLICATES</u>

	Equipment Blanks 1/parameter group/matrix			Trip Blanks VOC's only	Field Replicates 1/parameter group/matrix
	All equipment pre-cleaned		Equipment field decontaminated		
>10 Samples	1 Prior to sampling		1 on 5% of equipment sets	2/cooler	5% or **
5-10 Samples	1 Prior to sampling	<u>OR</u>	1 on decontaminated equipment*	2/cooler	1 or **
<5 Samples	1 Prior to sampling	<u>OR</u>	1 on decontaminated equipment*	2/cooler	NR or **

*Equipment blank on field-cleaned equipment only if field decontamination procedures used.
**As required by analytical method
NR: Not required

Figure 11.1 **BENTHIC ECOLOGY RESORT LOG**

Mote MarineLaboratory
1600 Ken Thompson Parkway
Sarasota, Florida 34236
(941) 388-4441

Benthic Sample Re-Sort Log

Project Name: ____________________

Project Number: ____________________

Collection Date: ____________________

Sample	Sorter Initials	Re-Sorted by	Number of Organisms Found	Total No. Original	Percentage Error	Remedial Action Taken

Revised June 2023

Figure 11.2 <u>INITIAL DEMONSTRATION OF CAPABILITY CERTIFICATION STATEMENT</u>

Initial Demonstration of Capability
Certification Statement
Mote Marine Laboratory, 1600 Ken Thompson Parkway, Sarasota Florida 34236.

Page ____of ____

Date: ___________________

Analyst(s) Name(s): ________________ , ____________________ , ____________________

Matrix: laboratory pure water soil air solid biological tissue Other: ___________________

Method number, SOP#, Rev#, and Analyte, or Class of Analytes or Measured Parameters
(Examples: barium by 200.7, trace metals by 6010, benzene by 8021, etc.)

____
(Most recent approved method)

We, the undersigned, CERTIFY that:

1. The analysts identified above, using the cited test method(s), which is in use at this facility for the analyses of samples under the National Environmental Laboratory Accreditation Program, have met the Demonstration of Capability.
2. The test method(s) was performed by the analyst(s) identified on this certification.
3. A copy of the test method(s) and the laboratory-specific SOPs are available for all personnel on-site.
4. The data associated with the demonstration capability are true, accurate, complete and self-explanatory (1).
5. All raw data (including a copy of this certification form) necessary to reconstruct and validate these analyses have been retained at the facility, and that the associated information is well organized and available for review by authorized assessors.
6. Analyst(s) have read, understood and agree to follow the most recent approved method.
7. Upon successful completion of IDOC, this analyst is authorized to do this method.

_________________________ , _________________________ , _________________________
Analyst's Signature / Date Analyst's Signature / Date Analyst's Signature / Date

_________________________ _________________________ _________________________
Technical Director's Name and Title Signature Date

_________________________ _________________________ _________________________
Quality Assurance Officer's Name Signature Date

This certification form must be completed each time a demonstration of capability study is completed.

(1) True: Consistent with supporting data.
Accurate: Based on good laboratory practices consistent with sound scientific principles/practices.
Complete: Includes the results of all supporting performance testing.
Self-Explanatory: Data properly labeled and stored so that the results are clear and require no additional explanation.

IDOCFORM.doc Revised Date: February 11, 2022; Effective Date: June 1, 2022

Figure 11.3 CONTINUOUS DEMONSTRATION OF CAPABILITY CERTIFICATION STATEMENT

Demonstration of Capability
Certification Statement
Mote Marine Laboratory, 1600 Ken Thompson Parkway, Sarasota Florida 34236.

Page ____of ____

Date: ________________

Analyst(s) Name(s): ______________ , ________________ , ________________

Matrix: laboratory pure water soil air solid biological tissue Other: ________________

Method number, SOP#, Rev#, and Analyte, or Class of Analytes or Measured Parameters
(Examples: barium by 200.7, trace metals by 6010, benzene by 8021, etc.)

____
(Most recent approved method)

We, the undersigned, CERTIFY that:

1. The analysts identified above, using the cited test method(s), which is in use at this facility for the analyses of samples under the National Environmental Laboratory Accreditation Program, have met the Demonstration of Capability.
2. The test method(s) was performed by the analyst(s) identified on this certification.
3. A copy of the test method(s) and the laboratory-specific SOPs are available for all personnel on-site.
4. The data associated with the demonstration capability are true, accurate, complete and self-explanatory (1).
5. All raw data (including a copy of this certification form) necessary to reconstruct and validate these analyses have been retained at the facility, and that the associated information is well organized and available for review by authorized assessors.
6. Analyst(s) have read, understood and agree to follow the most recent approved method.
7. Upon successful completion of DOC, this analyst is authorized to do this method.

Analyst's Signature / Date , Analyst's Signature / Date , Analyst's Signature / Date

Technical Director's Name and Title Signature Date

Quality Assurance Officer's Name Signature Date

This certification form must be completed each time a demonstration of capability study is completed.

(1) True: Consistent with supporting data.
Accurate: Based on good laboratory practices consistent with sound scientific principles/practices.
Complete: Includes the results of all supporting performance testing.
Self-Explanatory: Data properly labeled and stored so that the results are clear and require no additional explanation.

DOCFORM.doc Revised Date: June 22, 2023, Effective Date: June 1, 2022

12.0 DATA RECORDING, REDUCTION, VALIDATION, AND REPORTING

12.1 Access to Electronic Data Records

Access onto instrument workstations, department servers, and LIMS server is controlled via secure, individual passwords. The Chemical & Physical Ecology LIMS further requires an individual password before any LIMS function can be performed. A hierarchy of permissions restricts corrections of previous entries of sample tracking or data which is restricted to the department LIMS Manager, Laboratory Manager, or their designate. A LIMS logfile identifies all activities with the individual responsible. Any alterations to application programs or system functions are restricted to the System Administrator or LIMS manufacturer's representative.

12.2 Data Recording

Data reported by the laboratory can either be generated from manual or electronic capture of direct instrument readouts, or can be the product of further reduction of instrument signals.

Field data are typically loaded as electronic files into the LIMS or into project-specific database files. Field data can also be entered manually from manually-recorded field logs with 100% proofing of resulting entries. Field data reported directly from instrumentation include temperature, temperature compensated pH values, temperature compensated specific conductance, salinity, incident radiation, ORP, salinity compensated dissolved oxygen, and percent saturation of dissolved oxygen.

Laboratory data can be reported directly or further processed. Laboratory data reported directly include turbidity, color, pH, temperature, numbers of organisms for species enumeration, and species identity. Examples of analysis-specific benchsheets or records directly on chromatograms appear in **Figures 12.1** through **12.3**.

Raw data for NELAC-certified laboratory parameters are either manually recorded on electronic benchsheets with automated QA/QC functions, recorded as instrument raw data imported into electronic benchsheets with similar QA/QC functions, or recorded as instrument raw data which are automatically processed by controlling software to final sample concentrations and QA/QC results.

Minimally, analytical data are accompanied by date of analysis, type of analysis, and analyst's initials, as well as sample ID numbers and pertinent instrumental operating conditions (detector/column types, method or SOP and version number, wavelength, slit width, and path length, and initial and final sample volumes, as applicable). Benchsheets and analytical logs are stored in laboratory files. Field logs, chromatograms, species identification logs, and species identification bench sheets are stored by project number.

12.3 Data Reduction

If needed, data reduction can be either manual (calculator) or semi-automated (electronic bench sheets), or automated as software manipulations of instrument-derived raw data).

A. Manual Data Reduction

Following any manual data entry, a hard copy of the resultant file is proofed 100% by the analyst for chemical data, by the data entry clerk (with 10% review by the Data Manager) for macroinvertebrate data, or by the sampling crew leader or their designate for field data.

Simple methodologies or interim data to examine QA/QC criteria can be computed manually, allowing analysts to review on-going QC checks before proceeding with analyses. The final results and QC verification are recorded on the manual benchsheets or analytical logs.

B. Archived Data Reduction

Field data can be processed further with spreadsheet or application programs to generate temperature-corrected or salinity-corrected values following protocols specified by the methods listed in **Section 5**. For laboratory generated data, the bulk of data reduction is accomplished by electronic benchsheets or applications programs, which can automatically tabulate results of required QA/QC analyses and perform method-specific data reduction based on analytical calibrations and standardizations. Data reduction portions of electronic spreadsheets are locked to prevent alteration of analytical computations.

The equations used in controlling software which performs data reductions are supplied by the manufacturer, and are routinely verified by the successful performance of QC check standards and samples.

Data files generated from the automated process are either annotated on the hard copy of the chromatogram or data printout, recorded on the analytical work orders, or in the instrument/analytical log for cross-referencing with sample ID numbers.

C. Formulas for Data Reduction

Data calculations are performed according to method specifications (**Section 5.0**) with additional computations described below.

Dilution factors are used to bring samples within the response range of standards. Where these calculations are not handled by controlling software (following input by the analyst), the undiluted sample value ($Concentration_{Initial}$) for reporting purposes is computed as:

$$Concentration_{Initial} = \frac{Conc._{Final} * Volume_{Final}}{Volume_{Initial}}$$

where $Volume_{Initial}$ is the amount of sample taken for dilution, $Volume_{Final}$ is the volume the sample aliquot is brought to, and $Conc_{Final}$ is the concentration of the diluted sample measured by the analytical method.

Other common data reductions are the conversion of analytical results to reflect the amount of solids or liquid originally taken for analysis or from a wet weight basis to a dry weight basis. Reportable values are calculated as

$$Conc._{Reported} = \frac{Conc._{Analytical} * Volume_{Sample\ Ext\ or\ Digest}}{\text{Volume or Weight of Sample Processed}}$$

To convert results from a wet weight to a dry weight basis:

$$\mu g/g \text{ dry weight} = \frac{\mu g/g \text{ wet weight}}{(\%\ Solids / 100\%)}$$

OR

$$\mu g/g \text{ dry weight} = \frac{\mu g/g \text{ wet weight}}{(1 - (\%\text{Moisture} / 100\%))}$$

Where %Moisture or %Solids is calculated as:

$$\%\ \text{Moisture} = \frac{\text{Wet weight} - \text{Dry weight}}{\text{Wet weight} - \text{Tare}} * 100\%$$

$$\%\ \text{Solids} = \frac{\text{Dry weight} - \text{Tare}}{\text{Wet weight} - \text{Tare}} * 100\%$$

Colorimetric or spectrophotometric methods (total organic and inorganic carbon, manual and autoanalyzer nutrients, trace metals, turbidimetric sulfate, and surfactants) all depend on some form of Beer's Law for quantification, in which increasing analyte concentration results in increased photic response (absorbance, emission, or scattering). Both linear and polynomial regressions are used to develop quantification curves from calibration standards, as some of the chemistries are known to be non-linear. Specific ion analyses, in which a Nerstian response is observed in electrodes, are also quantified against a linear curve, but with the Log_{10} of the concentration plotted against the millivolt response.

<u>Linear and non-linear regressions</u> are calculated either manually with a statistical calculator, via spreadsheets, or by instrument software. Formulas for non-linear regressions are verified by the acceptable analysis of QC check standards.

<u>Response factors</u> (RF) for GC, GC-MS, LC-MS, and HPLC analyses may be manually computed from:

$$RF = \frac{C_i * A_{IS}}{A_i * C_{IS}}$$

where C_i and A_i are concentration and peak area of analyte, and C_{IS} and A_{IS} are the concentration and peak area of the internal standard.

<u>Total nitrogen</u> is calculated as the sum of Total Kjeldahl Nitrogen and Nitrate-Nitrite-Nitrogen (as N) concentrations. <u>Organic nitrogen</u> is computed as Total Kjeldahl Nitrogen less Ammonium-Nitrogen (as N) concentrations. <u>Nitrate-Nitrogen</u> is computed as Nitrate-Nitrite-Nitrogen less Nitrite-Nitrogen concentrations.

<u>Organic phosphorous</u> is operationally defined and is variously computed as total phosphorous less acid-hydrolyzable phosphorous or less soluble reactive phosphate (ortho-phosphorus), depending on reference.

<u>Un-ionized ammonia</u> (mg/L of NH_3) is calculated from total ammonia (the quantity analytically determined by either electrode or colorimetric methods as mg/l N), ambient temperature, salinity, and pH per DEP SOP (2001, Rev. 2) “Calculation of un-ionized ammonia in fresh water”. (Precisions and accuracy criteria are not applied to those parameters computed from the results of several other analyses, per FDEP, May 5, 2014.)

12.4 Analyst's Responsibilities

For both manual and automated data reduction, the analyst must ensure that the correct information is entered at the time of analysis for sample ID, dilutions, sample weights, QC criteria and check values for recovery calculations, and response factors. The analyst also must record pertinent operating conditions or method parameters for the instrument used. Operating conditions appear on the hard copy printout from the analyses (**Figure 12.2**).

Analyst's responsibilities also include interim manual or spreadsheet data reduction sufficient to calculate the results of QC checks and/or to proceed with the analysis (correlation coefficients, precision, accuracy, etc.). On completion of analysis, the analyst tabulates QC checks for review, assigns any necessary data qualifier codes (**Table 12.1**) and enters the QC data into the department's QC compilation. Electronic benchsheets used for NELAC-certified analyses compute QA/QC automatically and compare results to criteria, assigning qualifiers and flags as needed for analyst's corrective action.

12.5 Documentation

Documentation pertinent to data entry and data reduction include the following items which are stored in either the LIMS (LIMS), chronological laboratory files (LF) or project indexed files (PF):

A. Custody Forms (PF) and Sample Receipt Forms (LF)

B. Sorting and Identification Logs (PF)

C. Field Logs (PF) With a Record of
   - a). date, sampling crew, pertinent sampling information,
   - b). review of QC checks and calibrations,
   - c). data entry,
   - d). electronic file generated,
   - e). proofing,
   - f). Project Manager Review.

D. Work Orders or Benchsheets (LF/LIMS-inorganic, PF-organic) With a Record of
   - a). date, analyst, operating conditions,
   - b). QC check calculation and tabulation,
   - c). data entry,
   - d). electronic file generated,
   - e). analyst proofing,
   - f). analytical manager review.

E. Species Identification Data Sheets (PF) With a Record of
   - a). date, analyst, and pertinent sample information,
   - b). resort results,
   - c). data entry,
   - d). electronic file generated, and
   - e). data manager proofing.

F. Chromatograms, Charts, Automated Printouts (LF/LIMS-inorganic, PF-organic) recording
   - a). date, analyst, and operating conditions
   - b). QC check calculation and tabulation,

c). electronic file generated
d). record of analyst review of electronic file

G. Printouts of Code for Applications Programs (LF) or Record of Formulas Contained in Spreadsheet Calculations (LF)

H. Tabulations of QC Checks (LF/LIMS) for Indirect Validation of Controlling Software with Automatic Data Generating Capabilities

The department Sample Custodian is responsible for the proper retention of sample custody, sample receipt forms, sorting and identification logs, and field logs. Raw data are recorded by the analyst, who also verifies and tabulates QC checks. Manual data entry into electronic files or hard copy reports is performed by the analyst (for chemical analyses) and by data entry clerks (for species identification). Data from field logs is entered into computer files by the Data Manager, or their designate, and proofed. Data entered manually are then subject to Data and Project Manager review. Automated data collection files are reviewed by the analyst for verification. Upon correct entry or file verification, data is reviewed by the Data Manager for holding time compliance, QC check validity, anomalous data, submitted to the Project Manager for review, and then filed in the appropriate laboratory or project files upon acceptance. A record of all laboratory notebooks, instrument logbooks, standard logbooks and records for data reduction, validation storage and reporting are maintained by the Department Data Manager. MML retains all original field and laboratory measurements, calculations and derived data, calibration records, and reports for a minimum of five (5) years beyond project completion.

12.6 Data Integrity and Validation

The procedures to maintain data integrity ensure that an analytical value recorded by the analyst is the number which is either reported directly or appropriately reduced further, that analyses are complete, data reductions are properly performed, and that the unaltered or correctly reduced value is reported to the client. Data validation is the process which ensures data validity, *i.e*. that the values reported by the analyst are correct, within preselected limits of precision and accuracy.

12.6.1 Data Integrity

Data integrity is ensured by:

A. Field crew leader responsible for complete custody records, required field calibrations, accurate data recording, verification of anomalous values.
B. Department sample custodian review of field custody forms, entry into sample tracking system, field calibrations, field logs.
C. Analyst/sorter/taxonomist responsible for accurate and complete data recording, instrument calibration, QC check verifications and tabulations.
D. Analyst proofing of manual data entry at 100% (data entry clerk proof and department Data Manager review for biological data).
E. Recalculation of manual calculations at a rate of 10%.
F. Review of manually entered field data files.
G. Analyst review of electronic datafiles.
H. Analytical manager review of sample status/receipt forms, work orders, bench sheets, analytical run QA/QC data, and analytical logs.
I. Analytical Manager (or Data Manager) and project manager review of laboratory and field data for anomalous data points.
J. Letter reports and tabular data reviewed by Analytical Manager (or Data Manager) and Project Manager before submittal to clients.

K. All data reported submitted with the signature of Analytical Manager or Project Manager.

12.6.2 Data Validation

The processes used to ensure data validity primarily include an evaluation against predetermined data quality objectives (**Section 5.0**). Steps include:

A. Analytical Manager verification of proper method selection.
B. Analyst's evaluation of calibration validity (similarity with previous curves or responses, correlation coefficient, accuracy of QC check sample or standard results [ICV]).
C. Analytical manager verification of sorting efficiency (biological data).
D. Analyst's evaluation of method blank.
E. Analyst's evaluation of precision of laboratory duplicates against data quality objectives.
F. Analyst's evaluation of accuracy of matrix spikes against data quality objectives.
G. Analyst's evaluation of continuing calibration verification (CCV) within predetermined limits.
H. Analyst's evaluation and tabulation of batch QC checks, assignment of any data qualifier codes.
I. Analytical Manager review of raw data and QC tabulations.
J. Confirmation of taxonomists identifications by senior staff and confirmations by external experts for new taxa encountered, if needed.
K. Analytical Manager evaluation of field equipment and method blanks (together with container and reagent blanks if processed).
L. Analytical manager review of field replicates.
M. Analytical and Project Manager review of tabulated data for anomalous values, review of data qualifier codes.
N. Analytical manager assignment of additional data qualifiers, if necessary.

12.7 Data Reporting

Data are submitted to clients either electronically (in mutually agreeable format), in letter format with hard copy tabular data, and/or in bound final reports. When required, electronic transmittals include a confidentiality statement. Data reports are typically electronically generated from laboratory or project database files, from LIMS reports, or as multi-parameter tables of collated LIMS reports. Data tables may also be imported into spreadsheet or word processing environments to assist in formatting and then inserted into reports.

Any manual transfer of data to a report, *i.e.* for a letter report, is proofread against a hard copy by the analytical or project manager prior to signing the report. Tabular data generated directly from the LIMS, laboratory, or project database files are reviewed by the Data Manager or Analytical Manager, as well as by the Project Manager before submittal to clients. Files transferred to a word processing or spreadsheet environment are developed as a tabular file initially, reviewed by the Data or Analytical Manager, submitted to word processing, and on completion, are reviewed by the Project Manager.

Standard practice for reporting data include the use of standard units (unless requested otherwise by clients), reporting of all data for solid matrices on a dry weight basis unless wet weight is specifically requested, and reporting of blanks. Blanks values are not subtracted from sample values in standard data reports, and would be subtracted only if justified after the examination of container blanks from same lot numbers as equipment blanks and samples, the examination of method and reagent blanks to identify the source of the contamination, and if requested by the client. Any blank subtraction would be fully justified and clearly identified in the text of the report.

Letter reports are submitted with a Project or Analytical Manager's signature, as is tabular data. Bound final reports are submitted with a cover letter, again from the Project Manager, Analytical Manager, or Laboratory Director. Electronic copies of all text and data reports submitted are stored in project files. Larger interpretive reports are stored as electronic and as hard copy both in project files and in the MML library in the sequentially numbered Technical Report Collection.

12.7.1 Data Reporting for NELAC –Certified Analyses

All reports will clearly differentiate between analyses that were conducted with NELAC certification and analyses that were conducted without NELAC certification. Additionally, a statement is added to each report that states that results relate only to the samples. For amendments to reports, a reference to the original report will be included in the title. A statement requesting feedback is also included in each report.

Examples of a reporting format for a tabular data report for NELAC-certified data appears in **Figure 12.4**.

12.7.2 Electronic Signatures

In accordance with F.A.C. 62-160, electronic signatures are as acceptable as written signatures when the integrity of the electronic signature can be assured, the signature is unique to the individual, when the organization using electronic signatures has written policies for the generation and use of electronic signatures, including the security, confidentiality, integrity and auditability of each signature.

Analytical entries into the LIMS are performed by analysts who obtain access through user-specific, secure passwords. The LIMS activity log records individuals responsible for all data transactions. Analysts are directed not to share passwords and to upload the data for which they are responsible.

LIMS reporting also has the ability to provide electronic facsimiles of signatures, and those individuals with System Administration, Analytical Manager, or Authorized Reporting privileges can employ this feature (again with appropriate password protection) to generate analytical reports.

12.8 Sources of Error and Estimation of Uncertainty

Many factors determine the correctness and reliability of environmental tests performed by a laboratory. These factors include contributions from:

A. Human factors;
B. Accommodation and environmental conditions;
C. Environmental test methods and method validation;
D. Equipment;
E. Measurement traceability;
F. Sampling;
G. Handling of samples.

The extent to which factors contribute to total uncertainty of measurement differs considerably among types of environmental tests. MML takes these factors into account in developing environmental test methods and procedures, in training and qualification of personnel, and in selection and calibration of equipment. Sample matrix effects can contribute uncertainty to measurements on field samples, so rigorous evaluation of all errors is often impractical. In these cases, attempts are made to identify all components of uncertainty and make reasonable estimation. The contribution of all possible factors to uncertainty is estimated by MDL analysis and reported with appropriate significant figures. Measure of IDL, field replicates, and certified standards are used to help confirm uncertainty of a measurement remains within defined boundaries. Total measurement error is estimated using known, traceable or certified standards. For quantitative laboratory measurements, statistical quality control measures are used to estimate uncertainty.

Precision and bias for laboratory control samples and matrix spikes are available to clients on request. From that information, clients may estimate uncertainty on a sample and/or batch specific basis. To the extent possible and where not constrained by method reporting requirements, the laboratory also uses significant figures reported for results to convey uncertainty.

12.9 Data Storage

12.9.1 Hard Copy

Data retained as hard copy at MML includes the items listed above under Documentation, and includes field logs, sample receipt forms, sorting and identification logs, work orders or benchsheets, identification data sheets, chromatograms, charts, automated printouts, printouts of code for applications programs, records of formulas contained in spreadsheet calculations, and tabulations of QC checks. Data are stored in chronological laboratory files or project specific files as detailed above. Hard copy of data pertinent to laboratory operations (standards and reagent preparation, field meter calibrations, sample container cleaning and kit preparation records) are also retained.

Linkages or key fields interrelating the various files include project number and station designation, cleaning lot number, sampling kit lot number, container ID, bench sheet or analytical log number, reagent and standard lot numbers or preparation dates, and datafile name. The interrelationships for chemical data sets allow the traceability of all data from cleaning of containers to final report.

Current hard copy information is stored in the laboratory, older data are boxed by year or project, inventoried, and stored off-site. Hard copies of project data are stored for five (5) years from project completion; hard copies of chronological laboratory data are also stored for five (5) years. All archived hard-copy project records are kept in locked storage. All individuals accessing these records must sign the logbook kept in the storage area to record their access to this archived information.

12.9.2 Electronic Records

For chemical data, electronic files are produced and maintained of sample receipt information and container IDs (taken from the custody form), analytical work orders, analytical files, and project specific data files.

Electronic data files are on fixed discs of linked, stand-alone, or dedicated PC platforms. Electronic data files are backed-up regularly to independent electronic storage devices. During the required records retention period, all archived or active electronic data are supplemented by any hard copies of the custody forms, field logs, bench sheets, chromatograms, and automatic data printouts, which were used to build the data files.

For Chemical & Physical Ecology, analytical files on PC platforms dedicated to instruments are transferred to the department server at the completion of each analytical run. Analytical benchsheets are similarly copied to the department server. Benchsheets are subsequently transferred to the LIMS server and uploaded and linked to the LIMS database, which maintains laboratory files of electronic data for active and past projects. Automated backups of both department and LIMS servers are performed nightly in which complete images are copied and compressed with data duplication. Individual daily copies are maintained for three (3) months (90 days), monthly copies are maintained for five (5) years, and annual copies maintained beyond five years. Success of the ongoing back-up protocols is confirmed and documented weekly.

For biological data, data files on individual samples are proofread and then incorporated into project specific data files from which all final data tables, species lists, summary data, and calculations of indices and other statistics are prepared. Backups of sample and project files are prepared similarly to chemical data files.

12.10 Electronic Data Records

12.10.1 Access

Access onto networked or stand-alone computers is controlled via department-specific passwords. Entry of samples into the chemical tracking system further requires an approved access code before samples can be entered, hard copies of tracking forms generated, listing of analyses due, or status of various fractions presented. Any corrections of previous entries to sample tracking requires an additional access code which is restricted to the department Sample Custody Officer or their designate.

On networked data systems, access to data files is also limited to department personnel, with any modifications of data restricted to the data entry personnel or department Data Manager. Magnetically archived data are transferred to a server under a password protected directory. A logfile sequentially identifies all individuals who access the directory. Any alterations to application programs (or system functions such as time and date) are restricted to the System Administrator.

12.10.2 Quality Assurance Compilations

During the analysis of chemical samples, analysts compute the results of required quality assurance checks and compare them to data quality objectives (**Section 5.0**). The results are, in most cases, entered directly onto bench sheets to facilitate supervisor review. Following analysis, the precision and accuracy data are compiled into department files by parameter and the analyst verifies on the work order (**Figure 7.14**) that the QA data have been entered and reviewed.

If necessary, sediments are re-sorted (both for new analysts and at a set percentage for all projects) and original sorting efficiency must consist of 90% or better before data is released for data entry. Re-sorting percentages are 10% of the samples for each sampling or one from each sorter, whichever is greater. The results of sorting efficiency are documented on forms illustrated in **Figure 7.17**.

12.10.3 Data Entry

If the QA of an analytical group is acceptable, then manual entry of raw data is performed by data entry clerks (or the analyst) to temporary files. Temporary data files are verified by 100% proofing or a hard copy by the analyst who generated the raw data. (Biological data entry is proofread and reviewed by the Department Data Manager as multiple taxonomic specialists are involved with the identification of all taxa within a single sample.) The temporary datafile name and record of proofing are documented on the bench sheet of raw data, in addition to the entry of QA dat. Any manual transfer of data is always proofread 100%

For automated data collection platforms (GC, AA, Autoanalyzer, some balance procedures), in which collected datafiles are used without further reduction or re-entry, hard copies of the temporary data files are produced and reviewed by the analyst against the backup bench sheets or printer output, again by the responsible analyst.

Temporary data files, once proofread as correct by the analyst, are reviewed by the Department Data Manager. The data review is documented, again on the bench sheet of raw data and then data are incorporated through relational database programs or other commercial software into project specific and laboratory data files by the Data Manager or their designate.

12.10.4 Verifications

Forms printed for verifications and signatures through the laboratory sample tracking system include:

1) Sample status forms,
2) Analytical work orders for sample preparation, and
3) Analytical work orders for sample analysis.

Analysts complete the above three forms and, in the process of analysis and data reduction complete and sign:

1) Sequentially numbered bench sheets, with either raw data or record of automated data collection.

Following data entry or collection, signatures are required to document:

1) Proofing of data entry or review of automated data collection by the analyst,
2) Record of data review by the Analytical Manager, and
3) Record of incorporation of temporary datafile into project or laboratory database.

12.10.5 Data reporting

Data for projects are typically submitted in electronic form unless hard copy reports are required, with tabular final data contained. Hard or electronic copies of all text and data reports submitted are stored in project files. Larger interpretive reports are stored electronically both in project files and in the MML CLARK system in a sequentially numbered Technical Report Collection. Data supplied to clients via email are duplicated by a mailed hard copy if requested. MML retains all original observations, calculations, and derived data, calibration records, and a copy of the last report for a minimum of five (5) years.

When desired by the client, data are supplied on magnetic media in some mutually agreeable format (~~ASCII flat or~~ comma separated file, *.DIF, Microsoft Excel, etc.). When so supplied, electronic data are accompanied by metadata , together with a tabular listing (if not already supplied in the hard copy report) of all data. When required, electronic transmittals include a confidentiality statement. Successful transfer is verified by the error checking routines of communications software, and by ~~telephone~~ confirmation of receipt with the client recipient.

Electronic data files of ongoing and completed projects are maintained by project. Active project files and analytical results are backed up regularly to independent electronic storage devices. A backup copy of all analytical results is maintained, even for those instruments with automated data collection platforms, to prevent loss of data collected since the last backup in the event of a catastrophic failure. Raw analytical results (both magnetic and hard copy) are maintained for a minimum period of 5 years (or as dictated by the project).

Table 12.1 DATA QUALIFIER CODES (from Chapter 62-160, F.A.C., rev 4-16-18)

CODE	DEFINITION
A	Value reported is the arithmetic mean (average) of two or more determinations. This code shall be used if the reported value is the average of results for two or more discrete and separate samples. These samples shall have been processed and analyzed independently. Do not use this code if the data are the result of replicate analysis on the same sample aliquot, extract or digestate (for example, for Stream Condition Index, biochemical oxygen demand or bacteriological analyses, or instrumental analyses such as Inductively Coupled Plasma).
B	Results based upon colony counts outside the acceptable range. This code applies to microbiological tests and specifically to membrane filter colony counts. The code is to be used if the colony count is generated from a plate in which the total number of coliform colonies is outside the method indicated ideal range. This code is not to be used if a 100 mL sample has been filtered and the colony count is less than the lower value of the ideal range.
F	When reporting species: F indicates the female sex.
H	Value based on field kit determination; results may not be accurate. This code shall be used if a field screening test (e.g., field gas chromatograph data, immunoassay, or vendor-supplied field kit) was used to generate the value and the field kit or method has not been recognized by the Department as equivalent to laboratory methods.
I	The reported value is greater than or equal to the laboratory method detection limit but less than the laboratory practical quantitation limit.
J	Estimated value. A “J” – qualified sample value shall be accompanied by a detailed explanation to justify the reason(s) for designating the value as estimated. Where possible, the organization shall report whether the actual sample value is estimated to be less than or greater than the reported value, to assist data users in any evaluation of the usability of the sample value. A “J” data qualifier code shall not be used as a substitute for G, K, L, M, S, T, V, or Y, however, if additional reasons exist for identifying the value as an estimate (e.g., laboratory control spike or matrix spiked failed to meet acceptance criteria), the “J” code may be added to a G, K, L, M, T, U, V, or Y qualifier. Examples of situations in which a “J” code must be reported include: instances where a quality control item associated with the reported value failed to meet the established quality control criteria (the specific failure must be identified); instances when the sample matrix interfered with the ability to make any accurate determination; instances when data are questionable because of improper laboratory or field protocols (e.g., composite sample was collected instead of a grab sample); instances when the analyte was detected at or above the method detection limit in an analytical laboratory blank other than the method blank (such as a calibration blank) and, the blank value is greater than 10% of the associated sample value; or, instances when the field or laboratory calibrations or calibration verifications did not meet calibration acceptance criteria, including quantitative or chronological bracketing requirements for field testing data.
K	Off-scale low. Actual value is known to be less than the value given. This code shall not be used for microbiological tests or for biochemical oxygen demand. This code shall not be used for field-testing measurements where quantitative bracketing is required. This code shall be used if:
	1. The value is less than the lowest calibration standard and the calibration curve is known to be non-linear; or
	2. The value is known to be less than the reported value based on sample size, dilution.
	This code shall not be used to report values that are less than the laboratory practical quantitation limit or laboratory method detection limit.

Table 12.1 <u>DATA QUALIFIER CODES (from Chapter 62-160, F.A.C., rev 4-16-18) (continued)</u>

L	Off-scale high. Actual value is known to be greater than value given. This code shall not be used for microbiological tests or biochemical oxygen demand. This code shall not be used for field-testing measurements where quantitative bracketing is required. To be used when the concentration of the analyte is above the acceptable level for quantitation (exceeds the linear range or highest calibration standard) and the calibration curve is known to exhibit a negative deflection.
M	When reporting chemical analyses: presence of material is verified but not quantified; the actual value is less than the value given. The reported value shall be the laboratory practical quantitation limit. This code shall be used if the level is too low to permit accurate quantification, but the estimated concentration is greater than or equal to the method detection limit. If the value is less than the method detection limit use "T" below.
N	Presumptive evidence of presence of material. This qualifier shall be used if:
	1. The component has been tentatively identified based on mass spectral library search; or
	2. There is an indication that the analyte is present, but quality control requirements for confirmation were not met (i.e., presence of analyte was not confirmed by alternative procedures).
O	Sampled, but analysis lost or not performed.
Q	Sample held beyond the accepted holding time. This code shall be used if the value is derived from a sample that was prepared or analyzed after the approved holding time restrictions for sample preparation or analysis. This code shall be reported with sample results calculated from two or more component analyses, if one or more component sample preparations or analyses were performed out of holding time.
T	Value reported is less than the laboratory method detection limit. The value is reported for informational purposes only and shall not be used in statistical analysis.
U	Indicates that the compound was analyzed for but not detected. This symbol shall be used to indicate that the specified component **was not** detected. The value associated with the qualifier shall be the laboratory method detection limit. This code shall also be used to indicate the laboratory reporting limit, where applicable to the specific test, according to paragraph 62-160.340(3)(c), F.A.C. (e.g., biochemical oxygen demand, chlorophyll or microbiological tests). Unless requested by the client, less than the method detection limit values shall not be reported (see "T" above).
V	A "V" – qualified sample value indicates that the analyte was detected at or above the method detection limit in both the sample and the associated method blank and the blank value was greater than 10% of the associated sample value. The 10% criterion shall not apply to blank results for biochemical oxygen demand (BOD) or microbiological tests. For BOD tests, the "V" code shall be used for all sample results where the associated method blank result exceeds the maximum blank DO depletion specified in the analytical method. For microbiological tests, the "V" code shall be used for all samples where the associated method blank indicates growth of the target organism. Note: unless specified by the method, the value in the blank shall not be subtracted from associated samples.
X	Indicates, when reporting results from a Stream Condition Index Analysis (SCI 1000), that insufficient individuals were present in the sample to achieve a minimum of 280 organisms for identification (the method calls for two aliquots of 140-160 organisms), suggesting either extreme environmental stress or a sampling error.
Y	The laboratory analysis was from an improperly preserved sample. The data may not be accurate.

Table 12.1 DATA QUALIFIER CODES (from Chapter 62-160, F.A.C., rev 4-16-18) (continued)

Z	Too many colonies were present for accurate counting. Historically, this condition has been reported as "too numerous to count" (TNTC). The "Z" qualifier code shall be reported when the total number of colonies of all types is more than 200 in all dilutions of the sample tested using a membrane filter technique. When applicable to the observed test results, a numeric value for the colony count for the microorganism tested may be estimated by a laboratory from the highest dilution factor (smallest sample volume) and the upper limit of the ideal colony count range indicated in the method used for the test and reported with the qualifier code. Atypical, non-target, spreading colonies or other interferences may prevent estimation of typical target organism counts, and reporting a numerical result may not be possible. Report "No Result" along with the qualifier code when this condition is observed, or when more than 200 non-target colonies are observed. Additional comments such as "confluent growth" may be reported with the "Z" code. When required by Chapter 62-550, F.A.C., the samples with verified, positive colonies must be reported as detections.
?	Data are rejected and should not be used. Some or all of the quality control data for the analyte were outside criteria, and the presence or absence of the analyte cannot be determined from the data.
*	Not reported due to interference.

The following codes deal with certain aspects of field activities. The codes shall be used if the laboratory has knowledge of the specific sampling event. The codes shall be added by the organization collecting samples if they apply:

CODE	DEFINITION
D	Measurement was made in the field (i.e., in situ). This code applies to any value (**except** field measurements of pH, specific conductance, dissolved oxygen, temperature, total residual chlorine, transparency, turbidity or salinity) that was obtained under field conditions using approved analytical methods. If the parameter code specifies a field measurement (e.g., "Field pH"), this code is not required.
E	Indicates that extra samples were taken at composite stations.
G	A "G" – qualified sample value indicates that the analyte was detected at or above the method detection limit in both the sample and the associated field blank, equipment blank, or trip blank, and the blank value was greater than 10% of the associated sample value. The value in the blank shall not be subtracted from associated samples.
R	Significant rain in the past 48 hours. (Significant rain typically involves rain in excess of 1/2 inch within the past 48 hours.) This code shall be used when the rainfall might contribute to a lower or higher than normal value.
S	Secchi disk visible to bottom of waterbody. The value reported is the depth of the waterbody at the location of the Secchi disk measurement.
!	Data deviate from historically established concentration ranges.

Figure 12.1 ANALYSIS SPECIFIC BENCHSHEET

C:\Users\qjwalsh\Desktop\qj\QA\2023\QAManual2023\Turbidity Template 230123

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Mote Marine Laboratory, 1600 Ken Thompson Parkway, Sarasota, FL 34236

Turbidity: SOP Turbidity-1.9

Method: SM 2130B-2011 Template: 1/23/2023

Analyst: ______ Date: ______ # Samples: 0

Turbidimeter SN ______ Last Cal Date: ______ Cal Due Date: ______

Support Equipment SNs: ______

		Lot#	EXP Date/time:	NTU	RPD=	10	
CCV1	Set1: 0-10				MDL(NTU)=	0.2	
CCV2	Set1: 0-100				Warning	5	
CCV3	Set1: 0-1000					Range	
CCV4	Set2: 0-10				% REC ICV	90	110
CCV5	Set2: 0-100				WL ICV	93	107
CCV6	Set2: 0-1000				% REC CCV	85	115
ICV				10	WL CCV	90	110

	Lot#	EXP Date/time:	NTU
PQL			0.80

Proofed 100% ______ Date: ______ Omega run# ______

Acknowledge ______ Date: ______ OK

Backlog check ______ Date: ______ #DUPS 0

Sample ID	bottle	Tag no	Turbidity measured (NTU)	Analysis Time (EST)	Turbidity For Data (NTU)	RPD	OCL/OK?	% REC	OCL/OK?	blank OR samp	Analysis Date	Report Time	Comments	Sample Type	DF	TURB CALC	SEGMENT	LIMIT
ICV					0	IDL		0.00	OCL		1/0/1900	12:00:00 AM		ICV	1	0		
MBLK1					0	0.00		-			1/0/1900	12:00:00 AM		MBLK	1	0		
MBLK2					0			-			1/0/1900	12:00:00 AM		MBLK	1	0		
PQL					0			0.00	OCL		1/0/1900	12:00:00 AM		PQL	1	0		
*CCV1					0			#DIV/0!	#DIV/0!		1/0/1900	12:00:00 AM		CCV1	1	0		
*CCV2					0			#DIV/0!	#DIV/0!		1/0/1900	12:00:00 AM		CCV2	1	0		
0	D	0			0			-		#N/A	1/0/1900	12:00:00 AM		SAMP	1	0	#N/A	#N/A
0	D	0			0			-		#N/A	1/0/1900	12:00:00 AM		SAMP	1	0	#N/A	#N/A
0	D	0			0			-		#N/A	1/0/1900	12:00:00 AM		SAMP	1	0	#N/A	#N/A
0	D	0			0			-		#N/A	1/0/1900	12:00:00 AM		SAMP	1	0	#N/A	#N/A
0	D	0			0			-		#N/A	1/0/1900	12:00:00 AM		SAMP	1	0	#N/A	#N/A
0DUP	D	0D			0	#DIV/0!	#DIV/0!	-		#N/A	1/0/1900	12:00:00 AM		DUP	1	0	#N/A	#N/A
0	D	0			0			-		#N/A	1/0/1900	12:00:00 AM		SAMP	1	0	#N/A	#N/A
0	D	0			0			-		#N/A	1/0/1900	12:00:00 AM		SAMP	1	0	#N/A	#N/A
0	D	0			0			-		#N/A	1/0/1900	12:00:00 AM		SAMP	1	0	#N/A	#N/A
0	D	0			0			-		#N/A	1/0/1900	12:00:00 AM		SAMP	1	0	#N/A	#N/A
0DUP	D	0D			0	#DIV/0!	#DIV/0!	-		#N/A	1/0/1900	12:00:00 AM		DUP	1	0	#N/A	#N/A
0	D	0			0			-		#N/A	1/0/1900	12:00:00 AM		SAMP	1	0	#N/A	#N/A
0	D	0			0			-		#N/A	1/0/1900	12:00:00 AM		SAMP	1	0	#N/A	#N/A
MBLK3					0			-		#N/A	1/0/1900	12:00:00 AM		MBLK	1	0	#N/A	#N/A
*CCV1a	D				0			#DIV/0!	#DIV/0!	#N/A	1/0/1900	12:00:00 AM		CCV1	1	0	#N/A	#N/A
0	D	0			0			-		#N/A	1/0/1900	12:00:00 AM		SAMP	1	0	#N/A	#N/A
0	D	0			0			-		#N/A	1/0/1900	12:00:00 AM		SAMP	1	0	#N/A	#N/A
0	D	0			0			-		#N/A	1/0/1900	12:00:00 AM		SAMP	1	0	#N/A	#N/A
0	D	0			0			-		#N/A	1/0/1900	12:00:00 AM		SAMP	1	0	#N/A	#N/A
0	D	0			0			-		#N/A	1/0/1900	12:00:00 AM		SAMP	1	0	#N/A	#N/A
0	D	0			0			-		#N/A	1/0/1900	12:00:00 AM		SAMP	1	0	#N/A	#N/A
0	D	0			0			-		#N/A	1/0/1900	12:00:00 AM		SAMP	1	0	#N/A	#N/A
0	D	0			0			-		#N/A	1/0/1900	12:00:00 AM		SAMP	1	0	#N/A	#N/A
0DUP	D	0D			0	#DIV/0!	#DIV/0!	-		#N/A	1/0/1900	12:00:00 AM		DUP	1	0	#N/A	#N/A
0	D	0			0					#N/A	1/0/1900	12:00:00 AM		SAMP	1	0	#N/A	#N/A

Figure 12.2 CHROMATOGRAM OUTPUT

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Chromatogram Report

Lab Name: Ecotoxicology
Instrument: Thermo Scientific Instrument
User: Quantis
Batch: 240410 CMU TAML 2
Method: 240410 CMU TAML 2_Brevetoxin-Ace IS SRM
Brevetoxin-Ace IS SRM
Cali File: 240410 CMU TAML 2.calx

Vial Pos	Sample ID	File Name	Level	Sample Name	File Date	Comment
R:A8	MML#350	cal06	250	250ngcal	4/10/2024 4:51:55 PM	

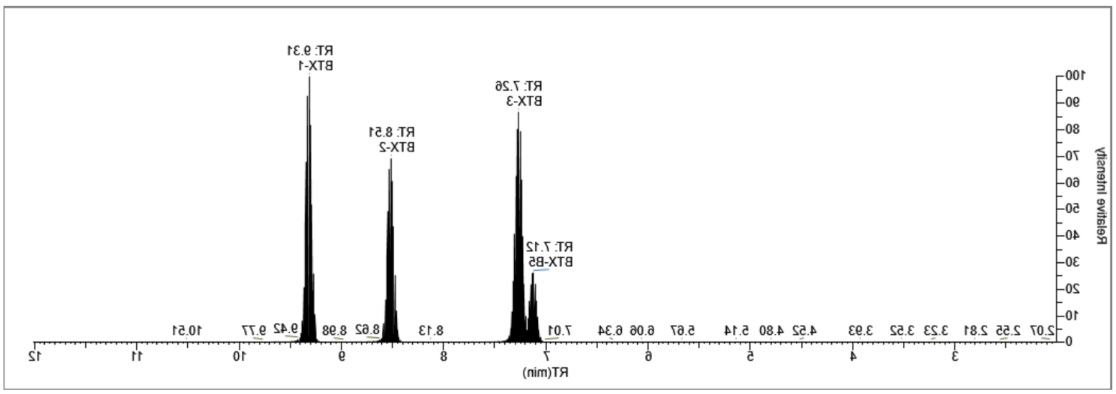

Figure 12.3 AUTO-ANALYZER BENCH SHEET

Mote Marine Laboratory, Ken Thompson Parkway, Sarasota, FL. 34236 Page ___1__ of ______
Auto Analyzer 3 – Work Sheet SN: AA3-001 / AA3-002 Proj #(s):__________________
Date: ____________ Digest Date(s): _____________ Run Name #: _____________ Prep Batch ID(s)/QA:_________/______
Analyst: ______________________ Support Eqp (Pipettes / Grad Cylinders) SN: ______________________________________

CH #	SOP #	Method	Λ nm	Path L	Path ID	Zero %	Primer %	DI Zero	Reag Blk	Gain	Sm Fac
				10 mm	1.0 mm						
				10 mm	1.0 mm						

Sample Time (Sec): _______________ Wash Time (Sec): ________________ Reagent / Standard Sheet Filled: _______________
Matrix: ________ # of Samples: _______ , Matrix: ________ # of Samples: _______ , Matrix: ________ # of Samples: _______

Ch#	Heater Temp(Ref) °C	Heater Temp (Actual) °C	Thermometer SN	Ch#	Heater Temp(Ref) °C	Heater Temp (Actual) °C	Thermometer SN

Matrix	Pk #	Spk Contn	C. spk Stock mg/L		mL Spk	mL Sampl	Final Vol mL	DF Sampl	Final C. Spk mg/L	
			Ch___	Ch___					Ch___	Ch___

Pk #	Cup#	F-Y Contn	Notes CH ____	Notes CH ____	Pk #	Cup#	F-Y Contn	Notes CH ____	Notes CH ____

Ch#	Proof 100%	Data Import/Cal/Ack	Run #	Backlog Check	QA Run

Comments: ____
Supervisors Signature: ___________________ Date: _______________ AA3-2CH-generic-20210319.doc Revised: June 7, 2023

Figure 12.4 TABULAR DATA REPORT

Mote Marine Laboratory
1600 Ken Thompson Parkway
Sarasota, Fl 34236
941-388-4441
DOH / NELAC # E84091

Report #: MML_Chemical Ecology_170104_2
File: NPRPT-1116.xls, Sheet: WQ-nutrients, Print Date:1/4/2017
Page 1 of 1

Myakkahatchee Creek Ambient Monitoring
(Water Quality, Nutrient Data)

Station	Sample Depth	Sample Date	Sample Time	Sample Container Number	Nitrate, Nitrite as N EPA 353.2		Ammonia as N SM 20 4500 NH3 G		Total Kjeldahl Nitrogen as N EPA 351.2			Orthophosphate as P SM 4500-P F			Total Phosphorus as P EPA 365.4		
					mg/L	Analysis Date	mg/L	Analysis Date	mg/L	Analysis Date	Digest Date	mg/L	Analysis Date	Analysis Time	mg/L	Analysis Date	Digest Date
STA#1	MID	11/3/2016	7:59	160773	0.255	11/11/2016	0.097	11/11/2016	1.02	11/9/2016	11/4/2016	0.231	11/3/2016	12:22	0.27	11/9/2016	11/4/2016
STA#2	1.0M	11/3/2016	8:12	160774	0.095	11/11/2016	0.033	11/11/2016	0.75	11/9/2016	11/4/2016	0.055	11/3/2016	12:27	0.09 I	11/9/2016	11/4/2016
STA#2 REP	1.0M	11/3/2016	8:19	160775	0.095	11/11/2016	0.028	11/11/2016	0.73	11/9/2016	11/4/2016	0.056	11/3/2016	12:28	0.09 I	11/9/2016	11/4/2016
NP-4	MID	11/3/2016	9:41	160776	0.132	11/11/2016	0.050	11/11/2016	0.78	11/9/2016	11/4/2016	0.124	11/3/2016	12:52	0.17 I	11/9/2016	11/4/2016
NP-6	1.0M	11/3/2016	9:05	160778	0.125	11/11/2016	0.034	11/11/2016	0.86	11/9/2016	11/4/2016	0.133	11/3/2016	12:57	0.18 I	11/9/2016	11/4/2016
NP-6 REP	1.0M	11/3/2016	9:10	160777	0.124	11/11/2016	0.034	11/11/2016	0.83	11/9/2016	11/4/2016	0.134	11/3/2016	12:55	0.17 I	11/9/2016	11/4/2016
NP-7	1.0M	11/3/2016	8:30	160779	0.113	11/11/2016	0.036	11/11/2016	0.89	11/9/2016	11/4/2016	0.160	11/3/2016	12:58	0.20	11/9/2016	11/4/2016
EQP BLK		11/3/2016	7:49	160772	U0.005	11/11/2016	U0.005	11/11/2016	U0.05	11/9/2016	11/4/2016	U0.005	11/3/2016	12:21	U0.05	11/9/2016	11/4/2016
EQP BLK		11/3/2016	8:25	160780	U0.005	11/11/2016	U0.005	11/11/2016	U0.05	11/9/2016	11/4/2016	U0.005	11/3/2016	12:51	U0.05	11/9/2016	11/4/2016

U = Less than Method Detection Limit
I = Value is > or = MDL but < Practical Quantitation Limit (PQL)

13.0 CORRECTIVE ACTION

13.1 QC Checks

The routine QC checks implemented during any analysis have been previously described in Section 11.0. There are additional types of QC checks possible, all of which can initiate corrective action to resolve problems. QC checks may be initiated either external or internal to the Laboratory, and may be initiated by the Analyst, the Analytical Manager, the Project Manager, the QAO, the Field Supervisor, or external auditing agencies.

13.2 Corrective Action

The procedure for corrective actions starts with an investigation to determine the root cause(s) of the problem. Where corrective action is needed, potential corrective actions are identified. The timeframe for corrective actions will vary depending on root cause and actions required. The actions that are most likely to eliminate the problem and prevent recurrence are implemented. Any required changes that result from corrective action investigations are documented. A timeframe is set for implementation of required changes and will vary depending on root cause and actions required. Corrective actions will be monitored to ensure effectiveness. If necessary, additional audits of the area of concern will be conducted. Corrective actions will be closed when resolved. When the results of corrective actions may cast doubt on client's data, the client will be notified in writing within 30 days.

13.2.1 Chemical Analyses

Once QC checks fail to pass the stated criteria, analyses of samples or field activities are halted while corrective actions are pursued. Corrective actions and results are documented on benchsheets, analytical logs, or field logs for those routine activities initiated by the Analyst or Field Supervisor. When QC check results indicate problems beyond instrument calibration (i.e., contamination during digestion, matrix interferences), summaries of Analyst's activities are prepared on Corrective Action Tracking forms (**Figure 13.1**), or analytical comments on LIMS. QC checks initiated by Analytical or Project Managers are similarly documented in laboratory and project files, respectively. If PT test results are unsatisfactory for a particular analyte, the root cause will be determined and corrective action pursued.

13.2.2 Macroinvertebrate Identification

For biological samples, 10% of the samples for each sampling event are randomly selected for resorting to verify accuracy and completeness. If a resorted sample exhibits less than 90% sorting efficiency, additional samples processed by the technician are resorted until an accuracy of 90% is exhibited. The numbers of organisms resulting from resorts are recorded on the identification bench sheets. Random samples are periodically checked to verify a technician's competence. Technicians repeatedly (2-3 checks after a formal warning) unable to demonstrate sorting competence are dismissed.

The accuracy of identifications is monitored by submitting samples of the dominant taxa collected for a study to external taxonomic consultants for verification. If discrepancies are found, name changes are made at the lowest level of data entry (bench sheet) and followed through to the magnetic data base. Documentation of changes is provided by correspondence to external consultants and notations of such corrections on the project bench sheets.

13.2.3 Preventive Maintenance

When improvements and/or potential sources of nonconformances, either technical or concerning the quality system, are identified, action plans will be developed, implemented, and monitored to reduce the likelihood of the occurrence of such nonconformances and to take advantage of opportunities for improvement. When necessary, such preventive action plans will be initiated and include controls to ensure effectiveness.

13.2.4 Nonconforming Environmental Testing Work

When nonconforming work is identified, ongoing analyses will be immediately stopped or test reports withheld, as necessary, until the situation can be resolved. An evaluation of the significance of the nonconforming work is made, corrective actions are initiated, and a decision about the acceptability of the nonconforming work is made according to the schedule in **Table 13.1** and **Table 13.2**. In cases where the data quality may be affected, the client is notified within 30 days. The Data Manager or the Technical Director will authorize resumption of work.

13.3 Final Corrective Action

Final corrective actions are the responsibility of the QA Officer. If necessary (Figure 13.1), the QA Officer works in concert with the President of the Laboratory to ensure compliance with QA goals and objectives.

13.4 External QC Checks

Checks initiated by external sources are also documented, either on tracking forms or in report format, by the Analytical or Project Managers. As required, results of Proficiency Tests are provided to the Florida DOH (see **Section 14.3.3**).

13.5 Procedures for Dealing with Complaints

In the event that complaints regarding NELAC-certified programs at MML are received, MML will make all efforts to resolve the complaints to the satisfaction of all parties involved. The Technical Director(s) involved and the QA Officer will discuss and evaluate the reasons for the complaint, and determine the best method for resolution. Technical Directors will identify quality control problems and take measures to correct or eliminate the problem source. Necessary audits and corrective actions will be initiated. Technical Directors will monitor and/or implement any corrective action procedures that are a result of any audit. The QAO will review the initiated corrective actions to assure effectiveness. Complaints and their resolution will be documented in the Laboratory's annual review of the Quality System. Where a complaint raises doubt concerning the Laboratory's compliance with the Laboratory's policies or procedures or concerning the quality of the Laboratory's calibrations or tests, the Laboratory will ensure that those areas of activity and responsibility involved are promptly audited. Records of the complaint and subsequent actions will be maintained.

Figure 13.1 QC MEASURE FAILURE – CORRECTIVE ACTIONS

Mote Marine Laboratory, 1600 Ken Thompson Parkway, Sarasota, FL 34236

Work Order Number:________________________ Parameter:____________________________
Analytical Run:____________________________ Analyst(Field/Lab):___________________________
Project:__________________________________

Signatures Required:				
1 and 2	1 and 2	1,3 and 4	1, 2 and 4	1 through 6
Continued failure after rerun, and remake/rerun				
Tuning	Method Blank	Field Calibration	Blind QC Stds	QC Check Samples (PE)
Cal Curve	Duplicates		Blind QC Samples	External Audits
Cal Stds	Matrix Spikes		Equipment Blank (3)	
Cal Blank	Recov Surrogate		Trip Blanks (3)	
ICV	Reagent Blanks		Field Replicates (3)	
QC Check Std	Reagent Spikes		Container Blanks (3)	
CCV			SRM's	
Quant Std			Incorrect data entry	
			Report resubmission	

Determine root cause:
____
____
____
____

Corrective actions required:
____
____
____
____

Timeframe for implementation and monitoring of corrective actions:
____
____

Recheck Signature:____
Recheck Date:____
Closed Date: ____

Signature/Dates:

		Signature	Date
1	Analyst		
2	Anal. Manager		
3	Field Suprvsr:		
4	Proj. Manager		
5	QAO~~/Asst QAO~~		
6	President		

Table 13.1 INTERNALLY ORIGINATED QC MEASURES AND POTENTIAL CORRECTIVE ACTIONS

INTERNAL QC MEASURES	INITIATE	APPROVE	CRITERIA*	CORRECTIVE	Corrective action form required (Y/N)
Calibration Curve	Analyst	Analyst Anal. Manager	r > = 0.995	Rerun calibration standard Remake standards, rerun	N
Calibration Standards	Analyst	Analyst Anal. Manager	Relative error <5% of known value or ± 2MDL	Rerun calibration standard Remake standards, rerun	N
Calibration Blank	Analyst	Analyst Anal. Manager	Within ±1MDL	Rerun blank Remake blank, rerun	N
Tuning Criteria	Analyst	Analyst Anal. Manager	Method specified	Retune Reinject	N
Initial Calibration Verification (ICV)	Analyst	Analyst Anal. Manager	90-100 % of known value	Rerun standard Remake standard, rerun	N
QC Check Standards	Analyst	Analyst Anal. Manager	Within acceptance limits	Rerun standards Remake standards, rerun. Spike QC check standard to determine matrix interferences Recalibrate Purchase a new standard	N
Continuing Calibration Verification (CCV)	Analyst	Analyst Anal. Manager	85-115% 90-110% (EPA mandatory) (80-120% SW-846)	Rerun 2 standards, both have to pass. Remake 2, rerun 2 Recalibrate, ICV, CCV Rerun samples since last acceptable CCV	N
Response factor from Quantitation Std	Analyst	Analyst Anal. Manager	90-110%	Rerun standard Remake standard, rerun Recalibrate, rerun samples since last acceptable CCV	N
Method Blank	Analyst	Analyst Anal. Manager	<MDL	Rerun blank Remake blank, rerun Determine source Redigest, re-extract if necessary	N
Duplicate Samples	Analyst	Analyst Anal. Manager	Within control limits	Rerun both duplicates Determine cause. Redigest, re-extract if necessary	N
Matrix Spikes	Analyst	Analyst Anal. Manager	Within control limits	Rerun spike Respike sample aliquot, rerun Perform reagent spike Redigest, re-extract if necessary or perform MSA	N
Recovery Surrogate	Analyst	Analyst Anal. Manager	80-120% (Compound specific)	Rerun Re-extract, rerun Annotate affected data sets	N
Reagent Blanks	Analyst	Analyst Anal. Manager	<MDL	Determine source Replace reagent if necessary	N
Reagent Spikes	Analyst	Analyst Anal. Manager	Within control limits	Rerun Repeat CCV Respike reagent water, rerun Redigest, re-extract if necessary	N
Blind QC Standards and/or Samples	Anal. Manager	Analyst Anal. Manager	Within Acceptance limits	Examine documentation of analysis Determine probable root cause	Y

				Reanalyze if possible Notify affected Proj. Manager(s)	
Field Calibration	Analyst Crew Leader	Analyst, Field Super. Anal. Manager Proj. Manager	Within Acceptance limits	Repeat with fresh standard Recalibrate (Parameter specific) except at the end of the day	Y
Equipment Blanks (Field, pre-cleaned or both)	Proj. Manager Anal. Manager Field Supervisor Analyst	Analyst, Field Super. Anal. Manager Proj. Manager	<MDL	Rerun blanks Determine root cause Annotate affected data sets Revise protocol and test	Y
Trip Blanks	Proj. Manager Anal. Manager Field Supervisor Analyst	Analyst, Field Super. Anal. Manager Proj. Manager	<MDL	Rerun blanks Determine root cause Annotate affected data sets Revise protocol and test	N – unless repeat problem
Field Replicates	Proj. Manager Anal. Manager Field Supervisor Analyst	Analyst, Field Supervisor Anal. Manager Proj. Manager	Within Control limits for duplicates	Rerun Review with sampler Revise sampling protocol if necessary Recognize variability of natural system sampled	N – unless repeat problem
Container Blanks	Proj. Manager Anal. Manager Field Supervisor Analyst	Analyst, Field Supervisor Anal. Manager Proj. Manager	<MDL	Rerun blanks Determine root cause Annotate data from affected kits Discard or reclean lot#s	N – unless repeat problem
Internal Audits	QAO Proj. Manager Anal. Manager Field Supervisor Analyst	Analyst, Field Supervisor Anal. Manager Proj. Manager QAO	According to QA Manual or QA Project Plan	Determine impact to data of any non-compliance Implement appropriate corrective action Set timeframe for completion of corrective action	Y
Incorrect data reported	Proj Manager Anal Manager Analyst	Proj Manager Analy Manager Analyst	Errors found in reported data	Determine impact Implement corrective action Set timeframe for corrective action Report corrected data within 30 days	Y
Reports	Proj Manager Anal Manager	Proj Manager Anal Manager	Errors founds in report after submitting	Determine impact Implement corrective action Set timeframe for corrective action Submit revised report within 30 days	Y

*Some methods may require more stringent criteria. Refer to individual SOPs for method specific requirements. MSA: Method of Standard Addition

Table 13.2 EXTERNALLY ORIGINATED QC MEASURES AND POTENTIAL CORRECTIVE ACTIONS

EXTERNAL QC MEASURES	INITIATE	APPROVE	CRITERIA	CORRECTIVE ACTION	Corrective action form required (Y/N)
QC Check Samples (Std. Reference Materials)	Anal. Manager Analyst	Analyst Anal. Manager Proj. Manager(s)	Within acceptance limits	-Examine documentation of analysis -Determine probable root cause -Reanalyze if possible -Notify affected Proj. Manager(s)	Y
Blind QC Standards and/or Samples	Ext. Auditor	Analyst Anal. Manager Field Supervisor Proj. Manager Ext. Auditor	Within acceptance limits	-Examine documentation of analysis -Determine probable root cause -Reanalyze if possible	Y
External Audits	Ext. Auditor Proj. Manager Anal. Manager Field Supervisor Analyst	Analyst Field Supervisor Anal. Manager Proj. Manager Ext. Auditor	According to QA Manual Project or QA Project Plan	-Determine impact to data of any non-compliance -Implement appropriate corrective action -Set timeframe for completion of corrective actions	Y

14.0 PERFORMANCE AND SYSTEM AUDITS

14.1 Types of Audits

Mote Marine Laboratory performs periodic assessments of the various components of laboratory and field activities to determine (a) their proper selection and use in specific projects, or (b) accuracy of total measurement systems and/or component parts. Audits are performed under the supervision of, or by (a) QA Officer or (b) external auditors (EPA, FDEP, FDOH, etc.) depending on the purpose of the audit or scope and complexity of a project.

The types of audits are (a) internal systems audits, (b) internal methods audits, (c) external systems audits (d) internal performance audits and (e) external performance audits. These may occur within specific projects or within general MML operations.

The type, frequency and format of systems and performance audits made on individual projects are specified in QA Project Plans. Audit frequency is consistent with QA reporting requirements for projects listed in Chapter 62-160, FAC.

The following information describes system and performance audits made on general field and laboratory programs at MML.

14.2 Systems Audits

Systems audits are made on both field and laboratory operations. Systems audits consist of reviews of each component to determine that each is functioning properly and according to the Quality Manual. The systems audit identifies corrections or improvements to the system and also recommends modifications to next year's Quality Manual.

14.2.1 Internal system audits

Internal system audits for field and laboratory programs are performed at least once each year. Components covered by internal system audits of programs which do not require NELAC certification are listed in **Table 14.1**. These audits are performed by the QAO with assistance, as needed, of the QA Committee. Sample forms used in conducting internal system audits are given in **Figures 14.1**, **14.2**, and **14.3**. Additional forms may be developed as each component is audited. Additionally, internal audits for NELAC-certified programs may include forms specific for current NELAC Quality Systems standards. The internal audit form used for programs which require NELAC certification is given in **Figure 14.4**. Methods audits are also conducted for each NELAC-certified analyses on an annual basis. An example of a method specific internal audit form is provided in **Figure 14.5**. Included in the Laboratory’s internal auditing program is a review with respect to any evidence of inappropriate actions or vulnerabilities related to data integrity (**Section 4.5.1**). If audit findings cast doubt on the effectiveness of the operations or on the correctness or validity of the Laboratory’s environmental test results, the Laboratory will take immediate corrective action and notify clients in writing within 30 days. The area of activity audited, the audit findings, and corrective actions that arise from them will be recorded and maintained in the office of the QAO. At the time of the audit an agreed upon time frame for monitoring corrections of deficiencies is determined. Follow-up audits will be conducted to record implementation of corrective actions.

14.2.2 External system audits

External system audits may be performed by FDEP, EPA, FDOH, and other state and federal agencies. Mote Marine Laboratory voluntarily submits to any FDEP or FDOH system audit, given notice. Currently, FL DOH contracts routine on-site assessments to private assessors.

A. External system audits of field components will be scheduled to meet FDEP requirements.
B. External system audits of laboratory components are scheduled with the following frequencies.
   1. Any field program, or benthic laboratory operations: FDEP schedule.
   2. FDOH certification audit of analytical chemistry components: Every two years.

14.3 Performance Audits

Performance audits are made on both field and laboratory operations. Performance audits are conducted to determine the accuracy of measurement systems used in the analytical laboratory. The performance audit identifies corrections or improvements to laboratory operations and also recommends modifications to next year's Quality Manual.

14.3.1 Internal performance audits

Internal performance audits are performed throughout the year. These audits are performed by the QA Officer with the assistance, as needed, of the QA Committee.

A. Benthic laboratory audits are based on the recovery of macroinvertebrates from preserved sediment samples prepared by the Benthic Supervisor.
B. Chemistry laboratory audits are based on blind samples and QC samples, the concentrations of which are unknown to the analyst. These samples are prepared by the Inorganic and Organic Chemistry Laboratory Supervisors, respectively, using analyte-free laboratory water or other matrix from either agency supplied or commercially-prepared knowns. All routine QA/QC practices will be followed during audit sample analysis.
C. Internal performance audits on analytical chemistry systems are performed semiannually.

14.3.2 External performance audits

External performance audits may be performed by FDEP, EPA, FDOH, and other state and federal agencies. Mote Marine Laboratory voluntarily submits to any FDEP or FDOH audit, given notice.

A. External performance audits of field measurement systems will be scheduled to meet FDEP requirements.
B. External performance audits of benthic laboratory measurement systems will be scheduled to meet FDEP requirements.
C. External performance audits of chemistry laboratory measurement systems for NELAC environmental laboratory certification are performed by FDOH at their request.
D. For phytoplankton cell counts, representative field samples will be shared with an ~~independent~~ external auditor upon request for quality assurance verification of species identification and enumeration.

14.3.3 Proficiency Testing

According to NELAC Standards, NELAC-certified programs will participate in proficiency testing (PT) programs. As required, MML will participate in single-blind, single-concentrations studies, where available, approximately every six months (at least 5 months apart, but no longer than 7 months apart) for each PT field of testing for which MML desires NELAC accreditation. The current list of NELAC-certified analytes appears in **Appendix III**. MML will obtain PT samples from PTOB/PTPA- approved PT Provider. PT samples will be analyzed and the results submitted to the PT Provider by the closing date specified by the PT Provider, which is usually within 45 calendar days from the scheduled study shipment date. The PT Provider releases the results directly to the FDOH. PT samples will be handled (managed, analyzed, and reported) in the same manner as real environmental samples utilizing the same staff, methods as used for routine analysis of that analyte, procedures, equipment, facilities, and frequency of analysis. MML will maintain copies of all written, printed, and electronic records, including bench sheets, instrument strip charts or printouts, data calculations, and data reports, resulting from the analysis of any PT sample for five years. These records will include a copy of the PT study report forms used by the laboratory to record PT results.

14.4 Documentation

The results of internal system and performance audits are recorded by the QA Officer and kept in an audit reports file. Copies of corrective action forms and other internal documentation are routed from analytical laboratories to the same audit reports file if approval or action of the QA Officer is required. Results of internal audits are summarized in QA reports (see **Section 15.0**) and in the report summarizing Annual Management Review of Quality Systems (see **Section 14.5**). Copies are shared with staff at all levels involved with the audit(s).

External audit reports (see **Figure 14.6** for example) are routed to the QA Officer's audit report file and affected analytical laboratory audit files. Copies will be shared with staff at all levels involved with the audit(s). Results of external audits will be routed to the President.

14.5 Annual Management Review of Quality Systems

Review of the Laboratory's Quality System is key to maintaining data integrity, quality, and efficiency. The Laboratory management will conduct an annual review of its Quality System and testing and calibration activities to ensure continuing suitability and effectiveness and to introduce any necessary changes or improvements in the Quality System and Laboratory operations. The annual management review only includes programs which desire NELAC certification (currently only Chemical & Physical Ecology).

Annual review will take into account the suitability of policies and procedures, 2) reports from managerial and supervisory personnel, 3) outcome of recent internal audits, 4) assessment by external bodies, 5) results of interlaboratory comparisons or proficiency tests, 6) changes in volume and types of work, 7) feedback from clients, 8) complaints, and 9) other relevant factors such as quality control activities, resources, and staff training. As part of the annual management review, the Laboratory's Quality Manual is reviewed annually by the QAO and the technical directors. Upon approval of the revised QA manual by senior technical directors and the QAO, a revised version is published. The revised Quality Manual is signed by Technical directors and the published version disseminated via email and inhouse internet link. Hard copies are provided upon request. Laboratory supervisors review SOPs for their programs every two years. The Laboratory will conduct annual internal audits to verify that its operations continue to comply with the requirements of the Laboratory's Quality System. Internal audits of quality systems and individual methods are organized by the QAO and these audits are conducted annually. Any deficiencies or additions required to comply with the most recent applicable NELAC standard are corrected and incorporated into new or revised protocols in the Laboratory's Quality System. At the time of the audit, an agreed upon time frame for monitoring corrections of deficiencies is determined. Where the audit findings cast doubt on the correctness or validity of the Laboratory's calibrations or test results, the Laboratory will take immediate corrective action and within 30 days notify, in writing, any clients whose work may have been affected. A year-end review document is prepared that incorporates and summarizes notes from meetings, results from external and internal audits, proficiency tests, feedback from outside sources, review findings, and any corrective actions required. This review document will serve as the annual management review and will be prepared by the QAO and a copy will be provided to the Technical Directors conducting NELAC-certified analyses and Mote's President. Annual management review documents will be maintained and archived for a minimum of 5 years by the QAO.

Figure 14.1 **SYSTEMS AUDIT FORM USED FOR STANDARD AND REAGENT PREPARATION AND STORAGE**

Yes, No, Not Appl.

___ 1. Have standards and chemicals been checked into MML inventory control?

___ 2. Has each container been dated with the date of receipt?

___ 3. Has the following information been recorded:
- -Compound name
- -Date of receipt
- -Manufacturer/supplier
- -Concentration
- -Lot number
- -Purity/Grade
- -Note of accompanying certifications
- -Expiration date

___ 4. Are all records and certificates retained for 5 years?

___ 5. When the manufacturer indicates that purity is less than 99.99% has that value been taken into account for computing final concentrations?

___ 6. Does the preparation frequency of working, intermediate, and stock standards and chemicals match that stated in the MML Quality Manual?

___ 7. Are standards and chemicals stored at the correct temperature and location?

___ 8. Are all standards and solutions traceable through lot numbers or dates to sources of the purchased material?

___ 9. Has the preparation of all standards and solutions from neat material been documented with the proper form?

___ 10. Has the preparation of all intermediate and working standards and solution been documented on the proper form?

___ 11. Are all containers marked with the expiration date?

___ 12. Are expired standards and solutions disposed of properly?

Figure 14.2 **SYSTEM AUDIT FORM USED FOR SAMPLE LOG-IN, CUSTODY, DISPOSAL AND ROUTING.**

Yes, No, Not Appl.

___ 1. Are samples logged into the laboratory sample tracking system upon arrival at the lab?

___ 2. Is the appropriate field documentation present upon receipt (field logs, sample labels, chain of custody forms)?

___ 3. Are the chain of custody forms complete (station, time, depth, responsible persons, etc)?

___ 4. Is the custody documentation completed in permanent, waterproof ink (or in pencil under inclement field conditions) with any errors corrected by a single line drawn through the error and initialed by the corrector, together with the date of the correction?

___ 5. Are the following traceable through custody documentation; container cleaning records, sample kit preparation records, and sample labels?

___ 6. When samples are delivered to the laboratory by a sampling crew or transporter that is not part of MML are the samples relinquished to the proper department's sample custody officer or their designate?

___ 7. Are custody sheets sent with any samples, sample extracts, or biological specimens shipped or delivered to another laboratory as well as duplicate (photocopies) retained by MML?

___ 8. Are all stored or archived samples and extracts stored according to the proper preservation requirements (i.e., room temperature, ≤4°C or frozen)?

___ 9. Are archived samples clearly marked with the disposal date?

___ 10. Are samples disposed of properly and is the disposal date and procedure recorded?

___ 11. If samples are collected by one MML department and routed to another, are the samples transferred to the custody officer or their designate in the receiving department?

Figure 14.3 **SYSTEMS AUDIT FORM USED FOR BENTHIC SAMPLE ANALYSIS (ROUGH SORT)**

Yes, No, Not Appl.

___ 1. Has sample been logged out properly?

___ 2. Is sample the only one logged out to analyst at a time?

___ 3. If a large sample is split, are fractions properly labeled, preserved, and protected?

___ 4. Do internal and external labels agree?

___ 5. Has sample been converted to alcohol or water?

___ 6. If [5] is NO, is a properly ventilated work bench available for use?

___ 7. Has sample been stained or re-stained at correct pH?

___ 8. Has washing sieve been inspected for tears or plugs?

___ 9. Is there a catch basin plug in drain?

___ 10. Is a bench lens available for pan sorting?

___ 11. Is a stereozoom microscope with at least one light source available?

___ 12. If the microscope is equipped with an optical micrometer, has it been calibrated?

___ 13. Does the number of sort vials correspond to the level of taxonomic detail called for in the scope of work?

___ 14. Are sort vials supported by tip-proof stands?

___ 15. Are general identification guidelines and references easily available, and current?

___ 16. Do analysts understand sorting policy for this project, regarding fragments, heads, etc.?

___ 17. Have all vials been properly labeled, filled, and capped or closed?

___ 18. If sample is a QC check, has it been resorted by another analyst?

___ 19. Have sample wastes been properly segregated, stored, or disposed of?

___ 20. Have used sample containers been emptied and rinsed thoroughly to prevent contamination of the next sample?

___ 21. Is sample turn-around time within acceptable limits for this season, location, and fauna?

Figure 14.4 INTERNAL AUDIT FORM BASED ON TNI STANDARDS 2016

PROFICIENCY TESTING (V1M1)
__ 4.1.2 The laboratory shall participate in PT studies for each field of accreditation where corresponding FoPTs exist in the TNI FoPT tables and for which the laboratory seeks to obtain or maintain accreditation.
__4.1.5(a) Prior to closing date of a study, laboratory personnel shall not send a PT study, or a portion of a PT study, to another laboratory for the analysis of a field of accreditation for which it seeks accreditation or is accredited.
__4.1.5(c) Prior to the closing date of a study, laboratory personnel shall not communicate with any individual at another laboratory concerning the analysis of the PT sample.
__4.2.2 PT samples shall be analyzed in accordance with the laboratory's routine standard operating procedures (SOPs) using the same quality control (QC) acceptance criteria and staff as used for analysis of routine environmental samples.
__4.4.1 The laboratory shall make all records necessary to facilitate reconstruction of the preparation, processing, and reporting of analytical results for PT samples for a minimum of five years.

DOCUMENT APPROVAL AND ISSUE (V1M2)
__4.3.2.1 All documents issued to personnel in the laboratory as part of the management system shall be reviewed and approved for use by authorized personnel prior to issue. A master list or an equivalent document control procedure identifying the current revision status and distribution of documents in the management system shall be established and shall be readily available to preclude the use of invalid and/or obsolete documents.
The document procedure(s) adopted shall ensure that:
__4.3.2.2(a) authorized editions of appropriate documents are available at all locations where operations essential to effective functioning of the laboratory are performed;
__4.3.2.2(b) documents are periodically reviewed and, where necessary, revised to ensure continuing suitability and compliance with applicable requirements.
__4.3.2.2(c) invalid or obsolete documents are promptly removed from all points of issue or use, or otherwise assured against unintended use.
__4.3.2.3 Management system documents generated by the laboratory shall be uniquely identified.
__4.3.3.1 Changes to documents shall be reviewed and approved by the same function that performed the original review unless specifically designated otherwise
__4.3.3.2 Where practicable, the altered or new text shall be identified in the document or the appropriate attachments.
__4.3.3.3 Amendments shall be clearly marked, initialed and dated.
__4.3.3.4 Procedures shall be established to describe how changes in documents maintained in computerized systems are made and controlled.

PURCHASING SERVICES AND SUPPLIES (V1M2 4.6)
__4.6.1 The laboratory shall have a policy and procedure(s) for the selection and purchasing of services and supplies it uses that affect the quality of tests and/or calibrations.
__4.6.1 Procedures shall exist for purchase, reception and storage of reagents and laboratory consumable materials relevant for the tests and calibrations.

Figure 14.4 INTERNAL AUDIT FORM BASED ON 2016 TNI STANDARDS (continued)

__4.6.2 The laboratory shall ensure that purchased supplies and reagents and consumable materials that affect the quality of tests and/or calibrations are not used until they have been inspected or otherwise verified as complying with standard specifications or requirements defined in the methods for the tests and/or calibrations concerned.
__4.6.3 Purchasing documents for items affecting the quality of laboratory output shall contain data describing the services and supplies ordered.
__4.6.3 These purchasing documents shall be reviewed and approved for technical content prior to release.
__4.6.4 The laboratory shall evaluate suppliers of critical consumables supplies and services which affect the quality of testing and calibration.
__4.6.4 The laboratory shall maintain records of the evaluation of suppliers and critical consumables, supplies and services and list those approved.

CONTROL OF RECORDS (V1M2)
___4.13.1 The laboratory shall establish and maintain procedures for identification, collection, indexing, access, filing, storage, maintenance and disposal of quality and technical records.
__4.13.1.2 All records shall be legible and shall be stored and retained in such a way that they are readily retrievable in facilities that provide a suitable environment to prevent damage or deterioration and to prevent loss.
__4.13.1.4 The laboratory shall have procedures to protect and back-up records stored electronically.
__4.13.1.4 The laboratory shall have procedures to prevent unauthorized access to or amendment of these records.

TECHNICAL RECORDS (V1M2)
__4.13.2.1 The laboratory shall retain records of original observations, derived data and sufficient information to establish an audit trail, calibration records, staff records and a copy of each test report or calibration certificate issued, for a defined period.
__4.13.2.1 The records shall include the identify of personnel responsible for the sampling, performance of each test and/or calibration and checking of results.
__4.13.2.1 Observations, data and calculations shall be recorded at the time they are made and shall be identifiable to the specific task.
__4.13.2.3 When mistakes occur in records, each mistake shall be crossed out, not erased, made illegible or deleted, and the correct value entered alongside.
__4.13.2.3 All such alterations to records shall be signed or initialed by the person making the correction.
__4.13.2.3 In the case of records stored electronically, equivalent measures shall be taken to avoid loss or change of original data.
__4.13.3 (a) The laboratory shall establish a record keeping system that allows the history of the sample and associated data to be readily understood through documentation.
__4.13.3 (a) This system shall produce unequivocal, accurate records that document all laboratory activities such as laboratory faciliti8es, equipment, analytical methods, and related laboratory activities, such as sample receipt, sample preparation, or data verification, and inter-laboratory transfers of samples and/or extracts.
__4.13.3 (b) The laboratory shall retain all records for a minimum of five years from generation of the last entry in the records.

Figure 14.4 INTERNAL AUDIT FORM BASED ON 2016 TNI STANDARDS (continued)

__4.13.3 (e) Access to archived information shall be documented with an access log.
__4.13.3 (f) All information necessary for historical reconstruction of data shall be maintained by the laboratory. Historical reconstruction information shall include

__ i. All raw data, whether hard copy or electronic, for calibrations, samples, and quality control measures, including analysts' worksheets and data output records (chromatograms, strip charts, and other instrument response readout records);
__ii. A written description or reference to the specified test method used
__iii Laboratory sample ID code;
__iv data of analysis
__v time of analysis is required if the holding time is 72 h or less
__vi instrument identification and instrument operating conditions/parameters (or reference to such data);
__vii All manual calculations;
__viii Analyst's or operator's initials/signature or electronic identification;
__ix Sample preparation, including cleanup, separation protocols, incubation periods or subculture, ID codes, volumes, weights, instrument printouts, meter readings, calculations, reagents;
__x Test results;
__xi standard and reagent origin, receipt, preparation, and use
__xii Calibration criteria, frequency and acceptance criteria;
__xiii Data and statistical calculations, review, confirmation, interpretation, assessment and reporting conventions;
__xiv quality control protocols and assessment;
__xv Electronic data security, software documentation and verification, software and hardware audits, backups, and records of any changes to automated data entries;
__xvi Method performance criteria including expected quality control requirements;
__xvii Proficiency test results;
__xviii Records of demonstration of capability for each analyst; and
__xix a record of names, initials, and signatures for all individuals who are responsible for signing or initialing any laboratory record.

4.13.3 (g) all generated data, except those generated by automated data collection systems, shall be recorded legibly in permanent ink.

__i An individual making corrections to records shall date and initial the correction
__ii Corrections due to reasons other than transcription errors shall specify the reason for the correction.

ACCOMMODATION AND ENVIRONMENTAL CONDITIONS (V1M2 5.3)
__5.3.1 Laboratory facilities for testing and/or calibration, including but not limited to energy sources, lighting and environmental conditions, shall be such as to facilitate correct performance of the tests and/or calibrations.
__5.3.2 The laboratory shall monitor, control and record environmental conditions as required by the relevant specifications, methods and procedures or where they influence the quality of the results.
__5.3.2 Tests and calibrations shall be stopped when the environmental conditions jeopardize the results of the tests and/or calibrations.
__5.3.3 Measures shall be taken to prevent cross-contamination.
__5.3.5 Measures shall be taken to ensure good housekeeping in the laboratory.

Figure 14.4 INTERNAL AUDIT FORM BASED ON 2016 TNI STANDARDS (continued)

ENVIRONMENTAL TEST METHODS AND METHOD VALIDATION (V1M2 5.4)
__5.4.1 The laboratory shall use appropriate method and procedure for all tests and/or calibrations within its scope.
__5.4.1 The laboratory shall have instructions on the use and operation of all relevant equipment, and on the handling and preparation of items for testing and/or calibration, or both, where the absence of such instructions could jeopardize the results of tests and/or calibrations.
__5.4.1 All instructions, standards, manuals and reference data relevant to the work of the laboratory shall be kept up to date and shall be made readily available to personnel.

SELECTION OF TEST METHODS (V1M2 5.4.2)
_5.4.2 The laboratory shall use test and/or calibration methods, including methods for sampling, which meet the needs of the customer and which are appropriate for the tests and/or calibrations it undertakes.
__5.4.2 When necessary, the standard shall be supplemented with additional details to ensure consistent application.
__5.4.2 The laboratory shall ensure that it uses the latest valid edition of a standard unless it is no appropriate or possible to do so.
__5.4.2 Methods published in international, regional or national standards shall preferably be used.
__5.4.2 The laboratory shall inform the customer when the method proposed by the customer is considered to be inappropriate or out of date.

CONTROL OF DATA (V1M2 5.4.7)
__5.4.7.1 Calculations and data transfers shall be subject to appropriate checks in a systematic manner
__5.4.7.2 When computers or automated equipment are used for the acquisition, processing, recording, reporting, storage or retrieval of test or calibration data, the laboratory shall ensure that:

a) Computer software developed by the user is documented in sufficient detail
b) Computer software developed by the user is suitably validated as being adequate for use;
c) Procedure are established and implemented for protecting the data;
d) Such procedures shall include, but not be limited to, integrity and confidentiality of data entry or collection, data storage, data transmission and data processing;
e) Computers and automated equipment are maintained to ensure proper functioning
f) Computers and automated equipment are provided with the environmental and operating conditions necessary to maintain the integrity of test and calibration data.

CALIBRATION REQUIREMENTS (V1M2 5.5)
__5.5.2 Before being placed into service, equipment (including that used for sampling) shall be calibrated or checked to establish that it meets the laboratory's specification requirements and complies with the relevant standard specifications.
__5.5.3 Equipment shall be operated by authorized personnel.

Figure 14.4 <u>INTERNAL AUDIT FORM BASED ON 2016 TNI STANDARDS (continued)</u>

__5.5.3 Up-to-date instructions on the use and maintenance of equipment (including any relevant manuals provided by the manufacturer of the equipment) shall be readily available for use by the appropriate laboratory personnel.
__5.5.4 Each item of equipment and its software used for testing and calibration and significant to the result shall, when practicable, be uniquely identified.
__5.5.5 Records shall be maintained of each item of equipment and it s software significant to these tests and/or calibrations performed
__5.5.5 The records shall include at least he following:
- -identify of the item of equipment
- -identify of the software
- -the manufacturer's name
- -type identification
- -serial number or other unique identification
- -checks that equipment complies with the specification
- -the current location, where appropriate;
- -the manufacturer's instructions, if available, or reference to their location;
- -dates, results and copies of reports and certificate of all calibrations
- -date, results and copies of reports and certification of all acceptance criteria
- -due date of next calibration
- -maintenance plan, where appropriate
- -maintenance carried out to date
- -any damage, malfunction, modification or repair to the equipment

_5.5.7 Equipment that has been subjected to overloading or mishandling, give suspect results, or has been shown to be defective or outside specified limits, shall be taken out of service
__5.5.8 Whenever practicable, all equipment under the control of the laboratory and requiring calibration shall be labelled, coded or otherwise identified to indicate the status of calibration.
_5.5.9 When, for whatever reason, equipment goes outside the direct control of the laboratory, the laboratory shall ensure that the function and calibration status of the equipment are checked and shown to be satisfactory before the equipment is returned to service.

MEASUREMENT TRACEABILITY (V1M2 5.6)
__5.6.1 All equipment used for tests and/or calibrations, including equipment for subsidiary measurements (e.g., for environmental conditions) having a significant effect on the accuracy or validity of the result of the test, calibration, or sampling shall be calibrated before being put into service. The laboratory shall have an established program and procedure for the calibration of its equipment.
__5.6.2.1.1 For calibration laboratories, the program for calibration of equipment shall be designed and operated so as to ensure that calibrations and measurements made by the laboratory are traceable to SI units.

REFERENCE STANDARDS (V1M2 5.6.3.1)
__5.6.3.1 The laboratory shall have a program and procedure for calibration of its reference standards.
__5.6.3.2 Reference materials shall, where possible, be traceable to SI units of measurement, or to certified reference materials.

Figure 14.4 INTERNAL AUDIT FORM BASED ON 2016 TNI STANDARDS (continued)

__5.6.4.1 The laboratory shall provide satisfactory evidence of correlation of results, for example, by participation in a suitable program of inter-laboratory comparisons, proficiency testing, or independent analysis.
__5.6.4.1 a) Where commercially available, this traceability shall be to a national standard of measurement.
__5.6.4.2 Documented procedures shall exist for the purchase, receipt and storage of consumable materials used for the technical operations of the laboratory.
__5.6.4.2 a) The laboratory shall retain records for all standards, reagents, reference materials, and media, including the manufacturer/vendor.
__5.6.5.2 a) The laboratory shall retain records for all standards, reagents, reference materials, and media, including recommended storage conditions.
__5.6.5.2 c) Records shall be maintained on standard, reference material, and reagent preparation. These records shall indicate traceability to purchased stocks or neat compounds, reference to the method of preparation, date of preparation, expiration date and preparer's initials.
__5.6.5.2 d) All containers or prepared standards, reference materials, and reagents shall bear a unique identifier, expiration date.
__5.6.5.2 f) Standards, reference materials, and reagents shall not be used after their expiration dates unless their reliability is verified by the laboratory.

COLLECTION OF SAMPLES (V1M2 5.7)
__5.7.1 The laboratory shall have a sampling plan and procedures for sampling when it carries out sampling of substances, materials or products for subsequent testing or calibration.
__5.7.2 Where the customer requires deviations, additions or exclusions form the documented sampling procedure, these shall be included in all documents containing test and/or calibration results.
__5.8.1 The laboratory shall have procedures for the transportation, receipt, handling, protection, storage, retention and/or disposal of test and/or calibration items, including all provisions necessary to protect the integrity of the test or calibration item, and to protect the interests of the laboratory and the customer.
__5.8.2 The laboratory shall have a system for identifying test and/or calibration items.
__5.8.2 The identification hall be retained throughout the life of the item in the laboratory.
__5.8.3 Upon receipt of the test or calibration item, abnormalities or departures from normal or specified conditions, as described in the test or calibration method, shall be recorded.
__5.8.4 The laboratory shall have procedures and appropriate facilities for avoiding deterioration, loss or damage to the test or calibration time during storage, handling, and preparation.
__5.8.4 When items have to be stored or conditioned under specified environmental conditions, these conditions shall be maintained, monitored and recorded.
__5.8.5 The laboratory shall have a documented system for uniquely identify the sample containers that hold samples to be tested, to ensure that there can be no confusion regarding the identity of the such samples at any time
__5.8.5 a) This system shall include identification for all samples, sub-samples, preservations, sample containers, test, and subsequent extracts and/or digestates.
__5.8.5 b) This laboratory code shall maintain an unequivocal link with the unique field ID code assigned to each sampled.
__5.8.5 c) The laboratory D code shall be placed as a durable mark on the sample container

Figure 14.4 <u>INTERNAL AUDIT FORM BASED ON 2016 TNI STANDARDS</u> <u>(continued)</u>

__5.8.5 d) The laboratory ID code shall be the link that associated the sample with related laboratory activities such as sample preparation.

SAMPLE ACCEPTANCE POLICY (V1M2 5.8.6)
__5.8.6 The laboratory shall have a written sample acceptance policy that includes the following:
a) proper, full, and complete documentation, which shall include
-sample identifications,
-the date of collection
-the time of collection
-the collector's name
-the preservation type
-sample type
-any special remarks concerning the sample
__5.8.6 b) proper sample labeling to include a labeling system for the samples with requirements concerning the durability of the labels (water resistant) and the use of indelible ink
__5.8.6 c) use of appropriate sample containers
__d) adherence to specified holding times
__e) sufficient sample volume to perform the necessary tests
__f) procedure to be used when samples show signs of damage, contamination or inadequate preservation;
__g) qualification of any data that do not meet the above requirements.

SAMPLE RECEIPT PROTOCOLS (V1M2 5.8.7)
__5.8.7.1 The laboratory shall implement procedures for verifying and documenting preservation
__5.8.7.2 If the sample does not meet the sample receipt acceptance criteria listed in this stand the laboratory shall either
__a) Retain correspondence and/or records of conversation concerning the final disposition of rejected samples or
__b) Fully document any decision to proceed with analysis of samples not meeting acceptance criteria.
__i) condition of these samples shall be noted on chain of custody or transmittal form and laboratory receipt documents.
__5.8.7.3 a) Sample receipt log shall record the following
-client/project name
-date and time of laboratory receipt
-unique laboratory ID code
-signature of initials of the person making the entries
__5.8.7.3 b) The placement of the laboratory ID number on the sample container is not considered a permanent record.
__ i The field ID code, which identifies each sample, shall be linked to the laboratory ID code in the sample receipt log.
__ ii The date and time of sample collection shall be linked to the sample and to the date and time of receipt in the laboratory.
__iii The requested analyses (including applicable approved method numbers) shall be linked to the laboratory ID code.

Figure 14.4 INTERNAL AUDIT FORM BASED ON 2016 TNI STANDARDS (continued)

__iv Any comments resulting from inspection for sample rejection shall be linked to the laboratory ID code.
__5.8.7.4 All documentation, such as memos, chain of custody, or transmittal forms that are transmitted to the laboratory by the sample transmitter, shall be retained.
__5.8.7.5 A complete chain of custody record form, if utilized shall be maintained.
__5.8.9 c) The laboratory shall have SOPs for the disposal of samples, digestates, leachates and extracts or other sample preparation products

QUALITY ASSURANCE FOR ENVIRONMENTAL TESTING (V1M2 5.9)
__5.9.1 The laboratory shall have quality control procedures for monitoring the validity of test and calibrations undertaken.
__5.9.1 This monitoring shall be planned and reviewed and may include, but not be limited to, the following:
__a) Regular use of certified reference materials and/or internal quality control using secondary reference materials;
__b) Participating in interlaboratory comparison or proficiency-testing programs;
__c) Replicate tests or calibrations using the same or different methods;
__d) Retesting or recalibration of retained items;
__e) Correlation of results for different characteristics of an item

ESSENTIAL QUALITY CONTROL PROCEDURES (V1M2 5.9.3)
__5.9.3 a) All laboratories shall have detained written protocols in place to monitor the following quality controls:
__i Positive and negative controls, chemical as applicable to test type, to monitor tests such as blanks matrix spikes,
__ii Tests to define variability and/or repeatability of the laboratory results such as replicates;
__iii Measures to assure accuracy of the method including calibration and/or continuing calibrations, use of certified reference materials, proficiency test samples, or other measures;
__iv Measures to evaluate method capability, such as limit of detection and limit of quantitation or range of applicability such as linearity;
__v Selection of appropriate formulae to reduce raw data to final results such as regression analysis, comparison to internal/external standard calculations, and statistical analyses;
__vi Selection and use of reagents and standards of appropriate quality;
__vii Measures to assure the selectivity of the test for its intended purpose;
__5.9.3 b) All quality control measures shall be assessed and evaluated on an on-going basis and quality control acceptance criteria shall be used.
__5.9.3 c) The quality control protocols specified by the laboratory’s SOP shall be followed.
__5.9.3 c) When it is not apparent which is more stringent, the QC in the mandated method or regulations is to be followed.

Figure 14.5 INTERNAL METHOD AUDIT FORM FOR NELAC-CERTIFIED ANALYSES

Methods Internal Audit: BOD/CBOD – SM 5210 B

1. Check IDOC/DOC to see if current

2. Check SOP

3. Equipment and supplies:

   a. YSI DO Meter and BOD bottle probe
   b. Distilled water from incubator – should be in glass bottle at least 2 weeks

4. Required reagents & standards:

   a. BRO water
   b. Glucose-glutamic acid solution (spike solution)
   c. Sodium sulfite 0.025 N
   d. Phosphate buffer
   e. Nutrient buffer (Magnesium sulfate solution, calcium chloride solution, ferric chloride solution)
   f. N_2 inhibition for CBOD

5. Holding time, sample container, and sample preservation requirements: 48-h holding time, <6 C

6. Initial instrument calibration acceptance criteria
   a. According to manufacturer's instructions – every 6 months

7. Precision and accuracy acceptance criteria
   a. ICV – incubator water
   b. Duplicates every 10% of samples
   c. Duplicate precision, 10%
   d. GGA Recovery 198 ± 30
   e. CCV: every 20 samples

Figure 14.6 EXTERNAL AUDIT REPORT

Displaying 1-1 of 1 result.

Accrediting Agency	Division	Accrediting Labcode	Accreditor	Accreditor Code
Florida Department of Health		FL00191	Vanessa Soto	

Entered Data

PE1060-20ML ANIONS - WP *Item Number and Name*							**LRAA9633** *MfgLotID*
1575 Chloride *Analyte Number and Name*	SM 4500-Cl¯ B 21st ED (1997) *Method*	173 *mg/L*	D.G. *Analyst*	2016-09-29 *Analysis Date*	no *Voluntary*	no *DMRQA*	Acceptable *Evaluations*
1730 Fluoride *Analyte Number and Name*	SM 4500-F¯ C 21st ED (1997) *Method*	0.898 *mg/L*	S.L. *Analyst*	2016-09-30 *Analysis Date*	no *Voluntary*	no *DMRQA*	Acceptable *Evaluations*
2000 Sulfate *Analyte Number and Name*	EPA 375.2 2 (1993) *Method*	53.9 *mg/L*	S.L. *Analyst*	2016-09-26 *Analysis Date*	no *Voluntary*	no *DMRQA*	Acceptable *Evaluations*
PE1126-20ML COLOR - WP *Item Number and Name*							**LRAA9695** *MfgLotID*
1605 Color *Analyte Number and Name*	SM 2120 B 21st ED (2001) *Method*	34 *PC Units*	D.G. *Analyst*	2016-10-06 *Analysis Date*	no *Voluntary*	no *DMRQA*	Acceptable *Evaluations*
PE1051-2ML COMPLEX NUTRIENTS - WP *Item Number and Name*							**LRAB0922** *MfgLotID*
1795 Kjeldahl nitrogen, total (TKN) *Analyte Number and Name*	EPA 351.2 2 (1993) *Method*	17.5 *mg/L*	S.L. *Analyst*	2016-10-17 *Analysis Date*	no *Voluntary*	no *DMRQA*	Acceptable *Evaluations*
1910 Phosphorus as P, total *Analyte Number and Name*	EPA 365.4 (1974) *Method*	2.82 *mg/L*	S.L. *Analyst*	2016-10-17 *Analysis Date*	no *Voluntary*	no *DMRQA*	Acceptable *Evaluations*
PE1130-20ML DEMAND - WP *Item Number and Name*							**LRAB0837** *MfgLotID*
1530 5-day BOD *Analyte Number and Name*	SM 5210 B 21st ED (2001) *Method*	80.4 *mg/L*	S.L. *Analyst*	2016-09-23 *Analysis Date*	no *Voluntary*	no *DMRQA*	Acceptable *Evaluations*
1555 Carbonaceous BOD (CBOD) *Analyte Number and Name*	SM 5210 B 21st ED (2001) *Method*	71.9 *mg/L*	S.L. *Analyst*	2016-09-23 *Analysis Date*	no *Voluntary*	no *DMRQA*	Acceptable *Evaluations*

Table 14.1 **COMPONENTS COVERED BY INTERNAL SYSTEM AUDITS**

1. Field decontamination
2. Field measurements
3. Sample log-in, custody, disposal and routing
4. Sample preparations
5. Calibrations
6. Sample analysis
7. Data reduction, validation and reporting
8. Standard and reagent preparation
9. Standard and reagent storage
10. Waste segregation and disposal
11. Container cleaning and storage
12. Preventative maintenance and repair
13. Documentation of QA/QC procedures
14. Benthic sample sorting
15. Invertebrate preservation and archiving

15.0 QUALITY ASSURANCE REPORTING

The results of the internal systems and performance audits made on routine operations (Section 14.0) are reported to affected staff and archived with the QA Officer. Results of Proficiency Tests are reported to Florida DOH.

15.1 Internal QA Reports

Results of internal audits are provided to Technical Directors of each respective program. The QAO reviews findings with each Technical Director. Any deficiencies requiring corrective actions must be addressed within an agreed upon time frame. All audit and review findings and any corrective actions that arise from them are documented.

15.1.1 Corrective Actions

Corrective actions (Section 13.0) made in routine operations are documented on tracking forms and copies are distributed to affected analysts or laboratory supervisors. A timeframe for completion will be set for each corrective action required.

15.2 External QA Reports

15.2.1 External Reports

Results of external audits, any round-robin tests, performance samples and/or annual certification tests will be reported to the President if corrective actions require his authorization. The QA Officer will produce external QA reports to auditing agencies or project sponsors as required to document general laboratory performance or to respond to specific issues. Any such external QA reports will be made available to Florida DEP or DOH on request. If results may affect data quality for a particular client, that client will be notified in writing within 30 days.

APPENDIX I. <u>BENTHIC INVERTEBRATE SAMPLE PROCESSING</u>

After field collection of benthic samples, three phases of laboratory processing are conducted: 1) transfer of samples to isopropyl alcohol preservative; 2) rough sorting of organisms to major taxonomic groups; and 3) faunal identifications and enumeration.

Transfer to Isopropyl Alcohol

After a minimum of 72 hours in 10% formalin fixative, benthic faunal samples may be transferred to 70% isopropyl alcohol. This activity is directed by the Laboratory Supervisor and proceeds as follows:

1) Pour off the 10% formalin through a 0.5 mm square mesh sieve, into the designated waste container.
2) Empty the sample from the jar into the sieve, draining the remaining 10 % formalin into the waste container.
3) Gently rinse the sample with tap water to remove excess formalin and return the sample to the original jar.
4) Add sufficient 70% isopropyl alcohol to cover the sample with 4 cm of liquid.
5) Return sample to storage until ready to rough sort.
6) Record date of decanting on custody sheet and make notes of any problems. Turn over custody sheet to Laboratory Supervisor for approval.

Sample Rough Sorting

This activity is also managed by the Laboratory Supervisor. Procedures for rough sorting of samples are as follows:

1) Sign out a sample from storage and record sample ID in Sorting Log and Personal Log.
2) While adding tap water to the sample, gently agitate with a swirling motion and pour off the suspended organisms into a 0.5 mm mesh sieve.
3) Continue rinsing and decanting until no additional organisms are suspended.
4) Wash the material retained on the sieve into a small beaker and remove a small aliquot for rough sorting under a stereozoom dissecting microscope. Continue sorting aliquots until the entire sample has been sorted.
5) Remove the heavier sediments from the jar and rough sort small aliquots in a white background pan, with the aid of magnifying lamps. If the amount of material is small conduct sorting in the same manner as # 4.
6) Rough sort fauna into four (4) categories: Annelids; Molluscs; Crustaceans; and Miscellaneous. Place both the fauna from the light scope sorted fraction and the heavier pan sorted fraction in the same set of 8 ml scintillation vials. If a large number of one species is present place that species in a separate labeled vial.
7) Label each vial internally with the following information: station ID; replicate no.; date of sampling; project no.; and your initials.

8) Dry the internal sample label, initial and record the number of scintillation vials used on the back of the label. Wrap internal label around the vials, secure with rubber band and place in labeled ziploc plastic bags for appropriate station.
9) Return the sorted remains of the sample to the original sample jar, initial the external label, and return it to storage.
10) Store sorted vials in the identification sample locker.

Faunal Identifications

Taxonomic identifications are monitored by the Laboratory Supervisor. Identification level is based on contract requirements. In general identification to the lowest practical taxonomic level (LPL) is made for all individuals collected at each station for each replicate. Identifications are made by trained taxonomists utilizing published literature, reference keys and the MML Reference Collection. Problem identifications (unsure; possibly new species) are verified by external consultants. Species not previously collected by previous studies are entered into the MML type collection.

Faunal identification procedures are as follows:

1) Sign out a replicate sample (vials). Record on log sheet.
2) Remove animals, place in petri dish under a stereozoom microscope. Identify, enumerate, and return to labeled vials, and record on standard bench sheets. Oligochaetes and chironomids will be temporarily mounted on microscope slides in Amman's lactophenol and identified under a compound microscope.
3) Remove any new specimens for the type collection and record removal on I.D. bench sheet. Place new specimen in archive quality preservative with appropriate label. Record information on type specimen 5" x 7" index file card. Specimens requiring slide mounting for identification will be placed in a permanent slide mounting media.
4) Refer uncertain or problem identifications to Laboratory Supervisor or Project Manager for resolution.
5) Repeat steps 1 through 4 for all processed replicates at each station.
6) After a station is completed, turn in completed bench sheets and vials to the Laboratory Supervisor.
7) The Laboratory Supervisor checks and signs the bench sheets after verifying ID and counts have been properly filled out.
8) Copy bench sheets, with the original remaining in the benthic laboratory and the copy stored in separate archive files.

APPENDIX II. <u>REFERENCES CITED</u>

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Bran+Luebbe/Seal Analytical Method No. G-172-96 Rev. 10. Nitrate and Nitrite in Water and Seawater Total Nitrogen in persulfate digests.

Bran+Luebbe/Seal Analytical Method No. G-175-96 Rev. 12. Phosphate in Water and Seawater Total P in persulfate or Kjeldahl digests.

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APPENDIX III. LISTING OF NELAC ACCREDITED ANALYSES

Ron DeSantis
Governor

Florida HEALTH

Laboratory Scope of Accreditation

Page 1 of 1

Attachment to Certificate #: E84091-30, expiration date June 30, 2025. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: **E84091** EPA Lab Code: **FL00191** **(941) 388-4441**

E84091
Mote Marine Laboratory
1600 Ken Thompson Parkway
Sarasota, FL 34236

Matrix: **Non-Potable Water**

Analyte#	Analyte	Method/Tech	Method Code	Category	Effective Date
1515	Ammonia as N	SM 4500-NH3 G-2011	20111415	General Chemistry	10/9/2018
1530	Biochemical oxygen demand	SM 5210 B-2011	20135266	General Chemistry	10/9/2018
1555	Carbonaceous BOD (CBOD)	SM 5210 B-2011	20135266	General Chemistry	10/9/2018
9345	Chlorophylls	EPA 445	10081400	General Chemistry	1/9/2002
9345	Chlorophylls	SM 10200 H	20300225	General Chemistry	1/9/2002
1605	Color	SM 2120 B-2011	20039310	General Chemistry	10/9/2018
1605	Color	SM 2120 C	20002000	General Chemistry	9/26/2019
1610	Conductivity	EPA 120.1	10006403	General Chemistry	7/6/2010
1610	Conductivity	SM 2510 B-2011	20048617	General Chemistry	10/9/2018
1795	Kjeldahl nitrogen - total	EPA 351.2	10065404	General Chemistry	1/9/2002
1810	Nitrate as N	EPA 353.2	10067604	General Chemistry	1/9/2002
1820	Nitrate-nitrite	EPA 353.2	10067604	General Chemistry	1/9/2002
1840	Nitrite as N	EPA 353.2	10067604	General Chemistry	12/23/2005
1865	Organic nitrogen	TKN minus AMMONIA	60034437	General Chemistry	3/3/2008
1870	Orthophosphate as P	EPA 365.1	10070005	General Chemistry	1/9/2002
1870	Orthophosphate as P	SM 4500-P F-2011	20125024	General Chemistry	10/9/2018
1910	Phosphorus, total	EPA 365.4	10071202	General Chemistry	1/9/2002
1955	Residue-filterable (TDS)	SM 2540 C-2011	20050413	General Chemistry	10/9/2018
1960	Residue-nonfilterable (TSS)	SM 2540 D-2011	20051212	General Chemistry	10/9/2018
1970	Residue-volatile	SM 2540 E-2011	20051596	General Chemistry	10/9/2018
1975	Salinity	SM 2520 B	20004006	General Chemistry	7/6/2010
1995	Silica-dissolved	USGS I-2700-85	40005605	General Chemistry	12/23/2005
2005	Sulfide	SM 4500-$S2^{-}$ F-2011	20126663	General Chemistry	10/9/2018
1725	Total, fixed, and volatile residue	SM 2540 G	20005203	General Chemistry	1/9/2002
2055	Turbidity	SM 2130 B-2011	20048220	General Chemistry	10/9/2018
2058	Un-Ionized Ammonia	DEP SOP 02/12/01	90015820	General Chemistry	3/3/2008

Clients and Customers are urged to verify the laboratory's current certification status with the Environmental Laboratory Certification Program.

Certification Type NELAP

Issue Date: 7/1/2024 **Expiration Date: 6/30/2025**

APPENDIX IV. MOTE MARINE LABORATORY CHEMICAL HYGIENE PLAN

Chemical Hygiene Plan
Laboratory Requirements
Revised 7/23/2021

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Application

The Chemical Hygiene Plan (CHP) summarizes policies and procedures to protect laboratory workers and inform them of chemicals' hazards inherent to their work.

The CHP applies to all hazardous chemical waste generators of Mote Laboratories regardless of campus. There are two primary components of the CHP:

•General CHP procedures for laboratories are provided below, and

•Laboratory-specific documentation must be completed by the LCHO, the principal investigator (PI), or the Lab Supervisor and maintained on-site (see lab-specific documentation Appendix 1).

(Personnel who work with chemicals in a non-laboratory setting are covered by a Hazard Communication Plan required by OSHA Standard 29 CFR 1910.1200. This applies to general non-laboratory staff members who work in other than laboratory settings).

Responsibilities

Responsibility for laboratory safety is assigned to several parties at Mote Marine Laboratory.

•Chief Executive Officer (CEO) - This individual has ultimate legal responsibility for Mote Marine Laboratory compliance with this program.

•Environmental & Occupational Safety Officer (EOS) - This individual works for Business Office.

•Laboratory Chemical Hygiene Officers (LCHO) - Each "laboratory unit" shall designate an individual to serve in this capacity. These individuals are responsible for developing and documenting the Laboratory-Specific Documentation for the unit and will oversee implementation, such as training, inspection coordination, and reviewing/revising the plan annually (The appointed LCHO may be a Principal Investigators (PI) or Laboratory Supervisor) A "Summary of Duties" for these individuals can be found in Laboratory-Specific Documentation Appendix 1.

•The Chemical Safety and Hazardous Materials Management Committee oversees compliance with the Mote Marine Laboratory CHP and any additional relative information contained within this program. Responsibilities include an **annual** review of the plan and assignment of disciplinary actions necessary to deal with non-compliance. Membership will consist of the MML and IC2R3 QA Officer, EOS Officer, and appointed LCHOs. Appointments will be made by the EOS. The Committee may conduct or facilitate lab safety training seminars.

•Department Heads are responsible for safety compliance within the department, including but not limited to: ensuring that Principle Investigators and/or Lab Supervisors are aware of the CHP requirements and mandating laboratory unit participation in the program.

•Department Heads have the responsibility for appointing an LCHO. A Department Head may nominate themselves as LCHO. A Department Head may also be a Principal Investigator or Lab Supervisor.

•Laboratory Workers are responsible for planning and conducting each laboratory operation per the Chemical Hygiene Plan's "Laboratory-Specific Documentation "and developing good personal chemical hygiene habits. Additional information is provided in the "Summary of Duties."

Training

The QA Officer and/or LCHO may act as consultants to laboratory personnel for related issues.

The LCHO is responsible for informing employees of the following:

•The CHP location within the unit and general contents,

•The laboratory-specific documentation location within the unit and general contents,

•An overview of the OSHA Lab Standard (29 CFR 1910.1450) is available in overview form in Appendix 4,

•The required reading list for the specific laboratory, including standard operating procedures (SOPs), and the Training Documentation Form, which must be signed and filed with the plan, and

•The location of SDS and how to obtain them (SDSs do not have to be in printed form as long as employees can access and print a copy in the vicinity where the chemical is being used)

Prudent Laboratory Practices

Persons responsible for establishing new research protocols in a lab should carefully review all operations for potential risks or hazards. The materials and chemical by-products should be understood before starting the experimental process. Once information and advice about the dangers have been obtained, appropriate protective procedures should be developed. The positioning of equipment should be planned. Additional information is contained in Preparing for Laboratory Work in Appendix 2.

Food and Drink

Food and drink storage, handling, and consumption are prohibited in specific high-risk laboratories, such as carcinogenic research labs, biological labs, pesticide labs, and labs containing highly toxic compounds. Additionally, some departments have rules prohibiting food in any laboratory.

Working Alone (Buddy System)

Work with chemical or physical hazards (e.g., high voltage, mechanical hazards not known to be intrinsically safe) or any other work that might prove immediately dangerous to life and health (IDLH) shall not be conducted alone in any laboratory. It is recommended that all laboratory work be performed with a partner or co-worker, or in proximity to others, in case of emergency.

Laboratory Chemical Storage

Chemicals should be stored in a defined storage area (safety cabinet or approved room). In general, avoid storing chemicals on laboratory bench tops or in fume hoods. Certain highly toxic materials that must be stored in a fume hood or glove box (ex. HCI gas) are the exception.

Laboratory Waste Storage

Failure to follow proper waste storage requirements may result in citations and/or fines by the EPA or OSHA.

- Hazardous waste may be accumulated in labs as long as they are collected in containers near the point of generation. This area must be under the control of the lab workers and LCHO. Waste containers must then remain in the lab, where they were filled until deposited in the Hazwaste Collection Building. See the EOS Officer gain access to the building. At the IC2R3 location, the process waste collection building is located on the ground level north side of the building. Containers of waste are labeled as the container's contents and the name or budget number of the lab generating the waste).
- Hazardous waste containers must be in good condition. They must be made of a material that is compatible with the waste it contains.
- Containers must be closed except when adding waste. Failure to close the waste containers may constitute an effort to treat waste on-site illegally.
- The list of contents on the label must be updated whenever waste is added!
- See Appendix 5 for sink disposal information.

Controlled Substances, Listed Chemicals, and Ethanol

These materials are covered by Federal and State policies. Please contact your Department Head, LCHO, or the Lab Supervisor for guidance.

•Controlled substances - Anyone who engages in controlled substances (e.g., drugs) included on the Drug Enforcement Agency (DEA) Schedules I-V must obtain DEA registration. Schedules I-V is contained in Appendix 4 A.
•Listed Chemicals - DEA requires vendors to identify each purchasing agent according to CFR 21, Part 1310.07, and "Proof of Identity" before selling any of their designated Listed Chemicals. The actual procedure and required paperwork may vary between vendors. Please contact your Department Head or the MML and IC2R3 Business Office Manager for assistance in completing the proof of identifying paperwork.
•Ethanol - Purchase and shipment are also regulated by Federal and State agencies. Storage of bulk ethanol at MML and IC2R3 is in a limited access ethanol locker. If you wish to order or access ethanol storage, please contact the MML and IC2R3 Business Office Manager.

Any material not used or no longer needed must be handled according to regulatory requirements. Individuals holding licenses to use Controlled Substances and/or Listed Chemicals in their research must meet the requirements set forth by DEA. To dispose of DEA Controlled Substances/Listed Chemicals, please contact the EOS Officer to arrange a schedule. If you have any questions, contact your Department Head, Director, or the EOS Officer for additional information.

Special Chemical Hazards

Certain chemicals require special handling and disposal. The following are some examples of these chemicals and special handling instructions for them.

•**Acrylamide (gels, liquids, solids)** - Commonly used in industry and research, particularly in the electrophoresis of DNA in polyacrylamide gels. Acrylamide in nearly all of its forms is toxic and considered to be a potential human carcinogen. It is also listed as a potential teratogen. Because of its toxic nature, every precaution must be taken to safely and adequately handle it. For more information, see Appendix 2 A.

•**Hydrofluoric Acid** - Hydrofluoric acid (HF) is a highly corrosive acid used for many purposes, including mineral digestion, surface cleaning, etching, and biological staining. Its unique properties make it significantly more hazardous than many of the other acids used on campus. The safety guidelines contained in Appendix 2 F must be used when working with HF.

•**Reactive** - While all chemicals are reactive to some degree, special attention must be given to some inherently unstable and potentially reactive/explosive chemicals susceptible to rapid decomposition or reaction. These chemicals can react alone or with other substances violently, giving off heat and toxic gases or leading to an explosion. Reactions of these chemicals often accelerate out of control and may result in injuries or costly accidents.

- **Mercury** - Elemental mercury should never be added to another chemical for disposal. Many of our waste disposal firms will not accept waste contaminated with elemental mercury. Place elemental mercury waste and debris (ex. broken thermometers or manometers) separately in a sealed container (such as a zip-lock bag) for deposit in the Hazwaste Collection Building.

- **Perchloric Acid** - To minimize hazards related to perchloric acid, follow recommendations in Appendix 2 C.

- **Peroxide-formers** - Some chemicals form explosive concentrations of peroxides with age (see list of peroxide formers in appendix 2D.) When peroxides become concentrated by evaporation or distillation and are disturbed by heat, shock, or friction, they may explode with extreme violence. These substances must not be housed in labs for long periods. To minimize the hazard of peroxide formation, strictly observe the safety guidelines contained in Appendix 2 D.

- **Picric Acid** - When picric acid becomes desiccated (color changes, visible crystals, or crystalline matrix formation in the cap), it forms picrate salts, which are an explosion hazard. Dry picric acid is classified as a class "A" explosive! It is shock-sensitive and can explode when disturbed. If you suspect that you have desiccated picric acid:
    - Do not touch the container! The act of moving the container may be enough to detonate the material.
    - Prevent all personnel from entering the area or disturbing the container.
    - Contact EOS Officer.
    - See explosive and shock-sensitive materials in Appendix 3B

- **Piranha Solution** - This solution is commonly used to remove organic residues from substrates; however, it can be dangerous. For more information, see Appendix 2 E.

Eye Wash Stations and Deluge Showers

ANSI - approved eyewash facilities and deluge showers must be available to all where there is a potential for human contact with hazardous/caustic materials and all pesticide mixing areas. Access must be within ten unobstructed seconds from the work area. These safety devices are necessary for halting the damage incurred from a chemical splash to the eyes or spill on the body. To support the appropriate type of eyewash station and/or deluge shower is made available, the Environmental & Occupational Safety Office must be contacted before purchasing or installing. Bottled water does not suffice as an eyewash station. Eyewash stations must be flushed weekly by the Laboratory Chemical Officer or designee to prevent rust accumulation and microorganism growth in the system. Allow the water to flow for approximately five minutes. It is recommended that a log be maintained indicating the date flushed and the person performing the task. Inspection of the equipment should include the following:

- The eye wash bowl is not cracked;
- The handle to activate the water is present and functioning;
- The water supply has not been turned off;
- The eyewash station water flows sufficiently to reach the eyes;
- Nothing is located in front of the equipment.

An annual inspection of the deluge shower should be conducted to include the following:

•Nothing is located in the way of its use and operation;

•A visual inspection of the safety shower components is in good working order (shower head, pull the lever, and lever valve).

•An annual flow of the emergency shower is recommended to remove stagnant water.

•All eyewash stations and deluge showers must have appropriate identification signs posted at their immediate location.

Fume Hoods

Laboratory fume hoods are ventilated enclosures designed to protect laboratory personnel from inhalation exposure to chemical vapors and dust. Before purchasing, installing, or moving a fume hood, the LCHO must consult with EOS for guidance. Fume hoods must be certified by an EHS contractor. Additional information is contained in Appendix 3.

Fire Extinguishers

Each laboratory must have an appropriate, functional, unobstructed portable fire extinguisher mounted on the wall three to four feet from the floor.

Emergency Response

All departments are required to have an Emergency Action Plan specific to the building where employees are located. This plan provides detailed information regarding actions to be taken by personnel in the event of an emergency, such as fire, explosion, injury, medical emergencies, chemical exposures, chemical spills, acts of terrorism, acts of nature (severe weather) etc.

Minor spills of hazardous chemicals that pose little or no threat to the safety and health of personnel can be cleaned by competent departmental personnel by following the warning and caution signs on the container's label or manufacturer's safety data sheet (SDS). A hazardous material emergency exists when cleanup of a spill of hazardous material is beyond the level of knowledge, training, or the ability of the staff in the immediate spill area, or the spill creates a situation that is immediately dangerous to the life and health of persons in the spill area or facility.

- Alert personnel in the immediate area of the spill and evacuate the room.

•Confine the hazard by closing doors as you leave the room.

•Use eyewash or safety showers as needed to rinse spilled chemicals off of personnel.

•Evacuate any nearby rooms that may be affected. If the hazard may affect the entire building, evacuate the whole building.

•Notify EOS Officer and provide the chemical name, location of the spill, size of the spill, number of injured persons (if any), and any environmental concerns, such as the location of storm drains or streams. You will also need to provide your name and a telephone number. Always call from a safe place. Be prepared to spell chemical names.

Procedures for laboratory personnel to handle chemical, biological, or radiological spills are provided in the laboratory-specific documentation. Trained laboratory personnel are authorized to determine appropriate emergency response measures for their areas.

Inspection Program

Maintenance and regular inspection of laboratory equipment are essential parts of the laboratory safety program. Management should participate in designing a laboratory inspection program to ensure that the facility is safe and healthy, workers are adequately trained, and proper procedures are being followed.

Types of inspections: The program should include an appropriate combination of routine inspections, self-audits, program audits, peer inspections, EOS inspections, and inspections by external entities.

Elements of an inspection:

- Inspectors should bring a checklist to ensure that all issues are covered and a camera to document problems that require correction.
- Conversations with workers should occur during the inspection. They can provide valuable information and allow inspectors an opportunity to show workers how to fix problems.
- Issues resolved during the inspection should be noted.
- An inspection report containing all findings and recommendations should be prepared for management and other appropriate workers.
- Management should follow up on the inspection to ensure that all corrections are implemented.

Appendix 1

Laboratory Specific Documentation

This section will be completed by the Laboratory Supervisor, or Laboratory Chemical Hygiene Officer (LCHO), to outline specific procedures to the laboratory unit. It is a convenient way to compile all documentation into a single manual.

Introduction

This is the laboratory-specific part of the (CHP). Each section requires documentation to be written or inserted in a lab CHP binder. It is the responsibility of the LCHO to compile and update this information. The Environmental & Occupational Safety (EOS) Officer will verify the completeness of this section during inspection visits.

Department Name:

Laboratory Unit (Name of Lab):

Laboratory Unit (Bldg. & Room #):

Lab Chemical Hygiene Officer (First & Last Name):

Lab Supervisor (if different from above) (First & Last Name):

Principal Investigator (if different from above) (First & Last Name):

Checklist

LCHOs should place a check beside each line item once all of the required information has been incorporated into the appropriate section of the Laboratory Specific manual.

- ☐ Evacuation Route
- ☐ Spill Cleanup information
- ☐ Safety Data Sheet availability
- ☐ Standard Operating Procedures
- ☐ Training documentation

Summary of Duties

Lab Chemical Hygiene Officer (LCHO)

•Read the MML and IC2R3 Chemical Hygiene Plan
•Be familiar with additional universal requirements of this program, such as hazardous waste disposal and departmental emergency planning.
•Build/maintain a lab-specific CHP using this section as a guide.
•Compile all information listed under 'Checklist' and include it in a Laboratory CHP manual.
•Review and update the inserted information annually.
•Present the information compiled in the Lab CHP to personnel in your laboratory, and ask them to read it and become familiar with the required reading sections. This should be covered with personnel whenever a new revision to the laboratory protocols is adopted or a new person is assigned to the laboratory.
•Training documentation must be maintained. Using the 'Training Documentation' provided in this appendix, ask each employee to sign a copy after reading both parts of the CHP (MML and IC2R3 and lab-specific) and file all signed copies in the Lab CHP manual or appropriate and known location.

- This applies to all paid employees, volunteers, student interns, grad- students, post-doc, paid work-study, or other wage or salaried personnel in the laboratory. Everyone must read the CHP and sign the form.

•Develop (or designate to a responsible person) written standard operating procedures (SOPs) for any procedure in the laboratory which is not adequately addressed in the MML and IC2R3 CHP. SOPs should include precautions for health and safety and be inserted into the Lab CHP manual.

Laboratory Workers

•Read, at a minimum, all parts of the CHP listed on the 'Training Documentation' form.

•Check off all sections from the 'Required Reading List' once they have been read.

•Sign the 'Training Documentation' form.

•Abide by all policies and procedures described in both the MML and IC2R3 and Laboratory CHP's.

Emergency Response

Map of evacuation route - Produce a map detailing the building/floor where your facility is located. Highlight the path to take during the evacuation of the laboratory. Attach the map behind this page (EOS Office can assist with floor maps).

Spill Clean-up Information - Each laboratory must have ready access to supplies appropriate to cleaning up any chemicals found in that lab. Chemical spill cleanup materials can be purchased from most scientific and safety supply vendors. A typical stock for a lab kit might include:

•Mercury absorbing sponges

•Sorbents (appropriate for your lab)

•Neutralizers

LCHO should fill in the following blanks:

- Spill cleanup supplies are located:
- Types Available (Acid, base, solvent, mercury, and combo. Etc.):
- Usage information:

Safety Data Sheets

At the bottom of this page, specify how to locate SDSs for chemicals in your laboratory. A binder containing the SDSs should be kept in a central location near this (Lab CHP) document for small labs. Alternatively, you may have other quick reference sources for the SDS files. Every lab worker should be instructed on the use and access of SDS files.

SDS for our chemicals can be found:

- ☐ In this laboratory located or,
- ☐ In the departmental file, located
- ☐ On a computer, located*

*SDS research may be done via the internet or with computerized files, as long as the employees have immediate access to the information without leaving their work area when needed. A backup is available for rapid access to the SDS in a power outage or other emergency. LCHO needs to designate a person(s) responsible for obtaining and maintaining the SDSs. Suppose the employer does not have an SDS. In that case, the employer or selected person(s) should contact the manufacturer to get one.

Standard Operating Procedures

Written SOPs for any hazardous procedure or use of hazardous materials must be developed and included in this section unless the information overlaps information already provided in the universal requirements detailed in the MML and IC2R3 CHP. These specific SOPs are needed to describe protocols in using equipment or materials that pose unique hazards.

•Labs that contain laser equipment must develop a written SOP for the safe use of that equipment.

- Labs that use radioactive materials, biohazards, or reproductive toxins must have written SOPs to safely use these materials. SOPs for working with such hazards may include establishing a 'designated work area,' containment devices, and decontamination procedures.

SOPs should be written according to the following outline:

I. Title
II. Purpose
III. Equipment or chemical involved
IV. Protocol
V. Safety

Attach SOPs to this section.

Training Documentation
(Copy this form and have each worker in your laboratory sign one)

I have received information and training on the subject of chemical hygiene, including the following:

- ☐ I have read both the MML and IC2R3 workplace Laboratory Chemical Hygiene Plan
- ☐ I have been allowed to read an overview of the OSHA Lab Standard, 29, CFR 1910.1450
- ☐ I have been instructed on locating essential reference materials, such as containing hazard information about chemicals and chemical hygiene practices.
- ☐ I know where to locate the SDS files for the chemicals in this laboratory.

I am (check one):

- ☐ A new employee
- ☐ Graduate student
- ☐ Post-Doc
- ☐ Work-study student
- ☐ Student intern
- ☐ Visiting scientist
- ☐ Laboratory volunteer
- ☐ Beginning a new task
- ☐ Reviewing the revised edition of a CHP

Required reading (Check each section that you have read):

- ☐ Responsibilities
- ☐ Training
- ☐ Prudent Laboratory Practices
- ☐ Food & Drink
- ☐ Working Alone
- ☐ Laboratory Chemical Storage
- ☐ Controlled Substances / List
- ☐ Laboratory Waste Storage
- ☐ Special Chemical Hazards
- ☐ Eye Wash Stations
- ☐ Fume Hoods
- ☐ Fire Extinguishers
- ☐ Emergency Response
- ☐ Safety Inspections
- ☐ Chemical Storage &

Laboratory Documentation (Lab CHP)

☐ All sections

I certify that I have been provided a copy of the CHP and that I have read the above sections of the MML and IC2R3 CHP and all of my Lab's CHP.

Print Name: ________________________________ Date: ____________________

Signature: ________________________________

Appendix 2

Preparing for Laboratory Work

Before beginning any laboratory work, a plan should be made describing goals, chemicals and equipment needed, and the sequence of steps to be followed, including safety measures, personal protective equipment, and disposal of lab process waste and residual chemicals before, during, and following completion of the project.

a. Chemicals

Full description of chemicals used in the laboratory can be found on Safety Data Sheets (SDS), which contains information on the physical characteristics, hazards, disposal, and routine and emergency precautions. There is an SDS for virtually every chemical marketed, available from chemical suppliers, MML AND IC2R3 SDS archive files (available in the library), and computer-based information systems, such as the chemical manufacturer's website SDS library. SDSs should be acquired for every chemical used and should be kept on file for reference. The information on the SDS should be given to every laboratory worker who will be handling the chemical in question. Evaluate your procedure to use the least hazardous chemical and the minimum possible quantity that will still allow meaningful results. Using smaller amounts of chemicals means that less can be spilled or volatilized. Less must ultimately be treated and/or disposed of as hazardous waste.

b. Equipment

Specific information must be obtained about any equipment to be used. Most equipment is sold with this information, ranging from one-page instruction sheets to complete books. This information must be read thoroughly and followed precisely for the safest use of the equipment. When used equipment is sold or donated to the Laboratory, recipients must obtain operating instructions from the donor or manufacturer.

c. Written Procedures

Principal investigators, who are not experienced lab supervisors/trained chemists, should consult a lab supervisor for assistance in developing a lab protocol. Developing a protocol is fundamental to the experimental process and should result in a written set of procedures. Documenting the procedures allows the researcher or instructor to go through the experiment in the planning stage and identify areas where special precautions may be necessary. The written protocol will provide workers with step-by-step instructions, minimizing the chance of errors. A well-written protocol will allow for modifications and include safety precautions (e.g., 'wear splash goggles,' 'pour acid into water,' 'perform this operation under fume hood'). Written procedures should also include SDSs for all chemicals used in the experiment. In addition, a laboratory notebook should be kept during the procedure, documenting each action and its results. In an accident, a set of written procedures and a laboratory notebook may indicate what went wrong and possibly why. The protocol must include instructions pertinent to the ultimate disposal of lab process waste during and after completing the project.

d. Set up

Just before beginning the work, review the written procedures, following the expected sequence of the experiment. Review the materials to be used as to their degree and nature of the hazard, including flammability, volatility, reactivity, etc.

All equipment and supplies should be in place before actual work begins, including proper protective equipment (e.g., hoods, gloves, aprons, safety goggles, shields, and lab coats). The work area should be uncluttered and orderly. Where possible contamination and exposure might exist, take preventive measures, such as lining the work surface with absorbent paper. Also, have on hand all necessary equipment to deal with a spill or accident (more absorbent paper, spill control kit, etc.).

e. Additional rules for interns, volunteers, students:

- Know who is in charge of your assigned lab;
- Perform only authorized experiments in the lab.

f. Additional rules for PI's, lab supervisors, instructors:

- Preventative and remedial safety measures should be part of your instruction;

•Assume responsibility for interns & visitors and require that they follow the same rules as other lab workers;

•Ensure that up-to-date, pertinent information is available regarding;

- Cutting of glass tubing
- Boring stoppers
- Vacuum operations
- Pressure operations
- Heating operations
- Cryogenic operations

g. Additional rules for maintenance workers;

- When working on a fume hood identified as being used as a perchloric acid fume hood, use only Teflon or fluorocarbon grease on hood components;
- Ordinary petroleum greases can leave potentially explosive residue in a perchloric acid fume hood.

Appendix 2 A

Acrylamide

•Acrylamide is harmful if swallowed, inhaled, or absorbed through the skin. It affects the central and peripheral nervous systems, reproductive systems. It is an irritant to the eyes, skin, and respiratory tract.

•The following personal protective equipment is required: safety glasses or goggles, rubber gloves (or other gloves recommended for this chemical), and lab coats.

•All work done with liquid and solid acrylamide should be performed in a properly functioning fume hood. This will eliminate nearly 100% of the hazards presented by airborne particles and vapors.

•Do not store acrylamide in the presence of oxidizers, peroxides, acids, or bases to avoid potential violent polymerization.

•Acrylamide may also polymerize violently in the presence of heat above the melting point of 85°C.

•Acrylamide must be stored in appropriate containers for disposal, away from heat sources, out of direct sunlight, and away from the incompatible chemicals listed above.

•All acrylamide is to be considered hazardous waste for disposal purposes. Even when polymerized, there is a significant portion (greater than 1 % of the total solution) in monomer formation. This amount of monomer means that the entire solution is toxic, hazardous waste.

•Acrylamide gels should be placed in the bags supplied by EHS (not red or yellow bags, please!). Pour off any liquid before placing the gels in the bags.

•Acrylamide liquid waste should be poured into appropriate containers (i.e., carboys) for disposal through EOS. *Please do not put solids in liquid waste, including paper towels, fish heads, specimens, flesh" or other solid materials!*

•In the event of a large spill of acrylamide, back away, call 911, and secure the lab area. The irritant and toxic nature of the chemical warrants help from experts.

Appendix 2 B

Explosive & Shock Sensitive Materials

- Acetylides of heavy metals
- Aluminum ophorite explosive
- Amatol
- Ammonal
- Ammonium picrate
- Ammonium salt lattice
- Butyl tetryl
- Calcium nitrate
- Copper acetylide
- Cyanuric triazide
- Cyclotrimethylenetrinitramine
- Cyclotetramethylenetetranitramine
- Dinitroethyleneurea
- Dinitroglycerine
- Dinitrophenol
- Dinitrophenolates
- Dinitrophenylhydrazine
- Dinitoresorcinol
- Dinitrotoluene
- Dipicrylamine
- Erythritol tetranitrate
- Erythritol tetranitrate
- Fulminate of mercury
- Fulminate of silver
- Fulminating gold
- Fulminating mercury
- Fulminating platinum
- Fulminating silver
- Gelatinized nitrocellulose
- Guanyl nitrosamino guanyl tetrazene
- Guanysnitrosaminic guanylidene hydrazine
- Heavy metal azides
- Hexanite
- Hexanitrodiphenylamine
- Hexanitrostilbene
- Hexogen
- Hydrazinium nitrate
- Hydrazoic acid
- Lead azide
- Lead mannite
- Lead mononitroresorcinate
- Lead picrate
- Lead salts
- Lead styphnate
- Magnesium ophorite
- Mannitol hexanitrate
- Mercury oxalate
- Nitrated carbohydrate
- Nitrated glucoside
- Nitrated polyhydric alcohol
- Nitroglycerine
- Nitroglycide
- Nitroglycol
- Nitroguanidine
- Nitroparraffins
- Nitronium perchlorate
- Nitrourea
- Organic amine nitrates
- Organic nitramines
- Organic peroxides
- Pircramic acid
- Picramide
- Picratol
- Picric acid
- Picryl fluoride/chloride
- Perchloric acid
- Polynitro aliphatic
- Potassium nitroaminotetrazole
- Silver acetyl ide
- Silver azide
- Silver styphnate
- Silver tetrazene
- Sodatol
- Sodium amatol
- Sodium Dinitro-ortho-cresolate
- Sodium nitrate-potassium nitrate explosive mixture
- Sodium picramate
- Syphnic acid
- Tetrazene
- Tetranitrocarbazole
- Tetrytol
- Trimethylolethane
- Trimonite
- Trinitroznisole
- Trinitrobenzene
- Trinitrobenzoic acid
- Trinitrocresol
- Trinitro-metal-cresol
- Trinitronaphthalene
- Trinitrohpenetol
- Trinitrophloroglucinal
- Trinitroresorcinol
- Trinotrotoluene

- Mercury tartrate
- Mononitrotoluene
- Tritonal
- Urea nitrate

Appendix 2 C

Perchloric Acid

- The building should be of masonry construction.
- Floors should be concrete or tile. Handling acid on wooden floors is dangerous, especially after the acid has dried. The wooden floor will then become sensitive to ignition by friction.
- Benches should be constructed or resistant materials (not wood) to prevent acid absorption, especially at the bottom surface, which rests on the floor and would be subject to the most significant exposure from acid spills. Benchtops of resistant and nonabsorbent materials, such as chemical stoneware, tile, epoxy composites, and polyethylene, are recommended.
- Shelves and cabinets made of epoxy-painted steel are highly recommended over wood.
- Heating sources, such as electric hot plates, electrical or steam-heated sand baths, or a steam bath, are recommended for heating perchloric acid. Direct flame heating or oil baths should not be used.
- Glassware can crack or break due to thermal or mechanical shock. Quartz apparatus should be considered, especially since many experiments must chill rapidly from the boiling point. Rubber stoppers, tubes, or stopcocks should not be used with perchloric acid due to incompatibility.

Appendix 2 D

Peroxide-forming Chemicals

- Containers should be dated upon receipt and again upon opening. Laboratory workers must remain aware of these dates and arrange for disposal before expiration.
- Peroxide-forming chemicals are to be used or disposed of within six months of the posted opening date.
- Never attempt to force open a rusted or stuck cap on a container of a peroxide-forming chemical.
- Manufacturers of lower-purity solvents add a peroxide inhibitor to some of their peroxide-forming chemicals. The expiration date of these preserved ethers may be up to two years from the date of receipt; however, once opened, the material is recommended to be used or disposed of within six months.
- Keep only a minimal working inventory of peroxide-forming chemicals in the lab.
- Never distill potential peroxide-formers to dryness. Always leave at least 10% of the original liquid volume. When preparing to distill or evaporate compounds listed as peroxide-formers, always test for peroxides first.
- Immediately dispose of any rusted, damaged, undated, or suspicious-appearing containers of peroxide-forming chemicals through EOS.
- Do not use any peroxide-forming chemicals; if a precipitate has formed or an oily viscous layer has appeared, contact EOS immediately.

The following classes of chemicals can form peroxide initiation:

Class I: Under-saturated materials, especially low molecular weight, may polymerize violently and hazardously due to peroxide initiation.

Acrylic Acid	Tetrafluoroethylene
Acrylonitrile	Vinyl Acetate
Butadiene	Vinyl Acetylene
Chlorobutadiene (chloroprene)	Vinyl Chloride
Chlorotrifluoroethylene	Vinyl Pyridine

Methyl Methacrylate	Vinylidene Chloride
Styrene	

Class II: The following chemical are a peroxide hazard upon concentration (distillation/evaporation). A test for peroxide should be performed if the concentration is intended or suspended.

Acetal	Dioxane (p-dioxane)
Cumene	Ethylene glycol dimethyl ether (glyme)
Cyclohexene	Furan
Cyclooctene	Methyl Acetylene
Cyclopentene	Methyl Cyclopentane
Dicylopentasiene	Methyl-i-butyl ketone
Diethylene glycol dimethyl ether (diglyme)	Tetrahydrofuran
Diacetylene	Vinyl Ether
Diethyl ether	Vinyl Ether

Class III: Peroxides derived from the following compounds may explode without concentration.

Organic	**Inorganic**
Divinyl ether	Potassium Metal
Divinyl Acetylene	Potassium Amide
Isopropyl Ether	Sodium Amide (isodamide)
Vinylidene Chloride	

Appendix 2 E

Piranha Solutions

Typically, there are two different piranha solutions used in the laboratory.

•Acid piranha is a 3:1 mixture of concentrated sulfuric acid (H_2S0_4) with hydrogen peroxide (H202). It produces heat upon mixing and is self-starting, meaning it will react with organics without being heated.

•Base piranha is a 3:1 mixture of ammonium hydroxide (NH_40H) with hydrogen peroxide (H_20_2). It is equally dangerous as acid piranha when hot, although the base piranha must be heated to 60^0e before the reaction takes off.

The piranha reaction can accelerate out of control. The results could be as small as an overflowing container and a benchtop to clean up or as large as a major laboratory explosion. Most often, these out-of-control reactions are caused by the addition of organic compounds to piranha solutions. The rapid oxidation of these organic materials produces enormous quantities of heat and gas. In a closed container, this will lead to an explosion.

The handling of piranha solutions requires the use of personal protective equipment, such as safety goggles AND a full face shield, heavy-duty rubber gloves (or equivalent), and a protective apron over a lab coat.

It is imperative that safety equipment contaminated with organic material not come into contact with piranha solution. Remember, the addition of organics to a fresh hot piranha solution produces an immediate and violent reaction.

•The worker must remember that they are organic. Piranha solution on a person will produce an immediate and violent reaction. Avoid all skin exposures in the presence of piranha solutions.

Piranha can melt or otherwise attack plastic containers. Use only glass containers for the piranha solution. All containers having piranha solution, **including hazardous waste containers,** must be clearly labeled as containing piranha solution. The label must also detail the hazards (corrosive, reactive) and be clearly visible to anyone working with or coming into contact with the material.

•When preparing the piranha solution, always add the peroxide to the acid very slowly. The peroxide is added immediately before the process because it immediately produces an energetic exothermic reaction with a gas release. Remember, piranha solutions will heat up during the mixing process. The solution is likely to become very hot, over 100° - handle with care.

•Substrates and glassware that are being cleaned should be rinsed and dried before placing them in a piranha bath. Piranha solution is used to remove organic *residues,* not the organic compounds themselves.

•Leave the hot piranha solution in an open container until cool. Don't store hot piranha solutions because closed containers will likely explode.

•Adding any acids or bases to piranha or adding water will accelerate the reaction, producing more heat, gas, and potential accidents.

•Mixing piranha with organic compounds may cause an explosion. This includes acetone, photoresist, isopropyl alcohol, and nylon. Organics mustn't be stored or staged near the piranha solution mixing area or the bath.

•Do not attempt to store hot piranha solution in an air-tight container - it will explode. Leave the solution in an open container and allow cooling down for several hours. Make sure that the open container is clearly labeled and left in a safe area during this process.

•Once cooled down, the solution can be transferred to a closed glass container for waste storage. Clearly label the container with "Hazardous Waste - Piranha Solution." No other materials must be mixed with this waste!

•In case of exposure to piranha solution, such as skin or eyes, rinse the affected area thoroughly with large amounts of water (safety shower or eye wash station) for 15 minutes or more to reduce the likelihood of burns. Remove all contaminated clothing immediately with appropriate gloves and safely discard.

•In case of exposure to piranha solution from inhalation, the person should be assisted to an area with fresh, uncontaminated air. Seek medical attention in the event of respiratory irritation, cough, or tightness in the chest. Symptoms may be delayed.

Appendix 2 F

Hydrofluoric Acid

Health Hazards

Eye and skin exposure:

Hydrofluoric acid (HF) is corrosive and readily destroys tissue. Exposure to the eyes may result in blindness or permanent eye damage. HF readily penetrates human skin, allowing it to destroy soft tissues and decalcify bone. Chemical burns from HF are typically excruciating and slow to heal. Skin exposure to highly concentrated HF (approximately 50% or greater) immediately results in severe and painful tissue destruction. Death can result from burns involving less than 2.5% of the skin surface. HF at lower concentrations may not produce pain or burning sensations until hours after the exposure. A victim may suffer severe delayed tissue damage without noticing appreciable pain. Every skin, eye, or tissue contact with HF should receive immediate first aid and medical evaluation, even if the injury appears minor or no pain is felt.

Inhalation of HF vapor:

Inhaling HF vapors can seriously damage the lungs. Delayed reactions such as pulmonary edema may not be apparent for hours after the initial exposure. Airborne concentrations of 10 to 15 ppm will irritate the eyes, skin, and respiratory tract. Airborne concentrations of 30 ppm are considered immediately dangerous to life and health (IDLH) and may have irreversible health effects. At airborne concentrations above 50 ppm, even brief exposure may be fatal.

Information and Training

Employee Information and Training:

HF is a colorless liquid with a pungent irritating odor at low concentrations (3 ppm). Employees who handle HF must receive documented training on the hazards of HF and what to do in the event of an exposure or a spill. A Safety Data Sheet (SDS) on HF should always be kept in the immediate work area where HF is used.

Engineering Controls

Ventilation:

HF should be used with adequate ventilation to minimize inhalation of vapor. Concentrations greater than 5% should always be handled inside a properly functioning chemical fume hood.

Personal Protective Equipment

Eye Protection:

Always use chemical splash goggles together with a face shield when handling concentrated HF. Due to HF's highly corrosive nature, safety glasses with side shields do not provide adequate eye protection.

Body Protection:

Wear a laboratory coat with a chemical splash apron made out of natural rubber, neoprene, or other suitable material. Consult the SDS for appropriate protective material.

Gloves:

Consult the manufacturer's glove selection guide in conjunction with the MSDS when selecting a glove for HF. If you have any questions about which glove to choose, contact EHS. If gloves become contaminated with HF, remove them immediately, thoroughly wash your hands, and check your hands for any sign of contamination. Contaminated gloves must be disposed of as hazardous waste.

First Aid and Emergency Procedures (also refer to SDS)

Eye exposure:

Immediately irrigate eyes at eyewash for at least 15 minutes with copious quantities of water, keeping eyelids apart and away from eyeballs. Do not apply calcium gluconate gel to the eyes. In all cases of eye exposure, seek prompt medical attention.

Skin Exposure:

Immediately wash affected area of skin at the sink if a small area of hand or forearm has been contaminated or at a drench shower if upper arms, torso, or legs are contaminated. Remove all contaminated clothing and place it in a hood or plastic bag. If calcium gluconate gel is readily available, limit rinsing to 5-minutes and apply calcium gluconate gel. Reapply calcium gluconate gel into the affected area of skin every 15-minutes. Every lab area using concentrated HF must have a ready supply of fresh calcium gluconate gel. In all cases of skin exposure, seek prompt medical attention.

- Note: Calcium gluconate gel is a topical antidote for HF skin exposure. It works by combining with HF to form insoluble calcium fluoride, thus preventing the extraction of calcium from tissues and bones. Keep calcium gluconate gel nearby whenever you're working with HF. Calcium gluconate has a limited shelf life and should be stored in a refrigerator if possible and replaced with a fresh supply after its expiration date has passed. Use disposable gloves to apply calcium gluconate gel.

Ingestion:

Drink large amounts of water to dilute. Do not induce vomiting. Several glasses of milk or several ounces of milk of magnesia may be given for their soothing effect. In all cases of ingestion, seek prompt medical attention.

Inhalation:

Move victim to fresh air. Exposure to HF by inhalation is hazardous. In all cases of overexposure through inhalation, seek prompt medical attention.

Handling and Storage

Safe Work Practices:

Never work alone when using concentrated solutions of HF. Wash hands thoroughly after handling HF and practice good clean-up habits.

HF Spills:

If HF is spilled outside a chemical hood:

- Evacuate the area.
- Close the doors.
- Post the area with a sign to prevent others from entering.
- Call 911 to notify EOS Officer.

Small spills of HF inside a chemical fume hood can be cleaned up by laboratory staff if they have the correct equipment, understand the hazards, and are confident in their ability to clean up the spill safely and dispose of the waste properly. Lime soda, ash, sodium bicarbonate, or a spill absorbent specified for HF should be used for clean-up. Organic spill kits containing Floor-Dry, kitty litter, or sand should not be used because HF is a powerful oxidizer. HF reacts with silica to produce silicon tetrafluoride, a toxic gas.

Storage:

Store all HF and HF waste in labeled chemically compatible containers (e.g., polyethylene or Teflon); Glass, metal, and ceramic containers are not compatible with HF. HF should never be stored with incompatible chemicals such as ammonia or other alkaline materials. Store all acids and corrosive materials below eye level

Waste:

HF waste should be placed in a chemically compatible container with a sealed lid, clearly labeled, and properly disposed of through EOS.

Appendix 3

Fume Hoods

For a hood to be effective, it must be appropriately selected, installed, and utilized. Some variables that can impact the effectiveness of a hood are:

•Sash opening height,

•Amount of chemicals stored within the hood,

•Air velocity (i.e., "face velocity"), and

•Hood location within the laboratory.

An EHS contractor conducts fume hood certifications, including a general inspection, air/face velocity measurement, and proper sash positioning. These certifications occur following installing a hood and/or following any maintenance involving the fan motor. The certificate will be expressed as "pass" or "fail." A hood that has passed certification will be indicated by a "Hood Certification" sticker, which will show the testing date, tester name, and average face velocity. The hood will also be marked with adhesive arrows to indicate the proper sash height position.

A hood that has failed certification will be indicated that states, "CAUTION! - THIS HOOD IS OUT OF ORDER". It is imperative that a hood bearing this tag not be used. The LCHO is responsible for contacting Facilities for necessary repairs.

If a hood has been tagged by an EHS contractor as having failed certification, or if it is apparently malfunctioning, the following steps should be taken:

•Tightly cap or remove chemical containers.

•Tightly cap containers when the problem is with the roof exhaust fan.

•Remove containers when the problem is within the hood or when the source of the problem is unknown.

•Submit a work request to the VP of Facilities Department to report the problem.

•Ensure that work is not conducted in the broken hood until repair and recertification have been successfully performed.

Fume hoods may also be tagged out by EHS for maintenance work performed on the fume hood in the laboratory or at the fume hood exhaust system at the roof level.

Appendix 4

OSHA 29 CFR 1910.1450 Overview

An overview of OSHA General Industry Standard 29 CFR 1910.1450 (Laboratory Hygiene

- **Part Number:** 1910
- **Part Title:** Occupational Safety and Health Standard
- **Subpart:** Z
- **Subpart Title:** Toxic and Hazardous Substances
- **Standard Number:** 1910.1450 App A
- **Title:** National Research Council Recommendations Concerning Chemical Hygiene in Laboratories (Non-Mandatory)
- **GOP Source** e-CFR

The following non-mandatory recommendations were based on the National Research Council's (NRC) 2011 edition of "Prudent Practices in the Laboratory:

Handling and Management of Chemical Hazards" This reference, henceforth referred to as "Prudent Practices," is available from the National Academies Press, 500 Fifth Street NW, Washington DC 20001 (www.nap.edu). "Prudent Practices" is cited because of its wide distribution and acceptance and its preparation by recognized authorities in the laboratory community through the sponsorship of the NRC. However, these recommendations do not modify any requirements of the OSHA Laboratory standard. This appendix presents pertinent recommendations from "Prudent Practices," organized into a form convenient for quick reference during the operation of a laboratory and during the development and application of a CHP. For a detailed explanation and justification for each recommendation, consult "Prudent Practices."

"Prudent Practices" deals with both general laboratory safety and many types of chemical hazards. At the same time, the Laboratory standard is concerned primarily with chemical health hazards resulting from chemical exposures. The recommendations from "Prudent Practices" have been paraphrased, combined, or otherwise reorganized to adapt them for this purpose. However, their sense has not been changed.

Section F contains information from the U.S. Chemical Safety Board's (CSB) Fiscal Year 2011 Annual Performance and Accountability Report, and Section F contains recommendations extracted from the CSB's 2011 case study, "Texas Tech University Laboratory Explosion," available from: http://www.csb.gov/.

Culture of Safety

With the promulgation of the Occupational Safety and Health Administration (OSHA) Laboratory standard (29 CFR 1910.1450), a culture of safety consciousness, accountability, organization, and education has developed in industrial, governmental, and academic laboratories. Safety and training programs have been implemented to promote the safe handling of chemicals from ordering to disposal and train laboratory personnel in safe practices. Laboratory personnel must realize that the welfare and safety of each individual depend on clearly defined attitudes of teamwork and personal responsibility. Learning to participate in this culture of habitual risk assessment, experiment planning, and considering worst-case possibilities for oneself and one's fellow workers is as much part of scientific education as learning the theoretical background of experiments or the step-by-step protocols for professionally doing them. A crucial component of chemical education for all personnel is to nurture basic attitudes and habits of prudent behavior so that safety is a valued and inseparable part of all laboratory activities throughout their career.

Over the years, special techniques have been developed for handling chemicals safely. Local, state, and federal regulations hold institutions that sponsor chemical laboratories accountable for providing safe working environments. Beyond regulation, employers and scientists also hold themselves personally responsible for their own safety, the safety of their colleagues, and the safety of the general public. A sound safety organization that is respected by all requires the participation and support of laboratory administrators, workers, and students. A successful health and safety program requires a daily commitment from everyone in the organization. To be most effective, safety and health must be balanced with, and incorporated into, laboratory processes. Strong safety and health culture is the result of positive workplace attitudes from the chief executive officer to the newest hire; involvement and buy-in of all members of the workforce; mutual, meaningful, and measurable safety and health improvement goals; and policies and procedures that serve as reference tools, rather than obscure rules.

To perform their work prudently, laboratory personnel must consider the health, physical, and environmental hazards of the chemicals they plan to use in an experiment. However, the ability to accurately identify and assess laboratory hazards must be taught and encouraged through training and ongoing organizational support. This training must be at the core of every good health and safety program. For management to lead, personnel to assess worksite hazards, and hazards to be eliminated or controlled, everyone involved must be trained.

A. General Principles

1. Minimize All Chemical Exposures and Risks

Because few laboratory chemicals are without hazards, general precautions for handling all laboratory chemicals should be adopted. In addition to these general guidelines, specific guidelines for chemicals that are used frequently or are particularly hazardous should be adopted. Laboratory personnel should conduct their work under conditions that minimize the risks from both known and unknown hazardous substances. Before beginning any laboratory work, the hazards and risks associated with an experiment or activity should be determined and the necessary safety precautions implemented. Every laboratory should develop facility-specific policies and procedures for the highest-risk materials and procedures used in their laboratory. To identify these, consideration should be given to past accidents, process conditions, chemicals used in large volumes, and particularly hazardous chemicals.

Perform Risk Assessments for Hazardous Chemicals and Procedures Prior to Laboratory Work:

(a) Identify chemicals to be used, amounts required, and circumstances of use in the experiment. Consider any special employee or laboratory conditions that could create or increase a hazard. Consult sources of safety and health information and experienced scientists to ensure that those conducting the risk assessment have sufficient expertise.
(b) Evaluate the hazards posed by the chemicals and the experimental conditions. The evaluation should cover toxic, physical, reactive, flammable, explosive, radiation, and biological hazards, as well as any other potential

hazards posed by the chemicals.

(c) For a variety of physical and chemical reasons, reaction scale-ups pose special risks, which merit additional prior review and precautions.

(d) Select appropriate controls to minimize risk, including use of engineering controls, administrative controls, and personal protective equipment (PPE) to protect workers from hazards. The controls must ensure that OSHA's Permissible Exposure Limits (PELs) are not exceeded. Prepare for contingencies and be aware of the institutional procedures in the event of emergencies and accidents.

One sample approach to risk assessment is to answer these five questions:

(a) What are the hazards?
(b) What is the worst thing that could happen?
(c) What can be done to prevent this from happening?
(d) What can be done to protect from these hazards?
(e) What should be done if something goes wrong?

2. Avoid Underestimation of Risk

Even for substances of no known significant hazard, exposure should be minimized; when working with substances that present special hazards, special precautions should be taken. Reference should be made to the safety data sheet (SDS) that is provided for each chemical. Unless otherwise known, one should assume that any mixture will be more toxic than its most toxic component and that all substances of unknown toxicity are toxic.

Determine the physical and health hazards associated with chemicals before working with them. This determination may involve consulting literature references, laboratory chemical safety summaries (LCSSs), SDSs, or other reference materials. Consider how the chemicals will be processed and determine whether the changing states or forms will change the nature of the hazard. Review your plan, operating limits, chemical evaluations and detailed risk assessment with other chemists, especially those with experience with similar materials and protocols.

Before working with chemicals, know your facility's policies and procedures for how to handle an accidental spill or fire. Emergency telephone numbers should be posted in a prominent area. Know the location of all safety equipment and the nearest fire alarm and telephone.

3. Adhere to the Hierarchy of Controls

The hierarchy of controls prioritizes intervention strategies based on the premise that the best way to control a hazard is to systematically remove it from the workplace, rather than relying on employees to reduce their exposure. The types of measures that may be used to protect employees (listed from most effective to least effective) are: engineering controls, administrative controls, work practices, and PPE. Engineering controls, such as chemical hoods, physically separate the employee from the hazard. Administrative controls, such as employee scheduling, are established by management to help minimize the employees, exposure time to hazardous chemicals. Work practice controls are tasks that are performed in a designated way to minimize or eliminate hazards. Personal protective equipment and apparel are additional protection provided under special circumstances and when exposure is unavoidable.

Face and eye protection is necessary to prevent ingestion and skin absorption of hazardous chemicals. At a minimum, safety glasses, with side shields, should be used for all laboratory work. Chemical splash goggles are more appropriate than regular safety glasses to protect against hazards such as projectiles, as well as when working with glassware under reduced or elevated pressures (e.g., sealed tube reactions), when handling potentially explosive compounds (particularly during distillations), and when using glassware in high-temperature operations. Do not allow laboratory chemicals to come in contact with skin. Select gloves carefully to ensure that they are impervious to the chemicals being used and are of correct thickness to allow reasonable dexterity while also ensuring adequate barrier protection.

Lab coats and gloves should be worn when working with hazardous materials in a laboratory. Wear closed-toe shoes and long pants or other clothing that covers the legs when in a laboratory where hazardous chemicals are used. Additional protective clothing should be used when there is significant potential for skin-contact exposure to chemicals. The protective characteristics of this clothing must be matched to the hazard. Never wear gloves or laboratory coats outside the laboratory or into areas where food is stored and consumed.

4. Provide Laboratory Ventilation

The best way to prevent exposure to airborne substances is to prevent their escape into the working atmosphere by the use of hoods and other ventilation devices. To determine the best choice for laboratory ventilation using engineering controls for personal protection, employers are referred to Table 9.3 of the 2011 edition of Prudent Practices. Laboratory chemical hoods are the most important components used to protect laboratory personnel from exposure to hazardous chemicals.

(a) Toxic or corrosive chemicals that require vented storage should be stored in vented cabinets instead of in a chemical hood.
(b) Chemical waste should not be disposed of by evaporation in a chemical hood.
(c) Keep chemical hood areas clean and free of debris at all times.
(d) Solid objects and materials, such as paper, should be prevented from entering the exhaust ducts as they can reduce the air flow.
(e) Chemical hoods should be maintained, monitored and routinely tested for proper performance.

A laboratory ventilation system should include the following characteristics and practices:

(a) Heating and cooling should be adequate for the comfort of workers and operation of equipment. Before modification of any building HVAC, the impact on laboratory or hood ventilation should be considered, as well as how laboratory ventilation changes may affect the building HVAC.
(b) A negative pressure differential should exist between the amount of air exhausted from the laboratory and the amount supplied to the laboratory to prevent uncontrolled chemical vapors from leaving the laboratory.
(c) Local exhaust ventilation devices should be appropriate to the materials and operations in the laboratory.
(d) The air in chemical laboratories should be continuously replaced so that concentrations of odoriferous or toxic substances do not increase during the workday.
(e) Laboratory air should not be recirculated but exhausted directly outdoors.
(f) Air pressure should be negative with respect to the rest of the building. Local capture equipment and systems should be designed only by an experienced engineer or industrial hygienist.
(g) Ventilation systems should be inspected and maintained on a regular basis. There should be no areas where air remains static or areas that have unusually high airflow velocities.

Before work begins, laboratory workers should be provided with proper training that includes how to use the ventilation equipment, how to ensure that it is functioning properly, the consequences of improper use, what to do in the event of a system failure or power outage, special considerations, and the importance of signage and postings.

5. Institute a Chemical Hygiene Program

A comprehensive chemical hygiene program is required. It should be designed to minimize exposures, injuries, illnesses and incidents. There should be a regular, continuing effort that includes program oversight, safe facilities, chemical hygiene planning, training, emergency preparedness and chemical security. The chemical hygiene program must be reviewed annually and updated as necessary whenever new processes, chemicals, or equipment is implemented. Its recommendations should be followed in all laboratories.

6. Observe the PELs and TLVs

OSHAs Permissible Exposure Limits (PELs) must not be exceeded. The American Conference of Governmental Industrial Hygienists Threshold Limit Values (TLVs) should also not be exceeded.

B. *Responsibilities*

Persons responsible for chemical hygiene include, but are not limited to, the following:

1. Chemical Hygiene Officer

   (a) Establishes, maintains, and revises the (CHP).
   (b) Creates and revises safety rules and regulations.
   (c) Monitors procurement, use, storage, and disposal of chemicals.
   (d) Conducts regular inspections of the laboratories, preparations rooms, and chemical storage rooms, and submits detailed laboratory inspection reports to administration.
   (e) Maintains inspection, personnel training, and inventory records.
   (f) Assists laboratory supervisors in developing and maintaining adequate facilities.

   (g) Seeks ways to improve the chemical hygiene program.

2. Department Chairperson or Director

   (a) Assumes responsibility for personnel engaged in the laboratory use of hazardous chemicals.

(b) Provides the chemical hygiene officer (CHO) with the support necessary to implement and maintain the CHP.

(c) After receipt of laboratory inspection report from the CHO, meets with laboratory supervisors to discuss cited violations and to ensure timely actions to protect trained laboratory personnel and facilities and to ensure that the department remains in compliance with all applicable federal, state, university, local and departmental codes and regulations.

(d) Provides budgetary arrangements to ensure the health and safety of the departmental personnel, visitors, and students.

3. Departmental Safety Committee reviews accident reports and makes appropriate recommendations to the department chairperson regarding proposed changes in the laboratory procedures.

4. Laboratory Supervisor or Principal Investigator has overall responsibility for chemical hygiene in the laboratory, including responsibility to:

(a) Ensure that laboratory personnel comply with the departmental CHP and do not operate equipment or handle hazardous chemicals without proper training and authorization.

(b) Always wear personal protective equipment (PPE) that is compatible to the degree of hazard of the chemical.

(c) Follow all pertinent safety rules when working in the laboratory to set an example.

(d) Review laboratory procedures for potential safety problems before assigning to other laboratory personnel.

(e) Ensure that visitors follow the laboratory rules and assumes responsibility for laboratory visitors.

(f) Ensure that PPE is available and properly used by each laboratory employee and visitor.

(g) Maintain and implement safe laboratory practices.

(h) Provide regular, formal chemical hygiene and housekeeping inspections, including routine inspections of emergency equipment;

(i) Monitor the facilities and the chemical fume hoods to ensure that they are maintained and function properly. Contact the appropriate person, as designated by the department chairperson, to report problems with the facilities or the chemical fume hoods.

5. Laboratory Personnel

(a) Read, understand, and follow all safety rules and regulations that apply to the work area;
(b) Plan and conduct each operation in accordance with the institutional chemical hygiene procedures;
(c) Promote good housekeeping practices in the laboratory or work area.
(d) Notify the supervisor of any hazardous conditions or unsafe work practices in the work area.

(e) Use PPE as appropriate for each procedure that involves hazardous chemicals.

C. *The Laboratory Facility*

General Laboratory Design Considerations Wet chemical spaces and those with a higher degree of hazard should be separated from other *spaces* by a wall or protective barrier wherever possible. If the areas cannot be separated, then workers in lower hazard spaces may require additional protection from the hazards in connected *spaces.*

1. Laboratory Layout and Furnishing

(a) Work surfaces should be chemically resistant, smooth, and easy to clean.
(b) Hand washing sinks for hazardous materials may require elbow, foot, or electronic controls for safe operation.
(c) Wet laboratory areas should have chemically resistant, impermeable, slip resistant flooring.
(d) Walls should be finished with a material that is easy to clean and maintain.
(e) Doors should have view panels to prevent accidents and should open in the direction of egress.

(f) Operable windows should not be present in laboratories, particularly if there are chemical hoods or other local ventilation systems present.

2. Safety Equipment and Utilities

(a) An adequate number and placement of safety showers, eyewash units, and fire extinguishers should be provided for the laboratory.

(b) Use of water sprinkler systems is resisted by some laboratories because of the presence of electrical equipment or water reactive materials, but it is still generally safer to have sprinkler systems installed. A fire large enough to trigger the sprinkler system would have the potential to cause far more destruction than the local water damage.

D. Chemical hygiene plan (CHP)

The OSHA Laboratory standard defines a CHP as a written program developed and implemented by the employer which sets forth procedures, equipment, personal protective equipment and work practices that are capable of protecting employees from the health hazards presented by hazardous chemicals used in that particular workplace, (29 CFR 191 O.1450(b). The Laboratory Standard requires a CHP:

Where hazardous chemicals as defined by this standard are used in the workplace, the employer shall develop and carry out the provisions of a written Chemical Hygiene Plan, (29 CFR *1910.1450(e)(1)).* The CHP is the foundation of the laboratory safety program and must be reviewed and updated, as needed, and at least on an annual basis to reflect changes in policies and personnel. A CHP should be facility specific and can assist in promoting a culture of safety to protect workers from exposure to hazardous materials.

1. The Laboratory's CHP must be readily available to workers and capable of protecting workers from health hazards and minimizing exposure. Include the following topics in the CHP:

(a) Individual chemical hygiene responsibilities;
(b) Standard operating procedures;
(c) Personal protective equipment, engineering controls and apparel;
(d) Laboratory equipment;
(e) Safety equipment;
(f) Chemical management;
(g) Housekeeping;
(h) Emergency procedures for accidents and spills;
(i) Chemical waste;
(j) Training;
(k) Safety rules and regulations;
(I) Laboratory design and ventilation;
(m) Exposure monitoring;
(n) Compressed gas safety;
(0) Medical consultation and examination

It should be noted that the nature of laboratory work may necessitate addressing biological safety, radiation safety and security issues.

2. Chemical Procurement, Distribution, and Storage

Prudent chemical management includes the following processes:

Chemical Procurement:

(a) Information on proper handling, storage, and disposal should be known to those who will be involved before a substance is received.
(b) Only containers with adequate identifying labels should be accepted.
(c) Ideally, a central location should be used for receiving all chemical shipments.
(d) Shipments with breakage or leakage should be refused or opened in a chemical hood
(e) Only the minimum amount of the chemical needed to perform the planned work should be ordered.
(f) Purchases of high risk chemicals should be reviewed and approved by the CHO.
(g) Proper protective equipment and handling and storage procedures should be in place before receiving a shipment.

Chemical Storage:

(a) Chemicals should be separated and stored according to hazard category and compatibility.
(b) SDS and label information should be followed for storage requirements.
(c) Maintain existing labels on incoming containers of chemicals and other materials.
(d) Labels on containers used for storing hazardous chemicals must include the chemical identification and appropriate hazard warnings.
(e) The contents of all other chemical containers and transfer vessels, including, but not limited to, beakers, flasks, reaction vessels, and process equipment, should be properly identified.
(f) Chemical shipments should be dated upon receipt and stock rotated.
(g) Peroxide formers should be dated upon receipt, again dated upon opening, and stored away from heat and light with tightfitting, nonmetal lids.
(h) Open shelves used for chemical storage should be secured to the wall and contain 3/4-inch lips. Secondary containment devices should be used as necessary.
(i) Consult the SDS and keep incompatibles separate during transport, storage, use, and disposal.

(j) Oxidizers, reducing agents, and fuels should be stored separately to prevent contact in the event of an accident.
(k) Chemicals should not be stored in the chemical hood, on the floor, in areas of egress, on the benchtop, or in areas near heat or in direct sunlight.
(I) Laboratory-grade, flammable-rated refrigerators and freezers should be used to store sealed chemical containers of flammable liquids that require cool storage. Do not store food or beverages in the laboratory refrigerator.
(m) Highly hazardous chemicals should be stored in a well-ventilated and secure area designated for that purpose.
(n) Flammable chemicals should be stored in a spark-free environment and in approved flammable-liquid containers and storage cabinets. Grounding and bonding should be used to prevent static charge buildups when dispensing solvents.

(0) Chemical storage and handling rooms should be controlled-access areas. They should have proper ventilation, appropriate signage, diked floors, and fire suppression systems.

Chemical Handling:

(a) As described above, a risk assessment should be conducted prior to beginning work with any hazardous chemical for the first time.
(b) All SDS and label information should be read before using a chemical for the first time.

(c) Trained laboratory workers should ensure that proper engineering controls (ventilation) and **PPE** are in place.

Chemical Inventory:

(a) Prudent management of chemicals in any laboratory is greatly facilitated by keeping an accurate inventory of the chemicals stored.

(b) Unneeded items should be discarded or returned to the storeroom.

Transporting Chemicals:

(a) Secondary containment devices should be used when transporting chemicals.
(b) When transporting chemicals outside of the laboratory or between stockrooms and laboratories, the transport container should be break-resistant

(c) High-traffic areas should be avoided.

Transferring Chemicals:

(a) Use adequate ventilation (such as a fume hood) when transferring even a small amount of a particularly hazardous substance (PHS).
(b) While drum storage is not appropriate for laboratories, chemical stockrooms may purchase drum quantities of solvents used in high volumes. Ground and bond the drum and receiving vessel when transferring flammable liquids from a drum to prevent static charge buildup.
(c) If chemicals from commercial sources are repackaged into transfer vessels, the new containers should be labeled with all essential information on the original container.

Shipping Chemicals: Outgoing chemical shipments must meet all applicable Department of Transportation (DOT) regulations and should be authorized and handled by the institutional shipper.

3. Waste Management

A waste management plan should be in place before work begins on any laboratory activity. The plan should utilize the following hierarchy of practices:

(a) Reduce waste sources. The best approach to minimize waste generation is by reducing the scale of operations, reducing its formation during operations, and, if possible, substituting less hazardous chemicals for a particular operation.
(b) Reuse surplus materials. Only the amount of material necessary for an experiment should be purchased, and, if possible, materials should be reused.
(c) Recycle waste. If waste cannot be prevented or minimized, the organization should consider recycling chemicals that can be safely recovered or used as fuel.
(d) Dispose of waste properly. Sink disposal may not be appropriate. Proper waste disposal methods include incineration, treatment, and land disposal. The organization's environmental health and safety (EHS) office should be consulted in determining which methods are appropriate for different types of waste.

Collection and Storage of *Waste:*

(a) Chemical waste should be accumulated at or near the point of generation, under the control of laboratory workers.

(b) Each waste type should be stored in a compatible container pending transfer or disposal. Waste containers should be clearly labeled and kept sealed when not in use.
(c) Incompatible waste types should be kept separate to ensure that heat generation, gas evolution, or another reaction does not occur.
(d) Waste containers should be segregated by how they will be managed. Waste containers should be stored in a designated location that does not interfere with normal laboratory operations. Ventilated storage and secondary containment may be appropriate for certain waste types.
(e) Waste containers should be clearly labeled and kept sealed when not in use. Labels should include the accumulation start date and hazard warnings as appropriate.

(f) Non-explosive electrical systems, grounding and bonding between floors and containers, and non-sparking conductive floors and containers should be used in the central waste accumulation area to minimize fire and explosion hazards. Fire suppression systems, specialized ventilation systems, and dikes should be installed in the central waste accumulation area. Waste management workers should be trained in proper waste handling procedures as well as contingency planning and emergency response. Trained laboratory workers most familiar with the waste should be actively involved in waste management decisions to ensure that the waste is managed safely and efficiently. Engineering controls should be implemented as necessary, and personal protective equipment should be worn by workers involved in waste management.

4. Inspection Program

Maintenance and regular inspection of laboratory equipment are essential parts of the laboratory safety program. Management should participate in the design of a laboratory inspection program to ensure that the facility is safe and healthy, workers are adequately trained, and proper procedures are being followed.

Types of inspections: The program should include an appropriate combination of routine inspections, self-audits, program audits, peer inspections, EHS inspections, and inspections by external entities.

Elements of an inspection:

(a) Inspectors should bring a checklist to ensure that all issues are covered and a camera to document issues that require correction.

(b) Conversations with workers should occur during the inspection, as they can provide valuable information and allow inspectors an opportunity to show workers how to fix problems.
(c) Issues resolved during the inspection should be noted.
(d) An inspection report containing all findings and recommendations should be prepared for management and other appropriate workers.
(e) Management should follow-up on the inspection to ensure that all corrections are implemented.

5. Medical Consultation and Examination

The employer must provide all employees who work with hazardous chemicals an opportunity to receive medical attention, including any follow-up examinations that the examining physician determines to be necessary, whenever an employee develops signs or symptoms associated with a hazardous chemical to which the employee may have been exposed in the laboratory. If an employee encounters a spill, leak, explosion or other occurrence resulting in the likelihood of a hazardous exposure, the affected employee must be provided an opportunity for a medical consultation by a licensed physician. All medical examinations and consultations must be performed by or under the direct supervision of a licensed physician and must be provided without cost to the employee, without loss of pay and at a reasonable time and place. The identity of the hazardous chemical, a description of the incident, and any signs and symptoms that the employee may experience must be relayed to the physician.

6. Records

All accident, fatality, illness, injury, and medical records and exposure monitoring records must be retained by the institution in accordance with the requirements of state and federal regulations (see 29 CFR part 1904 and § 1910.14500)). Any exposure monitoring results must be provided to affected laboratory staff within 15 working days after receipt of the results (29 CFR 1910.1450(d) (4)).

7. Signs

Prominent signs of the following types should be posted:

(a) Emergency telephone numbers of emergency personnel/facilities, supervisors, and laboratory workers;
(b) Location signs for safety showers, eyewash stations, other safety and first aid equipment, and exits; and

(c) Warnings at areas or equipment where special or unusual hazards exist.

8. Spills and Accidents

Before beginning an experiment, know your facility's policies and procedures for how to handle an accidental release of a hazardous substance, a spill or a fire. Emergency response planning and training are especially important when working with highly toxic compounds. Emergency telephone numbers should be posted in a prominent area. Know the location of all safety equipment and the nearest fire alarm and telephone. Know who to notify in the event of an emergency. Be prepared to provide basic emergency treatment. Keep your co-workers informed of your activities so they can respond appropriately. Safety equipment, including spill control kits, safety shields, fire safety equipment, PPE, safety showers and eyewash units, and emergency equipment should be available in well-marked highly visible locations in all chemical laboratories. The laboratory supervisor or CHO is responsible for ensuring that all personnel are aware of the locations of fire extinguishers and are trained in their use. After an extinguisher has been used, designated personnel must promptly recharge or replace it (29 CFR 1910.157(c)(4)). The laboratory supervisor or CHO is also responsible for ensuring proper training and providing supplementary equipment as needed.

Special care must be used when handling solutions of chemicals in syringes with needles. Do not recap needles, especially when they have been in contact with chemicals. Remove the needle and discard it immediately after use in the appropriate sharps containers. Blunt-tip needles are available from a number of commercial sources and should be used unless a sharp needle is required to puncture rubber septa or for subcutaneous injection.

For unattended operations, laboratory lights should be left on, and signs should be posted to identify the nature of the experiment and the hazardous substances in use. Arrangements should be made, if possible, for other workers to periodically inspect the operation. Information should be clearly posted indicating who to contact in the event of an emergency. Depending on the nature of the hazard, special rules, precautions, and alert systems may be necessary.

9. Training and Information

Personnel training at all levels within the organization are essential. Responsibility and accountability throughout the organization are key elements in a strong safety and health program. The employer is required to provide employees with information and training to ensure that they are apprised of the hazards of chemicals present in their work area (29 CFR 1910.1450(f)). This information must be provided at the time of an employee's initial assignment to a work area where hazardous chemicals are present and prior to assignments involving new exposure situations. The frequency of refresher information and training should be determined by the employer. At a minimum, laboratory personnel should be trained on their facility's specific CHP, methods and observations that may be used to detect the presence or release of a hazardous chemical (such as monitoring conducted by the employer, continuous monitoring devices, visual appearance or odor of hazardous chemicals when being released), the physical and health hazards of chemicals in the work area and means to protect themselves from these hazards. Trained laboratory personnel must know shut-off procedures in case of an emergency. All SDSs must be made available to the employees.

E. General Procedures for Working With Chemicals

The risk of laboratory injuries can be reduced through adequate training, improved engineering, good housekeeping, safe work practice and personal behavior.

1. General Rules for Laboratory Work With Chemicals

(a) Assigned work schedules should be followed unless a deviation is authorized by the laboratory supervisor.
(b) Unauthorized experiments should not be performed.
(c) Plan safety procedures before beginning any operation.
(d) Follow standard operating procedures at all times.
(e) Always read the SDS and label before using a chemical.
(f) Wear appropriate PPE at all times.
(g) To protect your skin from splashes, spills and drips, always wear long pants and closed-toe shoes.
(h) Use appropriate ventilation when working with hazardous chemicals.
(i) Pipetting should never be done by mouth.
(j) Hands should be washed with soap and water immediately after working with any laboratory chemicals, even if gloves have been worn.
(k) Eating, drinking, smoking, gum chewing, applying cosmetics, and taking medicine in laboratories where hazardous chemicals are used or stored should be strictly prohibited.
(l) Food, beverages, cups, and other drinking and eating utensils should not be stored in areas where hazardous chemicals are handled or stored.
(m) Laboratory refrigerators, ice chests, cold rooms, and ovens should not

be used for food storage or preparation.

(n) Contact the laboratory supervisor, Principal Investigator, CHO or EHS office with all safety questions or concerns.
(0) know the location and proper use of safety equipment.
(p) Maintain situational awareness.
(q) Make others aware of special hazards associated with your work.
(r) Notify supervisors of chemical sensitivities or allergies.
(s) Report all injuries, accidents, incidents, and near misses.
(t) Unauthorized persons should not be allowed in the laboratory.
(u) Report unsafe conditions to the laboratory supervisor or CHO.
(v) Properly dispose of chemical wastes.

Working Alone in the Laboratory

Working alone in a laboratory is dangerous and should be strictly avoided. There have been many tragic accidents that illustrate this danger. Accidents are unexpected by definition, which is why coworkers should always be present. Workers should coordinate schedules to avoid working alone.

Housekeeping

Housekeeping can help reduce or eliminate a number of laboratory hazards. Proper housekeeping includes appropriate labeling and storage of chemicals, safe and regular cleaning of the facility, and proper arrangement of laboratory equipment.

2. Nanoparticles and Nanomaterials

Nanoparticles and nanomaterials have different reactivity's and interactions with biological systems than bulk materials, and understanding and exploiting these differences is an active area of research. However, these differences also mean that the risks and hazards associated with exposure to engineered nanomaterials are not well known. Because this is an area of ongoing research, consult trusted sources for the most up to date information available. Note that the higher reactivity of many nanoscale materials suggests that they should be treated as potential sources of ignition, accelerants, and fuel that could result in fire or explosion. Easily dispersed dry nanomaterials may pose the greatest health hazard because of the risk of inhalation. Operations involving these nanomaterials deserve more attention and more stringent controls than those where the nanomaterials are embedded in solid or suspended in liquid matrixes.

Consideration should be given to all possible routes of exposure to nanomaterials including inhalation, ingestion, injection, and dermal contact (including eye and mucous membranes). Avoid handling nanomaterials in the open air in a free particle state. Whenever possible, handle and store dispersible nanomaterials, whether suspended in liquids or in a dry particle form, in closed (tightly-sealed) containers.

Unless cutting or grinding occurs, nanomaterials that are not in a free form (encapsulated in a solid or a nanocomposite) typically will not require engineering controls. If a synthesis is being performed to create nanomaterials, it is not enough to only consider the final material in the risk assessment, but consider the hazardous properties of the precursor materials as well.

To minimize laboratory personnel exposure, conduct any work that could generate engineered nanoparticles in an enclosure that operates at a negative pressure differential compared to the laboratory personnel breathing zone. Limited data exist regarding the efficacy of PPE and ventilation systems against exposure to nanoparticles. However, until further information is available, it is prudent to follow standard chemical hygiene practices. Conduct a hazard evaluation to determine PPE appropriate for the level of hazard according to the requirements set forth in OSHA Personal Protective Equipment standard (29 CFR 1910.132).

3. Highly Toxic and Explosive/Reactive Chemicals/Materials

The use of highly toxic and explosive/ reactive chemicals and materials has been an area of growing concern. The frequency of academic laboratory incidents in the U.S. is an area of significant concern for the Chemical Safety Board (CSB). The CSB issued a case study on an explosion at Texas Tech University in Lubbock, Texas, which severely injured a graduate student handling a high-energy metal compound. Since 2001, the CSB has gathered preliminary information on 120 different university laboratory incidents that resulted in 87 evacuations, 96 injuries, and three deaths.

It is recommended that each facility keep a detailed inventory of highly toxic chemicals and explosive/reactive materials. There should be a record of the date of receipt, amount, location, and responsible individual for all acquisitions, syntheses, and disposal of these chemicals. A physical inventory should be performed annually to verify active inventory records. There should be a procedure in place to report security breaches, inventory discrepancies, losses, diversions, or suspected thefts.

Procedures for disposal of highly toxic materials should be established before any experiments begin, possibly even before the chemicals are ordered. The procedures should address methods for decontamination of any laboratory equipment that comes into contact with highly toxic chemicals. All waste should be accumulated in clearly labeled impervious containers that are stored in unbreakable secondary containment.

Highly reactive and explosive materials that may be used in the laboratory require appropriate procedures and training. An explosion can occur when a material undergoes a rapid reaction that results in a violent release of energy. Such reactions can happen spontaneously and can produce pressures, gases, and fumes that are hazardous. Some reagents pose a risk on contact with the atmosphere. It is prudent laboratory practice to use a safer alternative whenever possible.

If at all possible, substitutes for highly acute, chronic, explosive, or reactive chemicals should be considered prior to beginning work and used whenever possible.

4. Compressed Gas

Compressed gases expose laboratory personnel to both chemical and physical hazards. It is essential that these are monitored for leaks and have the proper labeling. By monitoring compressed gas inventories and disposing of or returning gases for which there is no immediate need, the laboratory can substantially reduce these risks. Leaking gas cylinders can cause serious hazards that may require an immediate evacuation of the area and activation of the emergency response system. Only appropriately trained hazmat responders may respond to stop a leaking gas cylinder under this situation.

Physical Hazards

Physical hazards in the laboratory include combustible liquids, compressed gases, reactive, explosives and flammable chemicals, as well as high pressure/energy procedures, sharp objects and moving equipment. Injuries can result from bodily contact with rotating or moving objects, including mechanical equipment, parts, and devices. Personnel should not wear loose fitting clothing, jewelry, or unrestrained long hair around machinery with moving parts.

The Chemical Safety Board has identified the following key lessons for laboratories that address both physical and other hazards:

(1) Ensure that research-specific hazards are evaluated and then controlled by developing specific written protocols and training.

(2) Expand existing laboratory safety plans to ensure that all safety hazards, including physical hazards of chemicals, are addressed.
(3) Ensure that the organizations EHS office reports directly to an identified individual/office with organizational authority to implement safety improvements.
(4) Develop a verification program that ensures that the safety provisions of the CHP are communicated, followed, and enforced at all levels within the organization.
(5) Document and communicate all laboratory near-misses and previous incidents to track safety, provide opportunities for education and improvement to drive safety changes at the university.
(6) Manage the hazards unique to laboratory chemical research in the academic environment. Utilize available practice guidance that identifies and describes methodologies to assess and control hazards.
(7) Written safety protocols and training are necessary to manage laboratory risk.

G. *Emergency Planning*

In addition to laboratory safety issues, laboratory personnel should be familiar with established facility policies and procedures regarding emergency situations. Topics may include, but are not limited to:

(1) Evacuation procedures when it is appropriate and alternate routes;
(2) Emergency shutdown procedures equipment shutdown and materials that should be stored safely;
(3) Communications during an emergency what to expect, how to report, where to call or look for information;
(4) How and when to use a fire extinguisher;
(5) Security issues preventing tailgating and unauthorized access
(6) Protocol for absences due to travel restrictions or illness;
(7) Safe practices for power outage;
(8) Shelter in place when it is appropriate;
(9) Handling suspicious mail or phone calls;
(10) Laboratory-specific protocols relating to emergency planning and response;
(11) Handling violent behavior in the workplace; and
(12) First-aid and CPR training, including automated external defibrillator training if available

It is prudent that laboratory personnel are also trained in how to respond to short-term, long-term and large-scale emergencies. Laboratory security can play a role in reducing the likelihood of some emergencies and assisting in preparation and response for others. Every institution, department, and individual laboratory should consider having an emergency preparedness plan. The level of detail of the plan will vary depending on the function of the group and institutional planning efforts already in place.

Emergency planning is a dynamic process. As personnel, operations, and events change, plans will need to be updated and modified. To determine the type and level of emergency planning needed, laboratory personnel need to perform a vulnerability assessment. Periodic drills to assist in training and evaluation of the emergency plan are recommended as part of the training program.

H. Emergency Procedures

(1) Fire alarm policy. Most organizations use fire alarms whenever a building needs to be evacuated for any reason. When a fire alarm sounds in the facility, evacuate immediately after extinguishing all equipment flames. Check on and assist others who may require help evacuating.

(2) Emergency safety equipment. The following safety elements should be met:

a. A written emergency action plan has been provided to workers;
b. Fire extinguishers, eyewash units, and safety showers are available and tested on a regular basis; and

c. Fire blankets, first-aid equipment, fire alarms, and telephones are available and accessible.

(3) Chemical spills. Workers should contact the CHO or EHS office for instructions before cleaning up a chemical spill. All SOS and label instructions should be followed, and appropriate PPE should be worn during spill cleanup.

(4) Accident procedures. In the event of an accident, immediately notify appropriate personnel and local emergency responders. Provide an SOS of any chemical involved to the attending physician. Complete an accident report and submit it to the appropriate office or individual within 24 hours.

(5) Employee safety training program. New workers should attend safety training before they begin any activities. Additional training should be provided when they advance in their duties or are required to perform a task for the first time. Training documents should be recorded and maintained. Training should include hands-on instruction of how to use

safety equipment appropriately.

(6) Conduct drills. Practice building evacuations, including the use of alternate routes. Practice shelter-in-place, including plans for extended stays. Walk the fastest route from your work area to the nearest fire alarm, emergency eye wash and emergency shower. Learn how each is activated. In the excitement of an actual emergency, people rely on what they learned from drills, practice and training.

(7) Contingency plans. All laboratories should have long-term contingency plans in place (e.g., for pandemics). Scheduling, workload, utilities and alternate work sites may need to be considered.

I. Laboratory Security

Laboratory security has evolved in *the* past decade, reducing the likelihood of some emergencies and assisting in preparation and response for others. Most security measures are based on the laboratory's vulnerability. Risks to laboratory security include, but are not limited to:

(1) Theft or diversion of chemicals, biologicals, and radioactive or proprietary materials, mission-critical or high-value equipment;
(2) Threats from activist groups;
(3) Intentional release of, or exposure to, hazardous materials;
(4) Sabotage or vandalism of chemicals or high-value equipment;
(5) Loss or release of sensitive information; and

(6) Rogue work or unauthorized laboratory experimentation. Security systems in the laboratory are used to detect and respond to a security breach, or a potential security breach, as well as to delay criminal activity by imposing multiple layered barriers of increasing stringency. A good laboratory security system will increase overall safety for laboratory personnel and the public, improve emergency preparedness by assisting with preplanning, and lower the organizations liability by incorporating more rigorous planning, staffing, training, and command systems and implementing emergency communications protocols, drills, background checks, card access systems, video surveillance, and other measures. The security plan should clearly delineate response to security issues, including the coordination of institution and laboratory personnel with both internal and external responders.

[76 FR 33609, June 8, 2011; 77 FR 17888, March 26, 2012; 78 FR 4325, Jan. 22, 2013]

Appendix 4 A

Schedules I - V Substances

Title 21 Code of Federal Regulations (DEA)

Part 1308 - Schedules of Controlled Substances

Schedules

Section 1308.11 Schedules I; Opiates

Section 1308.12 Schedule II; Opiates

Section 1308.13 Schedule III; Stimulants, Depressants, Narcotics, Steroids Section 1308.14 Schedule IV; Stimulants, Depressants, Narcotics, Steroids Section 1308.15 Schedule V; Narcotics / Non-Narcotics

Appendix 5

Sink Disposal Information Guide

APPLICABLE SINK LOCATIONS
Sink discharge of aqueous waste streams is only approved at sinks inside lab spaces. At no point can any aqueous lab waste be discharged into sinks outside of laboratories. Sinks in bathrooms, kitchens, facility closets, as well as floor drains and toilets, are never to be used for discharge of aqueous lab wastes.

MATERIALS PERMITTED FOR SINK DISCHARGE

Approved Waste Stream Composition
To be considered for discharge into a sink, a waste stream must comply with each of the following criteria:

- Must contain at least 99% water
- Must have a pH within the range of > 5.5 and < 12.0
- Must contain less than 1% nonhazardous material. These materials include, but are not limited to:
  - Sodium Chloride, Potassium Phosphate, Calcium Chloride, and other nonhazardous salts
  - Dilute nonhazardous buffer solutions
  - Sugars, including glucose, sucrose, dextrose, etc.
  - Disinfected biological material, proteins, and amino acids
- Must not contain any material outlined in the Prohibited Materials for Discharge section below.

Liquid Biological Waste
Decontaminating liquid biological waste must occur in a biological safety cabinet or in an aspiration flask system by combining the waste with disinfectant. If using bleach (5.45% sodium hypochlorite solution) as the disinfectant, use 10% final concentration in the liquid volume. The waste must remain in contact with the disinfectant for at least 20 minutes. The disinfected liquid may then be carefully transported to the appropriate sink for disposal into the sink drain with copious amounts of water by running the faucet for at least two minutes. See sections 4.2 Aspiration Flasks and 6.1 Liquid Biological Waste of the Life Lab Biosafety Practices

document for specific steps for the bleach inactivation of liquid biological waste.

Review Process

There are strict criteria for the kinds of contaminants that are permitted into the wastewater system. It is impossible to list every approved and prohibited material in this document. If any questions or concerns arise about what exactly can be discharged into sinks, residents are encouraged to reach out to the Life Lab facility safety officer or the TEI consultant to review their material composition before disposal.

PROHIBITED MATERIALS FOR DISCHARGE

The following materials are strictly prohibited from sink disposal, regardless of the quantity or concentration.

Hazardous Waste

All hazardous waste is prohibited from sink disposal and/or sewer discharge. A material is considered a hazardous waste if it meets any of the following criteria:

- It contains a substance listed by the Massachusetts Department of Environmental Protection (DEP) as a hazardous waste. A complete list of hazardous wastes can be found at

https://www.epa.gov/hw/defining-hazardous-waste-listed-characteristic-and-mixed-radiological-wastes

- It is considered a corrosive hazardous waste, with a pH ≤ 2.0 or ≥ 12.5.
    - Note: Some Aqueous solutions with a mid-rage pH are not considered Resource Conservation and Recovery Act (RCRA) regulated hazardous wastes. However, they still do not meet the MWRA and/or Harvard University's requirements for drain disposal. These solutions should be collected in containers, labeled as Nonhazardous waste, stored in Hazardous Waste Satellite Accumulations areas, and discarded with hazardous wastes. This specifically applies to aqueous solutions with a pH greater than 2.0 but less than or equal to 5.5, as well as solutions with a pH greater than or equal to 12.0 but less than 12.5. (See section 5.2 for a detailed breakout of pH ranges.)
- It is considered a flammable hazardous waste, with a flashpoint of less than 140°C.
- It is considered a reactive hazardous waste.
    - Reactive wastes include material that is normally unstable and readily undergoes violent change, reacts violently with water, or forms potentially

explosive mixtures with air or water. A comprehensive guideline for reactive waste can be found on the EPA website,

https://www.epa.gov/hw/defining-hazardous-waste-listed-characteristic-and-mixed-radiological-wastes#react

Corrosive Solutions (pH ≤ 5.5 or ≥ 12.0), which are not considered RCRA hazardous wastes

The Life Lab contains a wastewater treatment system for the neutralization of lab wastewater that may need a mild pH adjustment. Only solutions with a pH > 5.5 and < 12.0 can be considered for sink disposal. Corrosive solutions with pH ranges (pH ≤ 2.0) and (pH ≥ 12.5) at the conclusion of a lab process must be managed as hazardous waste, and should be collected at designated hazardous waste satellite accumulation areas.

Even if an aqueous waste does not meet the pH criteria for a hazardous waste, it still must be within the pH range that complies with Harvard's drain disposal guidelines. In order for an aqueous waste to be considered for drain disposal, it must have a pH > 5.5 and < 12.0.

Table 1: Aqueous Solution pH Range Guide

pH range ≤ 2.0	Must be collected in sealable containers, and managed as hazardous waste. Containers must be affixed with a hazardous waste label, and stored in a hazardous waste satellite accumulation area. These containers will be collected by EH&S for disposal.
pH range > 2.0 and ≤ 5.5	Must be collected in sealable containers, and managed as nonhazardous waste. Containers must be affixed with a nonhazardous waste label, and stored in a hazardous waste satellite accumulation area. These containers will be collected by EH&S for disposal.
pH range > 5.5 and < 12.0	Aqueous solutions within this range can be considered for sink disposal, provided they meet all other criteria outlined in sections 4 and 5.
pH range ≥ 12.0 and < 12.5	Must be collected in sealable containers, and managed as nonhazardous waste. Containers must be affixed with a nonhazardous waste label, and stored in a hazardous waste satellite accumulation area. These containers will be collected by EH&S for disposal.
pH range ≥ 12.5	Must be collected in sealable containers, and managed as hazardous waste. Containers must be affixed with a hazardous waste label, and stored in a hazardous waste satellite accumulation area. These containers will be collected by EH&S for disposal.

For sink disposal, 10% bleach is typically used to render a solution noninfectious. A solution of 10% bleach (0.54% total sodium hypochlorite) should pH at approximately 10.0 – 11.0. This solution falls within the acceptable pH range. If higher concentrations of bleach are required, and the final solution has a pH that is or exceeds 12.0, it cannot be discharged into a sink.

Flammable or Explosive Substances

Solutions that are flammable (flash point less than 140oF) or explosive at the time of disposal must not be disposed into a sink or drain. The drain disposal of flammables/explosives can create an unsafe condition for lab and facilities personnel. Prohibited flammable substances include, but are not limited to alcohols, acetone, gasoline, ketones, aldehydes, peroxides, ethers, xylene, toluene, and pyridine.

Other Prohibited Materials

Only aqueous solutions containing at least 99% water and up to 1% other nonhazardous constituents, can be considered for drain disposal. There are strict criteria for what materials can make up the acceptable 1% of nonhazardous constituents, and the Life Lab’s Safety Officer and TEI Consultant must review every product to decide if it is acceptable. The following list summarizes some material that cannot compromise any portion of that 1%. Therefore, all materials listed below are barred from drain disposal in any concentration.

- Heavy metals - including mercury, lead, and silver
- Infectious biological waste that has not been appropriately disinfected with bleach
- Radioactive wastes
- Polychlorinated Biphenyls (PCBs)
- Sodium Azide (includes mixtures that may have sodium azide present from kits)
- Stains and dyes (including cell stains)
- Any liquid with a temperature higher than 180°F
- Oils, fats, and grease
- Petroleum Hydrocarbons at levels above 15 mg/L
- Pesticides
- Noxious or malodorous liquids
- Groundwater, stormwater, surface water, roof or surface runoff, or subsurface drainage
- Any solid or viscous substance in amount or size that may obstruct flow (e.g., sand, animal tissues, debris, gels, polymers, etc.)

DILUTION PROHIBITION

The dilution of an aqueous waste in an attempt to achieve compliance with these guidelines is strictly prohibited. The increased use of process water in place of proper treatment shall be considered dilution and is not permitted.

Note for rinsate: In many cases, the first rinse (with water and/or acetone) of a flask, beaker, etc., previously containing any prohibited material, must not be discharged into a sink and must be collected as hazardous waste. Subsequent rinses, in which very low concentrations of the materials exist, may be discharged into a sink. However, suppose the container formerly held a chemical that is on the RCRA acutely toxic chemicals list (the P-list). In that case, all of the rinsates must be collected as hazardous waste, and none can be discharged into the sink. A list of p-listed chemicals can be found on the EPA's website:
https://www.epa.gov/hw/defining-hazardous-waste-listed-characteristic-and-mixed-radiological-wastes#PandU

Chemical Hygiene Plan

Laboratory Requirements

Revised 7/23/2021

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Application

The Chemical Hygiene Plan (CHP) summarizes policies and procedures to protect laboratory workers from and inform them of hazards inherent to their work with chemicals.

The CHP applies to all hazardous chemical waste generators of Mote Laboratories regardless of campus. There are two primary components of the CHP:

- General CHP procedures for laboratories are provided below, and
- Laboratory-specific documentation must be completed by the LCHO or the Principle Investigator (PI), or the Lab Supervisor and maintained on-site (see lab-specific documentation Appendix 1).

(Personnel who work with chemicals in a non-laboratory setting are covered by a Hazard Communication Plan required by OSHA Standard 29 CFR 1910.1200. This applies to general non-laboratory staff members who work in other than laboratory settings).

Responsibilities

Responsibility for laboratory safety is assigned to several parties at Mote Marine Laboratory.

- Chief Executive Officer (CEO) - This individual has ultimate legal responsibility for Mote Marine Laboratory compliance with this program.
- Environmental & Occupational Safety Officer (EOS) - This individual works for Business Office.
- Laboratory Chemical Hygiene Officers (LCHO) - Each "laboratory unit" shall designate an individual to serve in this capacity. These individuals are responsible for developing and documenting the Laboratory-Specific Documentation for the unit and will oversee implementation, such as training, inspection coordination, and reviewing/revising the plan annually (The appointed LCHO may be a Principal Investigators (PI) or Laboratory Supervisor) A "Summary of Duties" for these individuals can be found in Laboratory-Specific Documentation Appendix 1.
- Chemical Safety and Hazardous Materials Management Committee - This committee oversees compliance with the Mote Marine Laboratory CHP and any additional relative information contained within this program. Responsibilities include an **annual** review of the plan and assignment of disciplinary actions necessary to deal with non-compliance. Membership will consist of the MML and IC2R3 QA Officer, EOS Officer, and appointed LCHOs. Appointments will be made by the EOS. The Committee may conduct or facilitate lab safety training seminars.
- Department Heads have the responsibility for safety compliance within the department, including but not limited to: ensuring that Principle Investigators and/or Lab Supervisors are aware of the CHP requirements and mandating laboratory unit participation in the program.
- Department Heads have the responsibility for appointing an LCHO. A Department Head

may nominate themselves as LCHO. A Department Head may also be a Principal Investigator or Lab Supervisor.

- Laboratory Workers are responsible for planning and conducting each laboratory operation per the Chemical Hygiene Plan's "Laboratory-Specific Documentation "and developing good personal chemical hygiene habits. Additional information is provided in the "Summary of Duties."

Training

The QA Officer and/or LCHO may act as consultants to laboratory personnel for related issues.

The LCHO is responsible for informing employees of the following:

- The CHP location within the unit and general contents,
- The laboratory-specific documentation location within the unit and general contents,
- An overview of the OSHA Lab Standard (29 CFR 1910.1450) is available in overview form in Appendix 4,
- The required reading list for the specific laboratory, including standard operating procedures (SOPs), and the Training Documentation Form, which must be signed and filed with the plan, and
- The location of SDS and how to obtain them (SDSs do not have to be in printed form as long as employees can access and print a copy in the vicinity where the chemical is being used)

Prudent Laboratory Practices

Persons responsible for establishing new research protocols in a lab should carefully review all operations for potential risks or hazards. The materials and chemical by-products should be understood before starting the experimental process. Once information and advice about the dangers have been obtained, appropriate protective procedures should be developed. The positioning of equipment should be planned. Additional information is contained in Preparing for Laboratory Work in Appendix 2.

Food and Drink

The storage, handling, and consumption of food and drink are prohibited in specific high-risk laboratories, such as carcinogenic research labs, biological labs, pesticide labs, and labs containing highly toxic compounds. Additionally, some departments have rules prohibiting food in any laboratory.

Working Alone (Buddy System)

Work with chemical or physical hazards (e.g., high voltage, mechanical hazards not known to be intrinsically safe) or any other work that might prove immediately dangerous to life and health (IDLH) shall not be conducted alone in any laboratory. It is recommended that all laboratory work be performed with a partner or co-worker, or in proximity to others, in case of emergency.

Laboratory Chemical Storage

Chemicals should be stored in a defined storage area (safety cabinet or approved room). In general, avoid storing chemicals on laboratory bench tops or in fume hoods. Certain highly toxic materials that must be stored in a fume hood or glove box (ex. HCI gas) are the exception.

Laboratory Waste Storage

Failure to follow proper waste storage requirements may result in citations and/or fines by the EPA or OSHA.

- Hazardous waste may be accumulated in labs as long as they are collected in containers near the point of generation. This area must be under the control of the lab workers and LCHO. Waste containers must then remain in the lab, where they were filled until deposited in the Hazwaste Collection Building. See the EOS Officer gain access to the building. At the IC2R3 location, the process waste collection building is located on the ground level north side of the building. Containers of waste are labeled as the container's contents and the name or budget number of the lab generating the waste).
- Hazardous waste containers must be in good condition. They must be made of a material that is compatible with the waste it contains.
- Containers must be closed except when adding waste. Failure to close the waste containers may constitute an effort to treat waste on-site illegally.
- The list of contents on the label must be updated whenever waste is added!
- See Appendix 5 for sink disposal information.

Controlled Substances, Listed Chemicals, and Ethanol

These materials are covered by Federal and State policies. Please contact your Department Head, LCHO, or the Lab Supervisor for guidance.

- Controlled substances - Anyone who engages in controlled substances (e.g., drugs) included on the Drug Enforcement Agency (DEA) Schedules I-V must obtain DEA registration. Schedules I-V is contained in Appendix 4 A.
- Listed Chemicals - DEA requires vendors to identify each purchasing agent according to CFR 21, Part 1310.07, and "Proof of Identity" before selling any of their designated Listed Chemicals. The actual procedure and required paperwork may vary between vendors. Please contact your Department Head or the MML and IC2R3 Business Office Manager for assistance in completing the proof of identifying paperwork.
- Ethanol - Purchase and shipment are also regulated by Federal and State agencies. Storage of bulk ethanol at MML and IC2R3 is in a limited access ethanol locker. If you wish to order or access ethanol storage, please contact the MML and IC2R3 Business Office Manager.

Any material not used or no longer needed must be handled according to regulatory requirements. Individuals holding licenses to use Controlled Substances and/or Listed Chemicals in their research must meet the requirements set forth by DEA. To dispose of DEA Controlled Substances/Listed

Chemicals, please contact the EOS Officer to arrange a schedule. If you have any questions, contact your Department Head, Director, or the EOS Officer for additional information.

Special Chemical Hazards

Certain chemicals require special handling and disposal. The following are some examples of these chemicals and special handling instructions for them.

- **Acrylamide (gels, liquids, solids)** - Commonly used in industry and research, particularly in the electrophoresis of DNA in polyacrylamide gels. Acrylamide in nearly all of its forms is toxic and considered to be a potential human carcinogen. It is also listed as a potential teratogen. Because of its toxic nature, every precaution must be taken to safely and adequately handle it. For more information, see Appendix 2 A.
- **Hydrofluoric Acid** - Hydrofluoric acid (HF) is a highly corrosive acid used for many purposes, including mineral digestion, surface cleaning, etching, and biological staining. Its unique properties make it significantly more hazardous than many of the other acids used on campus. The safety guidelines contained in Appendix 2 F must be used when working with HF.
- **Reactive** - While all chemicals are reactive to some degree, special attention must be given to some inherently unstable and potentially reactive/explosive chemicals susceptible to rapid decomposition or reaction. These chemicals can react alone or with other substances violently, giving off heat and toxic gases or leading to an explosion. Reactions of these chemicals often accelerate out of control and may result in injuries or costly accidents.
- **Mercury** - Elemental mercury should never be added to another chemical for disposal. Many of our waste disposal firms will not accept waste contaminated with elemental mercury. Place elemental mercury waste and debris (ex. broken thermometers or manometers) separately in a sealed container (such as a zip-lock bag) for deposit in the Hazwaste Collection Building.
- **Perchloric Acid** - To minimize hazards related to perchloric acid, follow recommendations in Appendix 2 C.
- **Peroxide-formers** - Some chemicals form explosive concentrations of peroxides with age (see list of peroxide formers in appendix 2D.) When peroxides become concentrated by evaporation or distillation and are disturbed by heat, shock, or friction, they may explode with extreme violence. These substances must not be housed in labs for long periods. To minimize the hazard of peroxide formation, strictly observe the safety guidelines contained in Appendix 2 D.
- **Picric Acid** - When picric acid becomes desiccated (color changes, visible crystals, or crystalline matrix formation in the cap), it forms picrate salts, which are an explosion hazard. Dry picric acid is classified as a class "A" explosive! It is shock-sensitive and can explode when disturbed. If you suspect that you have desiccated picric acid:
  - Do not touch the container! The act of moving the container may be enough to detonate the material.
  - Prevent all personnel from entering the area or disturbing the container.
  - Contact EOS Officer.
  - See explosive and shock-sensitive materials in Appendix 3B
- **Piranha Solution** - This solution is commonly used to remove organic residues from substrates; however, it can be dangerous. For more information, see Appendix 2 E.

Eye Wash Stations and Deluge Showers

ANSI - approved eyewash facilities and deluge showers must be available to all where there is a potential for human contact with hazardous/caustic materials and all pesticide mixing areas. Access must be within ten unobstructed seconds from the work area. These safety devices are necessary for halting the damage incurred from a chemical splash to the eyes or spill on the body. To support the appropriate type of eyewash station and/or deluge shower is made available, the Environmental & Occupational Safety Office must be contacted before purchasing or installing. Bottled water does not suffice as an eyewash station. Eyewash stations must be flushed weekly by the Laboratory Chemical Officer or designee to prevent rust accumulation and microorganism growth in the system. Allow the water to flow for approximately five minutes. It is recommended that a log be maintained indicating the date flushed and the person performing the task. Inspection of the equipment should include the following:

- The eye wash bowl is not cracked;
- The handle to activate the water is present and functioning;
- The water supply has not been turned off;
- The eyewash station water flows sufficiently to reach the eyes;
- Nothing is located in front of the equipment.

An annual inspection of the deluge shower should be conducted to include the following:

- Nothing is located in the way of its use and operation;
- A visual inspection of the safety shower components is in good working order (shower head, pull the lever, and lever valve).
- An annual flow of the emergency shower is recommended to remove stagnant water.
- All eyewash stations and deluge showers must have appropriate identification signs posted at their immediate location.

Fume Hoods

Laboratory fume hoods are ventilated enclosures designed to protect laboratory personnel from inhalation exposure to chemical vapors and dust. Before purchasing, installing, or moving a fume hood, the LCHO must consult with EOS for guidance. Fume hoods must be certified by an EHS contractor. Additional information is contained in Appendix 3.

Fire Extinguishers

Each laboratory must have an appropriate, functional, unobstructed portable fire extinguisher mounted on the wall three to four feet from the floor.

Emergency Response

All departments are required to have an Emergency Action Plan specific to the building where employees are located. This plan provides detailed information regarding actions to be taken by personnel in the event of an emergency, such as fire, explosion, injury, medical emergencies, chemical exposures, chemical spills, acts of terrorism, acts of nature (severe weather) etc.

Minor spills of hazardous chemicals that pose little or no threat to the safety and health of personnel can be cleaned by competent departmental personnel by following the warning and caution signs on the container's label or manufacturer's safety data sheet (SDS). A hazardous material emergency exists when cleanup of a spill of hazardous material is beyond the level of knowledge, training, or the ability of the staff in the immediate spill area, or the spill creates a situation that is immediately dangerous to the life and health of persons in the spill area or facility.

- Alert personnel in the immediate area of the spill and evacuate the room.
- Confine the hazard by closing doors as you leave the room.
- Use eyewash or safety showers as needed to rinse spilled chemicals off of personnel.
- Evacuate any nearby rooms that may be affected. If the hazard may affect the entire building, evacuate the whole building.
- Notify EOS Officer and provide the chemical name, location of the spill, size of the spill, number of injured persons (if any), and any environmental concerns, such as the location of storm drains or streams. You will also need to provide your name and a telephone number. Always call from a safe place. Be prepared to spell chemical names.

Procedures for laboratory personnel to handle chemical, biological, or radiological spills are provided in the laboratory-specific documentation. Trained laboratory personnel are authorized to determine appropriate emergency response measures for their areas.

Inspection Program

Maintenance and regular inspection of laboratory equipment are essential parts of the laboratory safety program. Management should participate in designing a laboratory inspection program to ensure that the facility is safe and healthy, workers are adequately trained, and proper procedures are being followed.

Types of inspections: The program should include an appropriate combination of routine inspections, self-audits, program audits, peer inspections, EOS inspections, and inspections by external entities.

Elements of an inspection:

- Inspectors should bring a checklist to ensure that all issues are covered and a camera to document problems that require correction.
- Conversations with workers should occur during the inspection. They can provide valuable information and allow inspectors an opportunity to show workers how to fix problems.
- Issues resolved during the inspection should be noted.
- An inspection report containing all findings and recommendations should be prepared for management and other appropriate workers.
- Management should follow up on the inspection to ensure that all corrections are implemented.

Appendix 1

Laboratory Specific Documentation

This section will be completed by the Laboratory Supervisor, or Laboratory Chemical Hygiene Officer (LCHO), to outline specific procedures to the laboratory unit. It is a convenient way to compile all documentation into a single manual.

Introduction

This is the laboratory-specific part of the (CHP). Each section requires documentation to be written or inserted in a lab CHP binder. It is the responsibility of the LCHO to compile and update this information. The Environmental & Occupational Safety (EOS) Officer will verify the completeness of this section during inspection visits.

Department Name:

Laboratory Unit (Name of Lab):

Laboratory Unit (Bldg. & Room #):

Lab Chemical Hygiene Officer (First & Last Name):

Lab Supervisor (if different from above) (First & Last Name):

Principal Investigator (if different from above) (First & Last Name):

Checklist

LCHOs should place a check beside each line item once all of the required information has been incorporated into the appropriate section of the Laboratory Specific manual.

- ☐ Evacuation Route
- ☐ Spill Cleanup information
- ☐ Safety Data Sheet availability
- ☐ Standard Operating Procedures
- ☐ Training documentation

Summary of Duties

Lab Chemical Hygiene Officer (LCHO)

- Read the MML and IC2R3 Chemical Hygiene Plan
- Be familiar with additional universal requirements of this program, such as hazardous waste disposal and departmental emergency planning.
- Build/maintain a lab-specific CHP using this section as a guide.

- Compile all information listed under 'Checklist' and include it in a Laboratory CHP manual.
- Review and update the inserted information annually.
- Present the information compiled in the Lab CHP to personnel in your laboratory, and ask them to read it and become familiar with the required reading sections. This should be covered with personnel whenever a new revision to the laboratory protocols is adopted, or a new person is assigned to the laboratory.
- Training documentation must be maintained. Using the 'Training Documentation' provided in this appendix, ask each employee to sign a copy after reading both parts of the CHP (MML and IC2R3 and lab-specific) and file all signed copies in the Lab CHP manual or appropriate and known location.
    - This applies to all paid employees, volunteers, student interns, grad- students, post-doc, paid work-study, or other wage or salaried personnel in the laboratory. Everyone must read the CHP and sign the form.
- Develop (or designate to a responsible person) written standard operating procedures (SOPs) for any procedure in the laboratory which is not adequately addressed in the MML and IC2R3 CHP. SOPs should include precautions for health and safety and be inserted into the Lab CHP manual.

Laboratory Workers

- Read, at a minimum, all parts of the CHP listed on the 'Training Documentation' form.
- Check off all sections from the 'Required Reading List' once they have been read.
- Sign the 'Training Documentation' form.
- Abide by all policies and procedures described in both the MML and IC2R3 and Laboratory CHP's.

Emergency Response

Map of evacuation route - Produce a map detailing the building/floor where your facility is located. Highlight the path to take during the evacuation of the laboratory. Attach the map behind this page (EOS Office can assist with floor maps).

Spill Clean-up Information - Each laboratory must have ready access to supplies appropriate to cleaning up any chemicals found in that lab. Chemical spill cleanup materials can be purchased from most scientific and safety supply vendors. A typical stock for a lab kit might include:

- Mercury absorbing sponges
- Sorbents (appropriate for your lab)
- Neutralizers

LCHO should fill in the following blanks:

- Spill cleanup supplies are located:
- Types Available (Acid, base, solvent, mercury, and combo. Etc.):
- Usage information:

Safety Data Sheets

At the bottom of this page, specify how to locate SDSs for chemicals in your laboratory. A binder containing the SDSs should be kept in a central location near this (Lab CHP) document for small labs. Alternatively, you may have other quick reference sources for the SDS files. Every lab worker should be instructed on the use and access of SDS files.

SDS for our chemicals can be found:

- ☐ In this laboratory located or,
- ☐ In the departmental file, located
- ☐ On a computer, located*

*SDS research may be done via the internet or with computerized files, as long as the employees have immediate access to the information without leaving their work area when needed. A backup is available for rapid access to the SDS in a power outage or other emergency. LCHO needs to designate a person(s) responsible for obtaining and maintaining the SDSs. Suppose the employer does not have an SDS. In that case, the employer or selected person(s) should contact the manufacturer to get one.

Standard Operating Procedures

Written SOPs for any hazardous procedure or use of hazardous materials must be developed and included in this section unless the information overlaps information already provided in the universal requirements detailed in the MML and IC2R3 CHP. These specific SOPs are needed to describe protocols in using equipment or materials that pose unique hazards.

- Labs that contain laser equipment must develop a written SOP for the safe use of that equipment.
- Labs that use radioactive materials, biohazards, or reproductive toxins must have written SOPs to safely use these materials. SOPs for working with such hazards may include provisions for establishing a 'designated work area,' containment devices, and decontamination procedures.

SOPs should be written according to the following outline:

I. Title
II. Purpose
III. Equipment or chemical involved
IV. Protocol
V. Safety

Attach SOPs to this section.

Training Documentation

(Copy this form and have each worker in your laboratory sign one)

I have received information and training on the subject of chemical hygiene, including the following:

- ☐ I have read both the MML and IC2R3 workplace Laboratory Chemical Hygiene Plan
- ☐ I have been allowed to read an overview of the OSHA Lab Standard, 29, CFR 1910.1450
- ☐ I have been instructed on locating essential reference materials, such as containing hazard information about chemicals and chemical hygiene practices.
- ☐ I know where to locate the SDS files for the chemicals in this laboratory.

I am (check one):

- ☐ A new employee
- ☐ Graduate student
- ☐ Post-Doc
- ☐ Work-study student
- ☐ Student intern
- ☐ Visiting scientist
- ☐ Laboratory volunteer
- ☐ Beginning a new task
- ☐ Reviewing the revised edition of a CHP

Required reading (Check each section that you have read):

- ☐ Responsibilities
- ☐ Training
- ☐ Prudent Laboratory Practices
- ☐ Food & Drink
- ☐ Working Alone
- ☐ Laboratory Chemical Storage
- ☐ Controlled Substances / List
- ☐ Laboratory Waste Storage
- ☐ Special Chemical Hazards
- ☐ Eye Wash Stations
- ☐ Fume Hoods
- ☐ Fire Extinguishers
- ☐ Emergency Response
- ☐ Safety Inspections
- ☐ Chemical Storage &

Laboratory Documentation (Lab CHP)

☐ All sections

I certify that I have been provided a copy of the CHP and that I have read the above sections of the MML and IC2R3 CHP and all of my Lab's CHP.

Print Name: ________________________________ Date: ____________________

Signature: ________________________________

Appendix 2

Preparing for Laboratory Work

Before beginning any laboratory work, a plan should be made describing goals, chemicals and equipment needed, and the sequence of steps to be followed, including safety measures, personal protective equipment, and disposal of lab process waste and residual chemicals before, during, and following completion of the project.

a. Chemicals

Full description of chemicals used in the laboratory can be found on Safety Data Sheets (SDS), which contains information on the physical characteristics, hazards, disposal, and routine and emergency precautions. There is an SDS for virtually every chemical marketed, available from chemical suppliers, MML AND IC2R3 SDS archive files (available in the library), and computer-based information systems, such as the chemical manufacturer's website SDS library. SDSs should be acquired for every chemical used and should be kept on file for reference. The information on the SDS should be given to every laboratory worker who will be handling the chemical in question. <u>Evaluate your procedure to use the least hazardous chemical and the minimum possible quantity that will still allow meaningful results. Using smaller amounts of chemicals means that less can be spilled or volatilized. Less must ultimately be treated and/or disposed of as hazardous waste.</u>

b. Equipment

Specific information must be obtained about any equipment to be used. Most equipment is sold with this information, ranging from one-page instruction sheets to complete books. This information must be read thoroughly and followed precisely for the safest use of the equipment. When used equipment is sold or donated to the Laboratory, recipients must obtain operating instructions from the donor or manufacturer.

c. Written Procedures

Principal investigators, who are not experienced lab supervisors/trained chemists, should consult a lab supervisor for assistance in developing a lab protocol. Developing a protocol is fundamental to the experimental process and should result in a written set of procedures. Documenting the procedures allows the researcher or instructor to go through the experiment in the planning stage and identify areas where special precautions may be necessary. The written protocol will provide workers with step-by-step instructions, minimizing the chance of errors. A well-written protocol will allow for modifications and include safety precautions (e.g., 'wear splash goggles,' 'pour acid into water,' 'perform this operation under fume hood'). Written procedures should also include SDSs for all chemicals used in the experiment. In addition, a laboratory notebook should be kept during the procedure, documenting each action and its results. In an accident, a set of written procedures and a laboratory notebook may indicate what went wrong and possibly why. The protocol must include instructions pertinent to the ultimate disposal of lab process waste during and after completing the project.

d. Set up

Just before beginning the work, review the written procedures, following the expected sequence of the experiment. Review the materials to be used as to their degree and nature of the hazard, including flammability, volatility, reactivity, etc.

All equipment and supplies should be in place before actual work begins, including proper protective equipment (e.g., hoods, gloves, aprons, safety goggles, shields, and lab coats). The work area should be uncluttered and orderly. Where possible contamination and exposure might exist, take preventive measures, such as lining the work surface with absorbent paper. Also, have on hand all necessary equipment to deal with a spill or accident (more absorbent paper, spill control kit, etc.).

e. Additional rules for interns, volunteers, students:

- Know who is in charge of your assigned lab;
- Perform only authorized experiments in the lab.

f. Additional rules for PI's, lab supervisors, instructors:

- Preventative and remedial safety measures should be part of your instruction;
- Assume responsibility for interns & visitors and require that they follow the same rules as other lab workers;
- Ensure that up-to-date, pertinent information is available regarding;
    - Cutting of glass tubing
    - Boring stoppers
    - Vacuum operations
    - Pressure operations
    - Heating operations
    - Cryogenic operations

g. Additional rules for maintenance workers;

- When working on a fume hood identified as being used as a perchloric acid fume hood, use only Teflon or fluorocarbon grease on hood components;
- Ordinary petroleum greases can leave potentially explosive residue in a perchloric acid fume hood.

Appendix 2 A

Acrylamide

- Acrylamide is harmful if swallowed, inhaled, or absorbed through the skin. It affects the central and peripheral nervous systems, reproductive systems. It is an irritant to the eyes, skin, and respiratory tract.
- The following personal protective equipment is required: safety glasses or goggles, rubber gloves (or other gloves recommended for this chemical), and lab coats.
- All work done with liquid and solid acrylamide should be performed in a properly functioning fume hood. This will eliminate nearly 100% of the hazards presented by airborne particles and vapors.
- Do not store acrylamide in the presence of oxidizers, peroxides, acids, or bases to avoid potential violent polymerization.
- Acrylamide may also polymerize violently in the presence of heat above the melting point of 85°C.
- Acrylamide must be stored in appropriate containers for disposal, away from heat sources, out of direct sunlight, and away from the incompatible chemicals listed above.
- All acrylamide is to be considered hazardous waste for disposal purposes. Even when polymerized, there is a significant portion (greater than 1 % of the total solution) in monomer formation. This amount of monomer means that the entire solution is toxic, hazardous waste.
- Acrylamide gels should be placed in the bags supplied by EHS (not red or yellow bags, please!). Pour off any liquid before placing the gels in the bags.
- Acrylamide liquid waste should be poured into appropriate containers (i.e., carboys) for disposal through EOS. *Please do not put solids in liquid waste, including paper towels, fish heads, specimens, flesh" or other solid materials!*
- In the event of a large spill of acrylamide, back away, call 911, and secure the lab area. The irritant and toxic nature of the chemical warrants help from experts.

Appendix 2 B

Explosive & Shock Sensitive Materials

- Acetylides of heavy metals
- Aluminum ophorite explosive
- Amatol
- Ammonal
- Ammonium picrate
- Ammonium salt lattice
- Butyl tetryl
- Calcium nitrate
- Copper acetylide
- Cyanuric triazide
- Cyclotrimethylenetrinitramine
- Cyclotetramethylenetetranitramine
- Dinitroethyleneurea
- Dinitroglycerine
- Dinitrophenol
- Dinitrophenolates
- Dinitrophenylhydrazine
- Dinitoresorcinol
- Dinitrotoluene
- Dipicrylamine
- Erythritol tetranitrate
- Erythritol tetranitrate
- Fulminate of mercury
- Fulminate of silver
- Fulminating gold
- Fulminating mercury
- Fulminating platinum
- Fulminating silver
- Gelatinized nitrocellulose
- Guanyl nitrosamino guanyl tetrazene
- Guanysnitrosaminic guanylidene hydrazine
- Heavy metal azides
- Hexanite
- Hexanitrodiphenylamine
- Hexanitrostilbene
- Hexogen
- Hydrazinium nitrate
- Hydrazoic acid
- Lead azide
- Lead mannite
- Lead mononitroresorcinate
- Lead picrate
- Lead salts
- Lead styphnate
- Magnesium ophorite
- Mannitol hexanitrate
- Mercury oxalate
- Mercury tartrate
- Mononitrotoluene
- Nitrated carbohydrate
- Nitrated glucoside
- Nitrated polyhydric alcohol
- Nitroglycerine
- Nitroglycide
- Nitroglycol
- Nitroguanidine
- Nitroparraffins
- Nitronium perchlorate
- Nitrourea
- Organic amine nitrates
- Organic nitramines
- Organic peroxides
- Pircramic acid
- Picramide
- Picratol
- Picric acid
- Picryl fluoride/chloride
- Perchloric acid
- Polynitro aliphatic
- Potassium nitroaminotetrazole
- Silver acetyl ide
- Silver azide
- Silver styphnate
- Silver tetrazene
- Sodatol
- Sodium amatol
- Sodium Dinitro-ortho-cresolate
- Sodium nitrate-potassium nitrate explosive
- mixture
- Sodium picramate
- Syphnic acid
- Tetrazene
- Tetranitrocarbazole
- Tetrytol
- Trimethylolethane
- Trimonite
- Trinitroznisole
- Trinitrobenzene
- Trinitrobenzoic acid
- Trinitrocresol
- Trinitro-metal-cresol
- Trinitronaphthalene
- Trinitrohpenetol
- Trinitrophloroglucinal
- Trinitroresorcinol
- Trinotrotoluene
- Tritonal
- Urea nitrate

Appendix 2 C

Perchloric Acid

- The building should be of masonry construction.
- Floors should be concrete or tile. Handling acid on wooden floors is dangerous, especially after the acid has dried. The wooden floor will then become sensitive to ignition by friction.
- Benches should be constructed or resistant materials (not wood) to prevent acid absorption, especially at the bottom surface, which rests on the floor and would be subject to the most significant exposure from acid spills. Benchtops of resistant and nonabsorbent materials, such as chemical stoneware, tile, epoxy composites, and polyethylene, are recommended.
- Shelves and cabinets made of epoxy-painted steel are highly recommended over wood.
- Heating sources, such as electric hot plates, electrical or steam-heated sand baths, or a steam bath, are recommended for heating perchloric acid. Direct flame heating or oil baths should not be used.
- Glassware can crack or break due to thermal or mechanical shock. Quartz apparatus should be considered, especially since many experiments must chill rapidly from the boiling point. Rubber stoppers, tubes, or stopcocks should not be used with perchloric acid due to incompatibility.

Appendix 2 D

Peroxide-forming Chemicals

- Containers should be dated upon receipt and again upon opening. Laboratory workers must remain aware of these dates and arrange for disposal before expiration.
- Peroxide-forming chemicals are to be used or disposed of within six months of the posted opening date.
- Never attempt to force open a rusted or stuck cap on a container of a peroxide-forming chemical.
- Manufacturers of lower-purity solvents add a peroxide inhibitor to some of their peroxide-forming chemicals. The expiration date of these preserved ethers may be up to two years from the date of receipt; however, once opened, the material is recommended to be used or disposed of within six months.
- Keep only a minimal working inventory of peroxide-forming chemicals in the lab.
- Never distill potential peroxide-formers to dryness. Always leave at least 10% of the original liquid volume. When preparing to distill or evaporate compounds listed as peroxide-formers, always test for peroxides first.
- Immediately dispose of any rusted, damaged, undated, or suspicious-appearing containers of peroxide-forming chemicals through EOS.
- Do not use any peroxide-forming chemicals; if a precipitate has formed or an oily viscous layer has appeared, contact EOS immediately.

The following classes of chemicals can form peroxide initiation:

Class I: Under-saturated materials, especially low molecular weight, may polymerize violently and hazardously due to peroxide initiation.

Acrylic Acid	Tetrafluoroethylene
Acrylonitrile	Vinyl Acetate
Butadiene	Vinyl Acetylene
Chlorobutadiene (chloroprene)	Vinyl Chloride
Chlorotrifluoroethylene	Vinyl Pyridine
Methyl Methacrylate	Vinylidene Chloride
Styrene	

Class II: The following chemical are a peroxide hazard upon concentration (distillation/evaporation). A test for peroxide should be performed if the concentration is intended or suspended.

Acetal	Dioxane (p-dioxane)
Cumene	Ethylene glycol dimethyl ether (glyme)
Cyclohexene	Furan
Cyclooctene	Methyl Acetylene
Cyclopentene	Methyl Cyclopentane
Dicylopentasiene	Methyl-i-butyl ketone
Diethylene glycol dimethyl ether (diglyme)	Tetrahydrofuran
Diacetylene	Vinyl Ether
Diethyl ether	Vinyl Ether

Class III: Peroxides derived from the following compounds may explode without concentration.

Organic	Inorganic
Divinyl ether	Potassium Metal
Divinyl Acetylene	Potassium Amide
Isopropyl Ether	Sodium Amide (isodamide)
Vinylidene Chloride	

Appendix 2 E

Piranha Solutions

Typically, there are two different piranha solutions used in the laboratory.

- Acid piranha is a 3:1 mixture of concentrated sulfuric acid (H_2S0_4) with hydrogen peroxide (H202). It produces heat upon mixing and is self-starting, meaning it will react with organics without being heated.
- Base piranha is a 3:1 mixture of ammonium hydroxide (NH_40H) with hydrogen peroxide (H_20_2). It is equally dangerous as acid piranha when hot, although the base piranha must be heated to 60^0e before the reaction takes off.

The piranha reaction can accelerate out of control. The results could be as small as an overflowing container and a benchtop to clean up or as large as a major laboratory explosion. Most often, these out-of-control reactions are caused by the addition of organic compounds to piranha solutions. The rapid oxidation of these organic materials produces enormous quantities of heat and gas. In a closed container, this will lead to an explosion.

The handling of piranha solutions requires the use of personal protective equipment, such as safety goggles AND a full face shield, heavy-duty rubber gloves (or equivalent), and a protective apron over a lab coat.

It is imperative that safety equipment contaminated with organic material not come into contact with piranha solution. Remember, the addition of organics to a fresh hot piranha solution produces an immediate and violent reaction.

- The worker must remember that they are organic. Piranha solution on a person will produce an immediate and violent reaction. Avoid all skin exposures in the presence of piranha solutions.

Piranha can melt or otherwise attack plastic containers. Use only glass containers for the piranha solution. All containers having piranha solution, **including hazardous waste containers,** must be clearly labeled as containing piranha solution. The label must also detail the hazards (corrosive, reactive) and be clearly visible to anyone working with or coming into contact with the material.

- When preparing the piranha solution, always add the peroxide to the acid very slowly. The peroxide is added immediately before the process because it immediately produces an energetic exothermic reaction with a gas release. Remember, piranha solutions will heat up during the mixing process. The solution is likely to become very hot, over 100° - handle with care.
- Substrates and glassware that are being cleaned should be rinsed and dried before placing them in a piranha bath. Piranha solution is used to remove organic

residues, not the organic compounds themselves.

- Leave the hot piranha solution in an open container until cool. Don't store hot piranha solutions because closed containers will likely explode.
- Adding any acids or bases to piranha or adding water will accelerate the reaction, producing more heat, gas, and potential accidents.
- Mixing piranha with organic compounds may cause an explosion. This includes acetone, photoresist, isopropyl alcohol, and nylon. Organics mustn't be stored or staged near the piranha solution mixing area or the bath.
- Do not attempt to store hot piranha solution in an air-tight container - it will explode. Leave the solution in an open container and allow cooling down for several hours. Make sure that the open container is clearly labeled and left in a safe area during this process.
- Once cooled down, the solution can be transferred to a closed glass container for waste storage. Clearly label the container with "Hazardous Waste - Piranha Solution." No other materials must be mixed with this waste!
- In case of exposure to piranha solution, such as skin or eyes, rinse the affected area thoroughly with large amounts of water (safety shower or eye wash station) for 15 minutes or more to reduce the likelihood of burns. Remove all contaminated clothing immediately with appropriate gloves and safely discard.
- In case of exposure to piranha solution from inhalation, the person should be assisted to an area with fresh, uncontaminated air. Seek medical attention in the event of respiratory irritation, cough, or tightness in the chest. Symptoms may be delayed.

Appendix 2 F

Hydrofluoric Acid

Health Hazards

Eye and skin exposure:

Hydrofluoric acid (HF) is corrosive and readily destroys tissue. Exposure to the eyes may result in blindness or permanent eye damage. HF readily penetrates human skin, allowing it to destroy soft tissues and decalcify bone. Chemical burns from HF are typically excruciating and slow to heal. Skin exposure to highly concentrated HF (approximately 50% or greater) immediately results in severe and painful tissue destruction. Death can result from burns involving less than 2.5% of the skin surface. HF at lower concentrations may not produce pain or burning sensations until hours after the exposure. A victim may suffer severe delayed tissue damage without noticing appreciable pain. Every skin, eye, or tissue contact with HF should receive immediate first aid and medical evaluation, even if the injury appears minor or no pain is felt.

Inhalation of HF vapor:

Inhaling HF vapors can seriously damage the lungs. Delayed reactions such as pulmonary edema may not be apparent for hours after the initial exposure. Airborne concentrations of 10 to 15 ppm will irritate the eyes, skin, and respiratory tract. Airborne concentrations of 30 ppm are considered immediately dangerous to life and health (IDLH) and may have irreversible health effects. At airborne concentrations above 50 ppm, even brief exposure may be fatal.

Information and Training

Employee Information and Training:

HF is a colorless liquid with a pungent irritating odor at low concentrations (3 ppm). Employees who handle HF must receive documented training on the hazards of HF and what to do in the event of an exposure or a spill. A Safety Data Sheet (SDS) on HF should always be kept in the immediate work area where HF is used.

Engineering Controls

Ventilation:

HF should be used with adequate ventilation to minimize inhalation of vapor. Concentrations greater than 5% should always be handled inside a properly functioning chemical fume hood.

Personal Protective Equipment

Eye Protection:

Always use chemical splash goggles together with a face shield when handling concentrated HF. Due to HF's highly corrosive nature, safety glasses with side shields do not provide adequate eye protection.

Body Protection:

Wear a laboratory coat with a chemical splash apron made out of natural rubber, neoprene, or other suitable material. Consult the SDS for appropriate protective material.

Gloves:

Consult the manufacturer's glove selection guide in conjunction with the MSDS when selecting a glove for HF. If you have any questions about which glove to choose, contact EHS. If gloves become contaminated with HF, remove them immediately, thoroughly wash your hands, and check your hands for any sign of contamination. Contaminated gloves must be disposed of as hazardous waste.

First Aid and Emergency Procedures (also refer to SDS)

Eye exposure:

Immediately irrigate eyes at eyewash for at least 15 minutes with copious quantities of water, keeping eyelids apart and away from eyeballs. Do not apply calcium gluconate gel to the eyes. In all cases of eye exposure, seek prompt medical attention.

Skin Exposure:

Immediately wash affected area of skin at the sink if a small area of hand or forearm has been contaminated or at a drench shower if upper arms, torso, or legs are contaminated. Remove all contaminated clothing and place it in a hood or plastic bag. If calcium gluconate gel is readily available, limit rinsing to 5-minutes and apply calcium gluconate gel. Reapply calcium gluconate gel into the affected area of skin every 15-minutes. Every lab area using concentrated HF must have a ready supply of fresh calcium gluconate gel. In all cases of skin exposure, seek prompt medical attention.

- Note: Calcium gluconate gel is a topical antidote for HF skin exposure. It works by combining with HF to form insoluble calcium fluoride, thus preventing the extraction of calcium from tissues and bones. Keep calcium gluconate gel nearby whenever you're working with HF. Calcium gluconate has a limited shelf life and should be stored in a refrigerator if possible and replaced with a fresh supply after its expiration date has passed. Use disposable gloves to apply calcium gluconate gel.

Ingestion:

Drink large amounts of water to dilute. Do not induce vomiting. Several glasses of milk or several ounces of milk of magnesia may be given for their soothing effect. In all cases of ingestion, seek prompt medical attention.

Inhalation:

Move victim to fresh air. Exposure to HF by inhalation is hazardous. In all cases of overexposure through inhalation, seek prompt medical attention.

Handling and Storage

Safe Work Practices:

Never work alone when using concentrated solutions of HF. Wash hands thoroughly after handling HF and practice good clean-up habits.

HF Spills:

If HF is spilled outside a chemical hood:

- Evacuate the area.
- Close the doors.
- Post the area with a sign to prevent others from entering.
- Call 911 to notify EOS Officer.

Small spills of HF inside a chemical fume hood can be cleaned up by laboratory staff if they have the correct equipment, understand the hazards, and are confident in their ability to clean up the spill safely and dispose of the waste properly. Lime soda, ash, sodium bicarbonate, or a spill absorbent specified for HF should be used for clean-up. Organic spill kits that contain Floor-Dry, kitty litter or sand should not be used because HF is a powerful oxidizer, and HF reacts with silica to produce silicon tetrafluoride, a toxic gas.

Storage:

Store all HF and HF waste in labeled chemically compatible containers (e.g., polyethylene or Teflon); Glass, metal, and ceramic containers are not compatible with HF. HF should never be stored with incompatible chemicals such as ammonia or other alkaline materials. Store all acids and corrosive materials below eye level

Waste:

HF waste should be placed in a chemically compatible container with a sealed lid, clearly labeled, and properly disposed of through EOS.

Appendix 3

Fume Hoods

For a hood to be effective, it must be appropriately selected, installed, and utilized. Some variables that can impact the effectiveness of a hood are:

- Sash opening height,
- Amount of chemicals stored within the hood,
- Air velocity (i.e., "face velocity"), and
- Hood location within the laboratory.

An EHS contractor conducts fume hood certifications, including a general inspection, air/face velocity measurement, and proper sash positioning. These certifications occur following installing a hood and/or following any maintenance involving the fan motor. The certificate will be expressed as "pass" or "fail." A hood that has passed certification will be indicated by a "Hood Certification" sticker, which will show the testing date, tester name, and average face velocity. The hood will also be marked with adhesive arrows to indicate the proper sash height position.

A hood that has failed certification will be indicated that states, "CAUTION! - THIS HOOD IS OUT OF ORDER". It is imperative that a hood bearing this tag not be used. The LCHO is responsible for contacting Facilities for necessary repairs.

If a hood has been tagged by an EHS contractor as having failed certification, or if it is apparently malfunctioning, the following steps should be taken:

- Tightly cap or remove chemical containers.
- Tightly cap containers when the problem is with the roof exhaust fan.
- Remove containers when the problem is within the hood or when the source of the problem is unknown.
- Submit a work request to the VP of Facilities Department to report the problem.
- Ensure that work is not conducted in the broken hood until repair and recertification have been successfully performed.

Fume hoods may also be tagged out by EHS for maintenance work performed on the fume hood in the laboratory or at the fume hood exhaust system at the roof level.

Appendix 4

OSHA 29 CFR 1910.1450 Overview

An overview of OSHA General Industry Standard 29 CFR 1910.1450 (Laboratory Hygiene

- **Part Number:** 1910
- **Part Title:** Occupational Safety and Health Standard
- **Subpart:** Z
- **Subpart Title:** Toxic and Hazardous Substances
- **Standard Number:** 1910.1450 App A
- **Title:** National Research Council Recommendations Concerning Chemical Hygiene in Laboratories (Non-Mandatory)
- **GOP Source** e-CFR

The following non-mandatory recommendations were based on the National Research Council's (NRC) 2011 edition of "Prudent Practices in the Laboratory:

Handling and Management of Chemical Hazards" This reference, henceforth referred to as "Prudent Practices," is available from the National Academies Press, 500 Fifth Street NW, Washington DC 20001 (www.nap.edu). "Prudent Practices" is cited because of its wide distribution and acceptance and its preparation by recognized authorities in the laboratory community through the sponsorship of the NRC. However, these recommendations do not modify any requirements of the OSHA Laboratory standard. This appendix presents pertinent recommendations from "Prudent Practices," organized into a form convenient for quick reference during the operation of a laboratory and during the development and application of a CHP. For a detailed explanation and justification for each recommendation, consult "Prudent Practices."

"Prudent Practices" deals with both general laboratory safety and many types of chemical hazards. At the same time, the Laboratory standard is concerned primarily with chemical health hazards resulting from chemical exposures. The recommendations from "Prudent Practices" have been paraphrased, combined, or otherwise reorganized to adapt them for this purpose. However, their sense has not been changed.

Section F contains information from the U.S. Chemical Safety Board's (CSB) Fiscal Year 2011 Annual Performance and Accountability Report, and Section F contains recommendations extracted from the CSB's 2011 case study, "Texas Tech University Laboratory Explosion," available from: http://www.csb.gov/.

Culture of Safety

With the promulgation of the Occupational Safety and Health Administration (OSHA) Laboratory standard (29 CFR 1910.1450), a culture of safety consciousness, accountability, organization, and education has developed in industrial, governmental, and academic laboratories. Safety and training programs have been implemented to promote the safe handling of chemicals from ordering to disposal and train laboratory personnel in safe practices. Laboratory personnel must realize that the welfare and safety of each individual depend on clearly defined attitudes of teamwork and personal responsibility. Learning to participate in this culture of habitual risk assessment, experiment planning, and considering worst-case possibilities for oneself and one's fellow workers is as much part of scientific education as learning the theoretical background of experiments or the step-by-step protocols for professionally doing them. A crucial component of chemical education for all personnel is to nurture basic attitudes and habits of prudent behavior so that safety is a valued and inseparable part of all laboratory activities throughout their career.

Over the years, special techniques have been developed for handling chemicals safely. Local, state, and federal regulations hold institutions that sponsor chemical laboratories accountable for providing safe working environments. Beyond regulation, employers and scientists also hold themselves personally responsible for their own safety, the safety of their colleagues, and the safety of the general public. A sound safety organization that is respected by all requires the participation and support of laboratory administrators, workers, and students. A successful health and safety program requires a daily commitment from everyone in the organization. To be most effective, safety and health must be balanced with, and incorporated into, laboratory processes. Strong safety and health culture is the result of positive workplace attitudes from the chief executive officer to the newest hire; involvement and buy-in of all members of the workforce; mutual, meaningful, and measurable safety and health improvement goals; and policies and procedures that serve as reference tools, rather than obscure rules.

To perform their work prudently, laboratory personnel must consider the health, physical, and environmental hazards of the chemicals they plan to use in an experiment. However, the ability to accurately identify and assess laboratory hazards must be taught and encouraged through training and ongoing organizational support. This training must be at the core of every good health and safety program. For management to lead, personnel to assess worksite hazards, and hazards to be eliminated or controlled, everyone involved must be trained.

A. General Principles

1. Minimize All Chemical Exposures and Risks

Because few laboratory chemicals are without hazards, general precautions for handling all laboratory chemicals should be adopted. In addition to these general guidelines, specific guidelines for chemicals that are used frequently or are particularly hazardous should be adopted. Laboratory personnel should conduct their work under conditions that minimize the risks from both known and unknown hazardous substances. Before beginning any laboratory work, the hazards and risks associated with an experiment or activity should be determined and the necessary safety precautions implemented. Every laboratory should develop facility-specific policies and procedures for the highest-risk materials and procedures used in their laboratory. To identify these, consideration should be given to past accidents, process conditions, chemicals used in large volumes, and particularly hazardous chemicals.

Perform Risk Assessments for Hazardous Chemicals and Procedures Prior to Laboratory Work:

(a) Identify chemicals to be used, amounts required, and circumstances of use in the experiment. Consider any special employee or laboratory conditions that could create or increase a hazard. Consult sources of safety and health information and experienced scientists to ensure that those conducting the risk assessment have sufficient expertise.
(b) Evaluate the hazards posed by the chemicals and the experimental conditions. The evaluation should cover toxic, physical, reactive, flammable, explosive, radiation, and biological hazards, as well as any other potential hazards posed by the chemicals.
(c) For a variety of physical and chemical reasons, reaction scale-ups pose special risks, which merit additional prior review and precautions.
(d) Select appropriate controls to minimize risk, including use of engineering controls, administrative controls, and personal protective equipment (PPE) to protect workers from hazards. The controls must ensure that OSHA's Permissible Exposure Limits (PELs) are not exceeded. Prepare for contingencies and be aware of the institutional procedures in the event of emergencies and accidents.

One sample approach to risk assessment is to answer these five questions:

(a) What are the hazards?
(b) What is the worst thing that could happen?
(c) What can be done to prevent this from happening?
(d) What can be done to protect from these hazards?
(e) What should be done if something goes wrong?

2. Avoid Underestimation of Risk

Even for substances of no known significant hazard, exposure should be minimized; when working with substances that present special hazards, special precautions should be taken. Reference should be made to the safety data sheet (SDS) that is provided for each chemical. Unless otherwise known, one should assume that any mixture will be more toxic than its most toxic component and that all substances of unknown toxicity are toxic.

Determine the physical and health hazards associated with chemicals before working with them. This determination may involve consulting literature references, laboratory chemical safety summaries (LCSSs), SDSs, or other reference materials. Consider how the chemicals will be processed and determine whether the changing states or forms will change the nature of the hazard. Review your plan, operating limits, chemical evaluations and detailed risk assessment with other chemists, especially those with experience with similar materials and protocols.

Before working with chemicals, know your facility's policies and procedures for how to handle an accidental spill or fire. Emergency telephone numbers should be posted in a prominent area. Know the location of all safety equipment and the nearest fire alarm and telephone.

3. Adhere to the Hierarchy of Controls

The hierarchy of controls prioritizes intervention strategies based on the premise that the best way to control a hazard is to systematically remove it from the workplace, rather than relying on employees to reduce their exposure. The types of measures that may be used to protect employees (listed from most effective to least effective) are: engineering controls, administrative controls, work practices, and PPE. Engineering controls, such as chemical hoods, physically separate the employee from the hazard. Administrative controls, such as employee scheduling, are established by management to help minimize the employees, exposure time to hazardous chemicals. Work practice controls are tasks that are performed in a designated way to minimize or eliminate hazards. Personal protective equipment and apparel are additional protection provided under special circumstances and when exposure is unavoidable.

Face and eye protection is necessary to prevent ingestion and skin absorption of hazardous chemicals. At a minimum, safety glasses, with side shields, should be used for all laboratory work. Chemical splash goggles are more appropriate than regular safety glasses to protect against hazards such as projectiles, as well as when working with glassware under reduced or elevated pressures (e.g., sealed tube reactions), when handling potentially explosive compounds (particularly during distillations), and when using glassware in high-temperature operations. Do not allow laboratory chemicals to come in contact with skin. Select gloves carefully to ensure that they are impervious to the chemicals being used and are of correct thickness to allow reasonable dexterity while also ensuring adequate barrier protection.

Lab coats and gloves should be worn when working with hazardous materials in a laboratory. Wear closed-toe shoes and long pants or other clothing that covers the legs when in a laboratory where hazardous chemicals are used. Additional protective clothing should be used when there is significant potential for skin-contact exposure to chemicals. The protective characteristics of this clothing must be matched to the hazard. Never wear gloves or laboratory coats outside the laboratory or into areas where food is stored and consumed.

4. Provide Laboratory Ventilation

The best way to prevent exposure to airborne substances is to prevent their escape into the working atmosphere by the use of hoods and other ventilation devices. To determine the best choice for laboratory ventilation using engineering controls for personal protection, employers are referred to Table 9.3 of the 2011 edition of Prudent Practices. Laboratory chemical hoods are the most important components used to protect laboratory personnel from exposure to hazardous chemicals.

(a) Toxic or corrosive chemicals that require vented storage should be stored in vented cabinets instead of in a chemical hood.
(b) Chemical waste should not be disposed of by evaporation in a chemical hood.
(c) Keep chemical hood areas clean and free of debris at all times.
(d) Solid objects and materials, such as paper, should be prevented from entering the exhaust ducts as they can reduce the air flow.
(e) Chemical hoods should be maintained, monitored and routinely tested for proper performance.

A laboratory ventilation system should include the following characteristics and practices:

(a) Heating and cooling should be adequate for the comfort of workers and operation of equipment. Before modification of any building HVAC, the impact on laboratory or hood ventilation should be considered, as well as how laboratory ventilation changes may affect the building HVAC.
(b) A negative pressure differential should exist between the amount of air exhausted from the laboratory and the amount supplied to the laboratory to prevent uncontrolled chemical vapors from leaving the laboratory.
(c) Local exhaust ventilation devices should be appropriate to the materials and operations in the laboratory.
(d) The air in chemical laboratories should be continuously replaced so that concentrations of odoriferous or toxic substances do not increase during the workday.
(e) Laboratory air should not be recirculated but exhausted directly outdoors.
(f) Air pressure should be negative with respect to the rest of the building. Local capture equipment and systems should be designed only by an experienced engineer or industrial hygienist.
(g) Ventilation systems should be inspected and maintained on a regular basis. There should be no areas where air remains static or areas that have unusually high airflow velocities.

Before work begins, laboratory workers should be provided with proper training that includes how to use the ventilation equipment, how to ensure that it is functioning properly, the consequences of improper use, what to do in the event of a system failure or power outage, special considerations, and the importance of signage and postings.

5. Institute a Chemical Hygiene Program

A comprehensive chemical hygiene program is required. It should be designed to minimize exposures, injuries, illnesses and incidents. There should be a regular, continuing effort that

includes program oversight, safe facilities, chemical hygiene planning, training, emergency preparedness and chemical security. The chemical
hygiene program must be reviewed annually and updated as necessary whenever new processes, chemicals, or equipment is implemented. Its recommendations should be followed in all laboratories.

6. Observe the PELs and TLVs

OSHAs Permissible Exposure Limits (PELs) must not be exceeded. The American Conference of Governmental Industrial Hygienists Threshold Limit Values (TLVs) should also not be exceeded.

B. *Responsibilities*

Persons responsible for chemical hygiene include, but are not limited to, the following:

1. Chemical Hygiene Officer

(a) Establishes, maintains, and revises the (CHP).
(b) Creates and revises safety rules and regulations.
(c) Monitors procurement, use, storage, and disposal of chemicals.
(d) Conducts regular inspections of the laboratories, preparations rooms, and chemical storage rooms, and submits detailed laboratory inspection reports to administration.
(e) Maintains inspection, personnel training, and inventory records.
(f) Assists laboratory supervisors in developing and maintaining adequate facilities.
(g) Seeks ways to improve the chemical hygiene program.

2. Department Chairperson or Director

(a) Assumes responsibility for personnel engaged in the laboratory use of hazardous chemicals.
(b) Provides the chemical hygiene officer (CHO) with the support necessary to implement and maintain the CHP.
(c) After receipt of laboratory inspection report from the CHO, meets with laboratory supervisors to discuss cited violations and to ensure timely actions to protect trained laboratory personnel and facilities and to ensure that the department remains in compliance with all applicable federal, state, university, local and departmental codes and regulations.
(d) Provides budgetary arrangements to ensure the health and safety of the departmental personnel, visitors, and students.

3. Departmental Safety Committee reviews accident reports and makes appropriate recommendations to the department chairperson regarding proposed changes in the laboratory procedures.

4. Laboratory Supervisor or Principal Investigator has overall responsibility for chemical

hygiene in the laboratory, including responsibility to:

(a) Ensure that laboratory personnel comply with the departmental CHP and do not operate equipment or handle hazardous chemicals without proper training and authorization.
(b) Always wear personal protective equipment (PPE) that is compatible to the degree of hazard of the chemical.
(c) Follow all pertinent safety rules when working in the laboratory to set an example.
(d) Review laboratory procedures for potential safety problems before assigning to other laboratory personnel.
(e) Ensure that visitors follow the laboratory rules and assumes responsibility for laboratory visitors.
(f) Ensure that PPE is available and properly used by each laboratory employee and visitor.
(g) Maintain and implement safe laboratory practices.
(h) Provide regular, formal chemical hygiene and housekeeping inspections, including routine inspections of emergency equipment;
(i) Monitor the facilities and the chemical fume hoods to ensure that they are maintained and function properly. Contact the appropriate person, as designated by the department chairperson, to report problems with the facilities or the chemical fume hoods.

5. Laboratory Personnel

(a) Read, understand, and follow all safety rules and regulations that apply to the work area;
(b) Plan and conduct each operation in accordance with the institutional chemical hygiene procedures;
(c) Promote good housekeeping practices in the laboratory or work area.
(d) Notify the supervisor of any hazardous conditions or unsafe work practices in the work area.
(e) Use PPE as appropriate for each procedure that involves hazardous chemicals.

C. *The Laboratory Facility*

General Laboratory Design Considerations Wet chemical spaces and those with a higher degree of hazard should be separated from other *spaces* by a wall or protective barrier wherever possible. If the areas cannot be separated, then workers in lower hazard spaces may require additional protection from the hazards in connected *spaces.*

1. Laboratory Layout and Furnishing

(a) Work surfaces should be chemically resistant, smooth, and easy to clean.
(b) Hand washing sinks for hazardous materials may require elbow, foot, or electronic controls for safe operation.
(c) Wet laboratory areas should have chemically resistant, impermeable, slip resistant flooring.
(d) Walls should be finished with a material that is easy to clean and maintain.

(e) Doors should have view panels to prevent accidents and should open in the direction of egress.
(f) Operable windows should not be present in laboratories, particularly if there are chemical hoods or other local ventilation systems present.

2. Safety Equipment and Utilities

(a) An adequate number and placement of safety showers, eyewash units, and fire extinguishers should be provided for the laboratory.
(b) Use of water sprinkler systems is resisted by some laboratories because of the presence of electrical equipment or water reactive materials, but it is still generally safer to have sprinkler systems installed. A fire large enough to trigger the sprinkler system would have the potential to cause far more destruction than the local water damage.

D. Chemical hygiene plan (CHP)

The OSHA Laboratory standard defines a CHP as a written program developed and implemented by the employer which sets forth procedures, equipment, personal protective equipment and work practices that are capable of protecting employees from the health hazards presented by hazardous chemicals used in that particular workplace, (29 CFR 191 O.1450(b). The Laboratory Standard requires a CHP:

Where hazardous chemicals as defined by this standard are used in the workplace, the employer shall develop and carry out the provisions of a written Chemical Hygiene Plan, (29 CFR *1910.1450(e)(1)).* The CHP is the foundation of the laboratory safety program and must be reviewed and updated, as needed, and at least on an annual basis to reflect changes in policies and personnel. A CHP should be facility specific and can assist in promoting a culture of safety to protect workers from exposure to hazardous materials.

1. The Laboratory's CHP must be readily available to workers and capable of protecting workers from health hazards and minimizing exposure. Include the following topics in the CHP:

(a) Individual chemical hygiene responsibilities;
(b) Standard operating procedures;
(c) Personal protective equipment, engineering controls and apparel;
(d) Laboratory equipment;
(e) Safety equipment;
(f) Chemical management;
(g) Housekeeping;
(h) Emergency procedures for accidents and spills;
(i) Chemical waste;
(j) Training;
(k) Safety rules and regulations;

(I) Laboratory design and ventilation;
(m) Exposure monitoring;
(n) Compressed gas safety;
(0) Medical consultation and examination

It should be noted that the nature of laboratory work may necessitate addressing biological safety, radiation safety and security issues.

2. Chemical Procurement, Distribution, and Storage

Prudent chemical management includes the following processes:

Chemical Procurement:

(a) Information on proper handling, storage, and disposal should be known to those who will be involved before a substance is received.
(b) Only containers with adequate identifying labels should be accepted.
(c) Ideally, a central location should be used for receiving all chemical shipments.
(d) Shipments with breakage or leakage should be refused or opened in a chemical hood
(e) Only the minimum amount of the chemical needed to perform the planned work should be ordered.
(f) Purchases of high risk chemicals should be reviewed and approved by the CHO.
(g) Proper protective equipment and handling and storage procedures should be in place before receiving a shipment.

Chemical Storage:

(a) Chemicals should be separated and stored according to hazard category and compatibility.
(b) SDS and label information should be followed for storage requirements.
(c) Maintain existing labels on incoming containers of chemicals and other materials.
(d) Labels on containers used for storing hazardous chemicals must include the chemical identification and appropriate hazard warnings.
(e) The contents of all other chemical containers and transfer vessels, including, but not limited to, beakers, flasks, reaction vessels, and process equipment, should be properly identified.
(f) Chemical shipments should be dated upon receipt and stock rotated.
(g) Peroxide formers should be dated upon receipt, again dated upon opening, and stored away from heat and light with tightfitting, nonmetal lids.
(h) Open shelves used for chemical storage should be secured to the wall and contain 3/4-inch lips. Secondary containment devices should be used as necessary.
(i) Consult the SDS and keep incompatibles separate during transport, storage, use, and disposal.

(j) Oxidizers, reducing agents, and fuels should be stored separately to prevent contact in the event of an accident.
(k) Chemicals should not be stored in the chemical hood, on the floor, in areas of egress, on the benchtop, or in areas near heat or in direct sunlight.
(I) Laboratory-grade, flammable-rated refrigerators and freezers should be used to store sealed chemical containers of flammable liquids that require cool storage. Do not store food or beverages in the laboratory refrigerator.
(m) Highly hazardous chemicals should be stored in a well-ventilated and secure area designated for that purpose.
(n) Flammable chemicals should be stored in a spark-free environment and in approved flammable-liquid containers and storage cabinets. Grounding and bonding should be used to prevent static charge buildups when dispensing solvents.
(0) Chemical storage and handling rooms should be controlled-access areas. They should have proper ventilation, appropriate signage, diked floors, and fire suppression systems.

Chemical Handling:

(a) As described above, a risk assessment should be conducted prior to beginning work with any hazardous chemical for the first time.
(b) All SDS and label information should be read before using a chemical for the first time.
(c) Trained laboratory workers should ensure that proper engineering controls (ventilation) and **PPE** are in place.

Chemical Inventory:

(a) Prudent management of chemicals in any laboratory is greatly facilitated by keeping an accurate inventory of the chemicals stored.
(b) Unneeded items should be discarded or returned to the storeroom.

Transporting Chemicals:

(a) Secondary containment devices should be used when transporting chemicals.
(b) When transporting chemicals outside of the laboratory or between stockrooms and laboratories, the transport container should be break-resistant
(c) High-traffic areas should be avoided.

Transferring Chemicals:

(a) Use adequate ventilation (such as a fume hood) when transferring even a small amount of a particularly hazardous substance (PHS).
(b) While drum storage is not appropriate for laboratories, chemical stockrooms may purchase drum quantities of solvents used in high volumes. Ground and bond the drum and receiving vessel when transferring flammable liquids from a drum to prevent static charge buildup.

(c) If chemicals from commercial sources are repackaged into transfer vessels, the new containers should be labeled with all essential information on the original container.

Shipping Chemicals: Outgoing chemical shipments must meet all applicable Department of Transportation (DOT) regulations and should be authorized and handled by the institutional shipper.

3. Waste Management

A waste management plan should be in place before work begins on any laboratory activity. The plan should utilize the following hierarchy of practices:

(a) Reduce waste sources. The best approach to minimize waste generation is by reducing the scale of operations, reducing its formation during operations, and, if possible, substituting less hazardous chemicals for a particular operation.
(b) Reuse surplus materials. Only the amount of material necessary for an experiment should be purchased, and, if possible, materials should be reused.
(c) Recycle waste. If waste cannot be prevented or minimized, the organization should consider recycling chemicals that can be safely recovered or used as fuel.
(d) Dispose of waste properly. Sink disposal may not be appropriate. Proper waste disposal methods include incineration, treatment, and land disposal. The organization's environmental health and safety (EHS) office should be consulted in determining which methods are appropriate for different types of waste.

Collection and Storage of *Waste:*

(a) Chemical waste should be accumulated at or near the point of generation, under the control of laboratory workers.
(b) Each waste type should be stored in a compatible container pending transfer or disposal. Waste containers should be clearly labeled and kept sealed when not in use.
(c) Incompatible waste types should be kept separate to ensure that heat generation, gas evolution, or another reaction does not occur.
(d) Waste containers should be segregated by how they will be managed. Waste containers should be stored in a designated location that does not interfere with normal laboratory operations. Ventilated storage and secondary containment may be appropriate for certain waste types.
(e) Waste containers should be clearly labeled and kept sealed when not in use. Labels should include the accumulation start date and hazard warnings as appropriate.
(f) Non-explosive electrical systems, grounding and bonding between floors and containers, and non-sparking conductive floors and containers should be used in the central waste accumulation area to minimize fire and explosion hazards. Fire suppression systems, specialized ventilation systems, and dikes should be installed in the central waste accumulation area. Waste management workers should be trained in proper waste handling procedures as well as contingency planning and emergency response. Trained

laboratory workers most familiar with the waste should be actively involved in waste management decisions to ensure that the waste is managed safely and efficiently. Engineering controls should be implemented as necessary, and personal protective equipment should be worn by workers involved in waste management.

4. Inspection Program

Maintenance and regular inspection of laboratory equipment are essential parts of the laboratory safety program. Management should participate in the design of a laboratory inspection program to ensure that the facility is safe and healthy, workers are adequately trained, and proper procedures are being followed.

Types of inspections: The program should include an appropriate combination of routine inspections, self-audits, program audits, peer inspections, EHS inspections, and inspections by external entities.

Elements of an inspection:

(a) Inspectors should bring a checklist to ensure that all issues are covered and a camera to document issues that require correction.
(b) Conversations with workers should occur during the inspection, as they can provide valuable information and allow inspectors an opportunity to show workers how to fix problems.
(c) Issues resolved during the inspection should be noted.
(d) An inspection report containing all findings and recommendations should be prepared for management and other appropriate workers.
(e) Management should follow-up on the inspection to ensure that all corrections are implemented.

5. Medical Consultation and Examination

The employer must provide all employees who work with hazardous chemicals an opportunity to receive medical attention, including any follow-up examinations that the examining physician determines to be necessary, whenever an employee develops signs or symptoms associated with a hazardous chemical to which the employee may have been exposed in the laboratory. If an employee encounters a spill, leak, explosion or other occurrence resulting in the likelihood of a hazardous exposure, the affected employee must be provided an opportunity for a medical consultation by a licensed physician. All medical examinations and consultations must be performed by or under the direct supervision of a licensed physician and must be provided without cost to the employee, without loss of pay and at a reasonable time and place. The identity of the hazardous chemical, a description of the incident, and any signs and symptoms that the employee may experience must be relayed to the physician.

6. Records

All accident, fatality, illness, injury, and medical records and exposure monitoring records must be retained by the institution in accordance with the requirements of state and federal regulations (see 29 CFR part 1904 and § 1910.14500)). Any exposure monitoring results must be provided to affected laboratory staff within 15 working days after receipt of the results (29 CFR 1910.1450(d) (4)).

7. Signs

Prominent signs of the following types should be posted:

(a) Emergency telephone numbers of emergency personnel/facilities, supervisors, and laboratory workers;
(b) Location signs for safety showers, eyewash stations, other safety and first aid equipment, and exits; and
(c) Warnings at areas or equipment where special or unusual hazards exist.

8. Spills and Accidents

Before beginning an experiment, know your facility's policies and procedures for how to handle an accidental release of a hazardous substance, a spill or a fire. Emergency response planning and training are especially important when working with highly toxic compounds. Emergency telephone numbers should be posted in a prominent area. Know the location of all safety equipment and the nearest fire alarm and telephone. Know who to notify in the event of an emergency. Be prepared to provide basic emergency treatment. Keep your co-workers informed of your activities so they can respond appropriately. Safety equipment, including spill control kits, safety shields, fire safety equipment, PPE, safety showers and eyewash units, and emergency equipment should be available in well-marked highly visible locations in all chemical laboratories. The laboratory supervisor or CHO is responsible for ensuring that all personnel are aware of the locations of fire extinguishers and are trained in their use. After an extinguisher has been used, designated personnel must promptly recharge or replace it (29 CFR 1910.157(c)(4)). The laboratory supervisor or CHO is also responsible for ensuring proper training and providing supplementary equipment as needed.

Special care must be used when handling solutions of chemicals in syringes with needles. Do not recap needles, especially when they have been in contact with chemicals. Remove the needle and discard it immediately after use in the appropriate sharps containers. Blunt-tip needles are available from a number of commercial sources and should be used unless a sharp needle is required to puncture rubber septa or for subcutaneous injection.

For unattended operations, laboratory lights should be left on, and signs should be posted to identify the nature of the experiment and the hazardous substances in use. Arrangements should be made, if possible, for other workers to periodically inspect the operation. Information should be clearly posted indicating who to contact in the event of an emergency. Depending on the nature of the hazard, special rules, precautions, and alert systems may be necessary.

9. Training and Information

Personnel training at all levels within the organization are essential. Responsibility and accountability throughout the organization are key elements in a strong safety and health program. The employer is required to provide employees with information and training to ensure that they are apprised of the hazards of chemicals present in their work area (29 CFR 1910.1450(f)). This information must be provided at the time of an employee's initial assignment to a work area where hazardous chemicals are present and prior to assignments involving new exposure situations. The frequency of refresher information and training should be determined by the employer. At a minimum, laboratory personnel should be trained on their facility's specific CHP, methods and observations that may be used to detect the presence or release of a hazardous chemical (such as monitoring conducted by the employer, continuous monitoring devices, visual appearance or odor of hazardous chemicals when being released), the physical and health hazards of chemicals in the work area and means to protect themselves from these hazards. Trained laboratory personnel must know shut-off procedures in case of an emergency. All SDSs must be made available to the employees.

E. General Procedures for Working With Chemicals

The risk of laboratory injuries can be reduced through adequate training, improved engineering, good housekeeping, safe work practice and personal behavior.

1. General Rules for Laboratory Work With Chemicals

(a) Assigned work schedules should be followed unless a deviation is authorized by the laboratory supervisor.
(b) Unauthorized experiments should not be performed.
(c) Plan safety procedures before beginning any operation.
(d) Follow standard operating procedures at all times.
(e) Always read the SDS and label before using a chemical.
(f) Wear appropriate PPE at all times.
(g) To protect your skin from splashes, spills and drips, always wear long pants and closed-toe shoes.
(h) Use appropriate ventilation when working with hazardous chemicals.
(i) Pipetting should never be done by mouth.
(j) Hands should be washed with soap and water immediately after working with any laboratory chemicals, even if gloves have been worn.
(k) Eating, drinking, smoking, gum chewing, applying cosmetics, and taking medicine in laboratories where hazardous chemicals are used or stored should be strictly prohibited.
(l) Food, beverages, cups, and other drinking and eating utensils should not be stored in areas where hazardous chemicals are handled or stored.
(m) Laboratory refrigerators, ice chests, cold rooms, and ovens should not be used for food storage or preparation.
(n) Contact the laboratory supervisor, Principal Investigator, CHO or EHS office with all

safety questions or concerns.
(0) know the location and proper use of safety equipment.
(p) Maintain situational awareness.
(q) Make others aware of special hazards associated with your work.
(r) Notify supervisors of chemical sensitivities or allergies.
(s) Report all injuries, accidents, incidents, and near misses.
(t) Unauthorized persons should not be allowed in the laboratory.
(u) Report unsafe conditions to the laboratory supervisor or CHO.
(v) Properly dispose of chemical wastes.

Working Alone in the Laboratory

Working alone in a laboratory is dangerous and should be strictly avoided. There have been many tragic accidents that illustrate this danger. Accidents are unexpected by definition, which is why coworkers should always be present. Workers should coordinate schedules to avoid working alone.

Housekeeping

Housekeeping can help reduce or eliminate a number of laboratory hazards. Proper housekeeping includes appropriate labeling and storage of chemicals, safe and regular cleaning of the facility, and proper arrangement of laboratory equipment.

2. Nanoparticles and Nanomaterials

Nanoparticles and nanomaterials have different reactivity's and interactions with biological systems than bulk materials, and understanding and exploiting these differences is an active area of research. However, these differences also mean that the risks and hazards associated with exposure to engineered nanomaterials are not well known. Because this is an area of ongoing research, consult trusted sources for the most up to date information available. Note that the higher reactivity of many nanoscale materials suggests that they should be treated as potential sources of ignition, accelerants, and fuel that could result in fire or explosion. Easily dispersed dry nanomaterials may pose the greatest health hazard because of the risk of inhalation. Operations involving these nanomaterials deserve more attention and more stringent controls than those where the nanomaterials are embedded in solid or suspended in liquid matrixes.

Consideration should be given to all possible routes of exposure to nanomaterials including inhalation, ingestion, injection, and dermal contact (including eye and mucous membranes). Avoid handling nanomaterials in the open air in a free particle state. Whenever possible, handle and store dispersible nanomaterials, whether suspended in liquids or in a dry particle form, in closed (tightly-sealed) containers.

Unless cutting or grinding occurs, nanomaterials that are not in a free form (encapsulated in a solid or a nanocomposite) typically will not require engineering controls. If a synthesis is being performed to create nanomaterials, it is not enough to only consider the final material in the risk assessment, but consider the hazardous properties of the precursor materials as well.

To minimize laboratory personnel exposure, conduct any work that could generate engineered nanoparticles in an enclosure that operates at a negative pressure differential compared to the laboratory personnel breathing zone. Limited data exist regarding the efficacy of PPE and ventilation systems against exposure to nanoparticles. However, until further information is available, it is prudent to follow standard chemical hygiene practices. Conduct a hazard evaluation to determine PPE appropriate for the level of hazard according to the requirements set forth in OSHA Personal Protective Equipment standard (29 CFR 1910.132).

3. Highly Toxic and Explosive/Reactive Chemicals/Materials

The use of highly toxic and explosive/ reactive chemicals and materials has been an area of growing concern. The frequency of academic laboratory incidents in the U.S. is an area of significant concern for the Chemical Safety Board (CSB). The CSB issued a case study on an explosion at Texas Tech University in Lubbock, Texas, which severely injured a graduate student handling a high-energy metal compound. Since 2001, the CSB has gathered preliminary information on 120 different university laboratory incidents that resulted in 87 evacuations, 96 injuries, and three deaths.

It is recommended that each facility keep a detailed inventory of highly toxic chemicals and explosive/reactive materials. There should be a record of the date of receipt, amount, location, and responsible individual for all acquisitions, syntheses, and disposal of these chemicals. A physical inventory should be performed annually to verify active inventory records. There should be a procedure in place to report security breaches, inventory discrepancies, losses, diversions, or suspected thefts.

Procedures for disposal of highly toxic materials should be established before any experiments begin, possibly even before the chemicals are ordered. The procedures should address methods for decontamination of any laboratory equipment that comes into contact with highly toxic chemicals. All waste should be accumulated in clearly labeled impervious containers that are stored in unbreakable secondary containment.

Highly reactive and explosive materials that may be used in the laboratory require appropriate procedures and training. An explosion can occur when a material undergoes a rapid reaction that results in a violent release of energy. Such reactions can happen spontaneously and can produce pressures, gases, and fumes that are hazardous. Some reagents pose a risk on contact with the atmosphere. It is prudent laboratory practice to use a safer alternative whenever possible.

If at all possible, substitutes for highly acute, chronic, explosive, or reactive chemicals should be considered prior to beginning work and used whenever possible.

4. Compressed Gas

Compressed gases expose laboratory personnel to both chemical and physical hazards. It is essential that these are monitored for leaks and have the proper labeling. By monitoring compressed gas inventories and disposing of or returning gases for which there is no immediate need, the laboratory can substantially reduce these risks. Leaking gas cylinders can cause serious hazards that may require an immediate evacuation of the area and activation of the emergency response system. Only appropriately trained hazmat responders may respond to stop a leaking gas cylinder under this situation.

Physical Hazards

Physical hazards in the laboratory include combustible liquids, compressed gases, reactive, explosives and flammable chemicals, as well as high pressure/energy procedures, sharp objects and moving equipment. Injuries can result from bodily contact with rotating or moving objects, including mechanical equipment, parts, and devices. Personnel should not wear loose fitting clothing, jewelry, or unrestrained long hair around machinery with moving parts.

The Chemical Safety Board has identified the following key lessons for laboratories that address both physical and other hazards:

(1) Ensure that research-specific hazards are evaluated and then controlled by developing specific written protocols and training.
(2) Expand existing laboratory safety plans to ensure that all safety hazards, including physical hazards of chemicals, are addressed.
(3) Ensure that the organizations EHS office reports directly to an identified individual/office with organizational authority to implement safety improvements.
(4) Develop a verification program that ensures that the safety provisions of the CHP are communicated, followed, and enforced at all levels within the organization.
(5) Document and communicate all laboratory near-misses and previous incidents to track safety, provide opportunities for education and improvement to drive safety changes at the university.
(6) Manage the hazards unique to laboratory chemical research in the academic environment. Utilize available practice guidance that identifies and describes methodologies to assess and control hazards.
(7) Written safety protocols and training are necessary to manage laboratory risk.

G. *Emergency Planning*

In addition to laboratory safety issues, laboratory personnel should be familiar with established facility policies and procedures regarding emergency situations. Topics may include, but are not limited to:

(1) Evacuation procedures when it is appropriate and alternate routes;
(2) Emergency shutdown procedures equipment shutdown and materials that should be stored safely;
(3) Communications during an emergency what to expect, how to report, where to call or

look for information;
(4) How and when to use a fire extinguisher;
(5) Security issues preventing tailgating and unauthorized access
(6) Protocol for absences due to travel restrictions or illness;
(7) Safe practices for power outage;
(8) Shelter in place when it is appropriate;
(9) Handling suspicious mail or phone calls;
(10) Laboratory-specific protocols relating to emergency planning and response;
(11) Handling violent behavior in the workplace; and
(12) First-aid and CPR training, including automated external defibrillator training if available

It is prudent that laboratory personnel are also trained in how to respond to short-term, long-term and large-scale emergencies. Laboratory security can play a role in reducing the likelihood of some emergencies and assisting in preparation and response for others. Every institution, department, and individual laboratory should consider having an emergency preparedness plan. The level of detail of the plan will vary depending on the function of the group and institutional planning efforts already in place.

Emergency planning is a dynamic process. As personnel, operations, and events change, plans will need to be updated and modified. To determine the type and level of emergency planning needed, laboratory personnel need to perform a vulnerability assessment. Periodic drills to assist in training and evaluation of the emergency plan are recommended as part of the training program.

H. Emergency Procedures

(1) Fire alarm policy. Most organizations use fire alarms whenever a building needs to be evacuated for any reason. When a fire alarm sounds in the facility, evacuate immediately after extinguishing all equipment flames. Check on and assist others who may require help evacuating.
(2) Emergency safety equipment. The following safety elements should be met:

a. A written emergency action plan has been provided to workers;
b. Fire extinguishers, eyewash units, and safety showers are available and tested on a regular basis; and
c. Fire blankets, first-aid equipment, fire alarms, and telephones are available and accessible.

(3) Chemical spills. Workers should contact the CHO or EHS office for instructions before cleaning up a chemical spill. All SOS and label instructions should be followed, and appropriate PPE should be worn during spill cleanup.
(4) Accident procedures. In the event of an accident, immediately notify appropriate personnel and local emergency responders. Provide an SOS of any chemical involved to

the attending physician. Complete an accident report and submit it to the appropriate office or individual within 24 hours.

(5) Employee safety training program. New workers should attend safety training before they begin any activities. Additional training should be provided when they advance in their duties or are required to perform a task for the first time. Training documents should be recorded and maintained. Training should include hands-on instruction of how to use safety equipment appropriately.

(6) Conduct drills. Practice building evacuations, including the use of alternate routes. Practice shelter-in-place, including plans for extended stays. Walk the fastest route from your work area to the nearest fire alarm, emergency eye wash and emergency shower. Learn how each is activated. In the excitement of an actual emergency, people rely on what they learned from drills, practice and training.

(7) Contingency plans. All laboratories should have long-term contingency plans in place (e.g., for pandemics). Scheduling, workload, utilities and alternate work sites may need to be considered.

I. Laboratory Security

Laboratory security has evolved in *the* past decade, reducing the likelihood of some emergencies and assisting in preparation and response for others. Most security measures are based on the laboratory's vulnerability. Risks to laboratory security include, but are not limited to:

(1) Theft or diversion of chemicals, biologicals, and radioactive or proprietary materials, mission-critical or high-value equipment;
(2) Threats from activist groups;
(3) Intentional release of, or exposure to, hazardous materials;
(4) Sabotage or vandalism of chemicals or high-value equipment;
(5) Loss or release of sensitive information; and
(6) Rogue work or unauthorized laboratory experimentation. Security systems in the laboratory are used to detect and respond to a security breach, or a potential security breach, as well as to delay criminal activity by imposing multiple layered barriers of increasing stringency. A good laboratory security system will increase overall safety for laboratory personnel and the public, improve emergency preparedness by assisting with preplanning, and lower the organizations liability by incorporating more rigorous planning, staffing, training, and command systems and implementing emergency communications protocols, drills, background checks, card access systems, video surveillance, and other measures. The security plan should clearly delineate response to security issues, including the coordination of institution and laboratory personnel with both internal and external responders.

[76 FR 33609, June 8, 2011; 77 FR 17888, March 26, 2012; 78 FR 4325, Jan. 22, 2013]

Appendix 4 A

Schedules I - V Substances

Title 21 Code of Federal Regulations (DEA)

Part 1308 - Schedules of Controlled Substances

Schedules

Section 1308.11 Schedules I; Opiates

Section 1308.12 Schedule II; Opiates

Section 1308.13 Schedule III; Stimulants, Depressants, Narcotics, Steroids Section 1308.14 Schedule IV; Stimulants, Depressants, Narcotics, Steroids Section 1308.15 Schedule V; Narcotics / Non-Narcotics

Appendix 5

Sink Disposal Information Guide

APPLICABLE SINK LOCATIONS

Sink discharge of aqueous waste streams is only approved at sinks inside lab spaces. At no point can any aqueous lab waste be discharged into sinks outside of laboratories. Sinks in bathrooms, kitchens, facility closets, as well as floor drains and toilets are never to be used for discharge of aqueous lab wastes.

MATERIALS PERMITTED FOR SINK DISCHARGE

Approved Waste Stream Composition

In order to be considered for discharge into a sink, a waste stream must comply with each of the following criteria:

- Must contain at least 99% water
- Must have a pH within the range of > 5.5 and < 12.0
- Must contain less than 1% nonhazardous material. These materials include, but are not limited to:
    - Sodium Chloride, Potassium Phosphate, Calcium Chloride and other nonhazardous salts
    - Dilute nonhazardous buffer solutions
    - Sugars, including glucose, sucrose, dextrose, etc.
    - Disinfected biological material, proteins, and amino acids
- Must not contain any material outlined in the Prohibited Materials for Discharge section below.

Liquid Biological Waste

Decontamination of liquid biological waste must occur in a biological safety cabinet or in an aspiration flask system by combining the waste with disinfectant. If using bleach (5.45% sodium hypochlorite solution) as the disinfectant, use 10% final concentration in the liquid volume. The waste must remain in contact with the disinfectant for at least 20 minutes. The disinfected liquid may then be carefully transported to the appropriate sink for disposal into the sink drain with copious amounts of water by running the faucet for at least two minutes. See sections 4.2 Aspiration Flasks and 6.1 Liquid Biological Waste of the Life Lab Biosafety Practices document for specific steps for the bleach inactivation of liquid biological waste.

Review Process

There are strict criteria for the kinds of contaminants that are permitted into the wastewater system. It is impossible to list every approved and prohibited material in this document. If any questions or concerns arise about what exactly can be discharged into sinks, residents are encouraged to reach out to the Life Lab facility safety officer or the TEI consultant to review their material composition before disposal.

PROHIBITED MATERIALS FOR DISCHARGE

The following materials are strictly prohibited from sink disposal, regardless of the quantity or concentration.

Hazardous Waste
All hazardous waste is prohibited from sink disposal and/or sewer discharge. A material is considered a hazardous waste if it meets any of the following criteria:

- It contains a substance listed by the Massachusetts Department of Environmental Protection (DEP) as a hazardous waste. A complete list of hazardous wastes can be found at

https://www.epa.gov/hw/defining-hazardous-waste-listed-characteristic-and-mixed-radiological-wastes

- It is considered a corrosive hazardous waste, with a pH ≤ 2.0 or ≥ 12.5.

    - Note: Some Aqueous solutions with a mid-rage pH are not considered Resource Conservation and Recovery Act (RCRA) regulated hazardous wastes. However, they still do not meet the MWRA and/or Harvard University's requirements for drain disposal. These solutions should be collected in containers, labeled as Nonhazardous waste, stored in Hazardous Waste Satellite Accumulations areas, and discarded with hazardous wastes. This specifically applies to aqueous solutions with a pH greater than 2.0 but less than or equal to 5.5, as well as solutions with a pH greater than or equal to 12.0 but less than 12.5. (See section 5.2 for a detailed breakout of pH ranges.)

- It is considered a flammable hazardous waste, with a flashpoint of less than 140°C.
- It is considered a reactive hazardous waste.

    - Reactive wastes include material that is normally unstable and readily undergoes violent change, reacts violently with water, or forms potentially explosive mixtures with air or water. A comprehensive guideline for reactive waste can be found on the EPA website,

https://www.epa.gov/hw/defining-hazardous-waste-listed-characteristic-and-mixed-radiological-wastes#react

Corrosive Solutions (pH ≤ 5.5 or ≥ 12.0), which are not considered RCRA hazardous wastes
The Life Lab contains a wastewater treatment system for the neutralization of lab wastewater that may need a mild pH adjustment. Only solutions with a pH > 5.5 and < 12.0 can be considered for sink disposal. Corrosive solutions with pH ranges (pH ≤ 2.0) and (pH ≥ 12.5) at the conclusion of a lab process must be managed as hazardous waste, and should be collected at designated hazardous waste satellite accumulation areas.
Even if an aqueous waste does not meet the pH criteria for a hazardous waste, it still must be within the pH range that complies with Harvard's drain disposal guidelines. In order for an aqueous waste to be considered for drain disposal, it must have a pH > 5.5 and < 12.0.

Table 1: Aqueous Solution pH Range Guide

pH range ≤ 2.0	Must be collected in sealable containers, and managed as hazardous waste. Containers must be affixed with a hazardous waste label, and stored in a hazardous waste satellite accumulation area. These containers will be collected by EH&S for disposal.
pH range > 2.0 and ≤ 5.5	Must be collected in sealable containers, and managed as nonhazardous waste. Containers must be affixed with a nonhazardous waste label, and stored in a hazardous waste satellite accumulation area. These containers will be collected by EH&S for disposal.
pH range > 5.5 and < 12.0	Aqueous solutions within this range can be considered for sink disposal, provided they meet all other criteria outlined in sections 4 and 5.
pH range ≥ 12.0 and < 12.5	Must be collected in sealable containers, and managed as nonhazardous waste. Containers must be affixed with a nonhazardous waste label, and stored in a hazardous waste satellite accumulation area. These containers will be collected by EH&S for disposal.
pH range ≥ 12.5	Must be collected in sealable containers, and managed as hazardous waste. Containers must be affixed with a hazardous waste label, and stored in a hazardous waste satellite accumulation area. These containers will be collected by EH&S for disposal.

For sink disposal, 10% bleach is typically used to render a solution noninfectious. A solution of 10% bleach (0.54% total sodium hypochlorite) should pH at approximately 10.0 – 11.0. This solution falls within the acceptable pH range. If higher concentrations of bleach are required, and the final solution has a pH that is or exceeds 12.0, it cannot be discharged into a sink.

Flammable or Explosive Substances

Solutions that are flammable (flash point less than 140oF) or explosive at the time of disposal must not be disposed into a sink or drain. The drain disposal of flammables/explosives can create an unsafe condition for lab and facilities personnel. Prohibited flammable substances include, but are not limited to alcohols, acetone, gasoline, ketones, aldehydes, peroxides, ethers, xylene, toluene, and pyridine.

Other Prohibited Materials

Only aqueous solutions containing at least 99% water and up to 1% other nonhazardous constituents, can be considered for drain disposal. There are strict criteria for what materials can make up the acceptable 1% of nonhazardous constituents, and the Life Lab's Safety Officer and TEI Consultant must review every product to decide if it is acceptable. The following list summarizes some material that cannot compromise any portion of that 1%. Therefore, all materials listed below are barred from drain disposal in any concentration.

- Heavy metals - including mercury, lead, and silver
- Infectious biological waste that has not been appropriately disinfected with bleach
- Radioactive wastes

• Polychlorinated Biphenyls (PCBs)
• Sodium Azide (includes mixtures that may have sodium azide present from kits)
• Stains and dyes (including cell stains)
• Any liquid with a temperature higher than 180°F
• Oils, fats, and grease
• Petroleum Hydrocarbons at levels above 15 mg/L
• Pesticides
• Noxious or malodorous liquids
• Groundwater, stormwater, surface water, roof or surface runoff, or subsurface drainage

• Any solid or viscous substance in amount or size that may obstruct flow (e.g., sand, animal tissues, debris, gels, polymers, etc.)

DILUTION PROHIBITION

The dilution of an aqueous waste in an attempt to achieve compliance with these guidelines is strictly prohibited. The increased use of process water in place of proper treatment shall be considered dilution and is not permitted.

Note for rinsate: In many cases, the first rinse (with water and/or acetone) of a flask, beaker, etc., previously containing any prohibited material, must not be discharged into a sink and must be collected as hazardous waste. Subsequent rinses, in which very low concentrations of the materials exist, may be discharged into a sink. However, suppose the container formerly held a chemical that is on the RCRA acutely toxic chemicals list (the P-list). In that case, all of the rinsates must be collected as hazardous waste, and none can be discharged into the sink. A list of p-listed chemicals can be found on the EPA's website: https://www.epa.gov/hw/defining-hazardous-waste-listed-characteristic-and-mixed-radiological-wastes#PandU

About ESA

Environmental Science Associates (ESA) is a 100% employee-owned environmental consulting firm founded in 1969. We specialize in planning, designing, permitting, mitigating, and restoring projects across communities, infrastructure systems, open spaces, and wildlands. With over 55 years of experience, we operate from 21 offices nationwide, employing 750 staff members who bring a wide range of expertise and experience. In Florida, ESA has a significant presence with offices in Boynton Beach, Orlando, Tampa, and Pensacola. These offices provide a range of environmental consulting services tailored to the unique needs of the region. Our Southeast team, comprising more than 70 staff members, focuses on projects that enhance community resilience, support sustainable development, and protect natural resources. We work closely with local stakeholders to ensure compliance with regional regulations and effectively address environmental challenges. ESA specializes in community and airport planning, environmental planning, analysis and assessment, natural and cultural resources management, environmental restoration and design, and regulatory compliance. Our team of scientists, planners, historians, archaeologists, engineers, designers, and technical specialists provide critical thinking, in-depth analyses, and committed follow-through to guide successful policy development and project planning, delivering enduring multi-objective solutions.

State of Florida
Department of State

I certify from the records of this office that ENVIRONMENTAL SCIENCE ASSOCIATES CORPORATION is a California corporation authorized to transact business in the State of Florida, qualified on March 20, 2000.

The document number of this corporation is F00000001598.

I further certify that said corporation has paid all fees due this office through December 31, 2025, that its most recent annual report/uniform business report was filed on February 27, 2025, and that its status is active.

I further certify that said corporation has not filed a Certificate of Withdrawal.

Given under my hand and the Great Seal of the State of Florida at Tallahassee, the Capital, this the Twenty-seventh day of February, 2025

Secretary of State

Tracking Number: 8622403657CC

To authenticate this certificate,visit the following site,enter this number, and then follow the instructions displayed.

https://services.sunbiz.org/Filings/CertificateOfStatus/CertificateAuthentication

GIS Certification Institute

This is to certify that The Board of Directors of the GIS Certification Institute,

Upon the recommendation of the Executive Director, has conferred upon

Jon S. Perry

the distinction of

Geographic Information Systems Professional

GISP

Certificate Number 58956

Date of Initial Certification 3/25/2008

Date of Expiration 3/25/2027

Jochen Albrecht
GISCI President

Anthony Spicci, GISP
GISCI Executive Director

QUALIFIED STORMWATER MANAGEMENT INSPECTOR

The undersigned hereby acknowledges that

Jon S. Perry

has successfully met all requirements necessary to be fully certified through the Florida Department of Environmental Protection Stormwater, Erosion, and Sedimentation Control Inspector Training Program

Marleina Overton
Marleina Overton

March 16, 2005
Inspector #8899

Karl Kurka
Karl Kurka

Enterococcus
Multiple Tube Fermentation SM 9230B – 2016
Enterococcus Enterolert® Quanti-tray® Method

Approved: Rick Cleaver
Laboratory Director: Rick Cleaver
Document Number: 1-D-15-6
Revision Number: 7
Effective Date: 01/28/2025

1. Identification of test method:

Reference: Standard Method 9230B – 2016

The Enterolert® reagent, based on IDEXX's Defined Substrate Technology®, is used for the detection of enterococci in water. Enterolert® uses 4-methylumbelliferyl-β-D-glucoside as the defined substrate nutrient-indicator. This compound, when hydrolyzed by enterococcus β- glucosidase, releases 4-methylumbelliferone which exhibits fluorescence under a UV_{365nm} lamp.

This reagent system is specifically formulated to achieve optimum sensitivity and specificity in the detection and identification of enterococcus. After 24 hours incubation at 41°C, if enterococcus is present, the reagent should show fluorescence when exposed to a long-wave (365-366 nm) UV lamp.

The test should detect one (1) enterococcus in 100 mL of water within 24 hours.

2. Applicable matrix or matrices:

Water, Saltwater

3. Method Detection Limit:

Reference: SM 9230B - 2016

1cfu/100ml

4. Scope and application, including components to be analyzed:

The Enterolert® reagent, based on IDEXX's Defined Substrate Technology®, is used for the detection of enterococci in water. Enterolert® uses 4-methylumbelliferyl-β-D-glucoside as the defined substrate nutrient-indicator. This compound, when hydrolyzed by enterococcus β- glucosidase, releases 4-methylumbelliferone which exhibits fluorescence under a UV_{365nm} lamp.

This reagent system is specifically formulated to achieve optimum sensitivity and specificity in the detection and identification of enterococcus. After 24 hours incubation at 41°C, if enterococcus is present, the reagent should show fluorescence when exposed to a long-wave (365-366 nm) UV lamp.

The test should detect one (1) enterococcus in 100 mL of water within 24 hours.

5. Summary of the test method:

Reference: SM 9230B - 2016

6. Definitions:

Reference: SM 9230B - 2016

7. Interferences:

Reference: SM 9230B - 2016

8. Safety:

1. Chemical and unknown biological hazards - wear gloves, safety glasses. Clean up spills as soon as they occur.

9. Equipment & Supplies:

Equipment

IDEXX Quanti-Tray® Sealer w/ insert (89-00039336-00)
41 ± 0.5°C incubator (2-C-42-7)
Long-wave UV Lamp (365-366 nm)
Hardy Diagnostics sterile deionized water marked at 90 mLs.

Supplies

100 mL sterile bacteriological sample bottles or 100 mL Whirlpak bags. Larger sample bottles may be needed for

bacteriological duplicates.
Enterolert® reagent
IDEXX Quanti-Tray®
10 mL pipets - sterile, disposable
90 mL sterile dilution blanks (DDI water)*

Note: Do not dilute samples in buffered water. The Enterolert® reagent is buffered.

10. Reagents & standards:

11. Sample collection, preservation, shipment & storage:

Enterococcus samples must arrive at the laboratory within 6 hours of collection. Samples must be processed within 2 hours of arriving at the laboratory. Samples that arrive after the 6 hour time limit will not be analyzed.

Enterococcus samples are accepted only in approved sterile plastic bottles. Chlorinated samples must be collected in bottles treated with sodium thiosulfate.

12. Quality Control:

Analytical Quality Control

For each lot of medium, check productivity and accuracy by testing known positive and negative control cultures.

Recommended QC cultures:

Positive *Enterococcus faecium* or
Enterococcus faecalis

Negative *Enterobacter aerogenes*

Perform bacteriological duplicate analyses on 10% of samples tested and at least once per run.

13. Calibration & standardization:

SM 9230B - 2016

14. Procedure:

Analytical Methodology for marine samples and and freshwater samples

The single standard test volume is 10 mL diluted with 90 mL sterile DI water to a 100 mL total volume. Adjust this volume according to the history of the each sample site and information obtained about possible bacterial contamination and other interferences.
Sample dilutions must be used within 20 minutes.

1. Turn on Quanti-Tray® Sealer 10-15 minutes before starting analysis. The sealer is ready to use when the green light comes on.

2. Shake sample 25 times in 7 seconds in 1 ft. arc.

3. Dilute samples as follows:

<u>1 to 10 dilution</u>	Pipet 10 mL of sample into a 90 ml sterile dilution blank for a total volume of 100mL.

4. Add Enterolert® reagent. The reagent has a light yellow color in water

5. Shake well to dissolve reagent.

6. Place the rubber insert on the input shelf with the large cutout facing away from the Sealer

7. Confirm that reagent has dissolved completely. If not, shake bottle again.

8. Carefully pour the entire contents of the dilution blank into a sterile Quanti-Tray®.

9. Lightly tap the small wells to release trapped air.

10. Put the Quanti-Tray® onto the rubber insert, well side down, with the open end facing away from the sealer, making sure that the tray is properly seated in the rubber insert.

11. Slide the Quanti-Tray® into the sealer until the motor begins to draw it in.

12. Remove the Quanti-Tray® from the back of the sealer.

13. Label the Quanti-Tray® with the sample number and dilution factor.

14. Place the Quanti-Tray® in the incubator, well side down, within 30 minutes of adding reagent.

15. Incubate for 24 to 28 hours @ 41 ± 0.5°C.*

16. Record date and time the sample will be read on the incubator door.

17. Turn sealer off when not in use.

15. Calculations:

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Count the number of positive large wells and small wells and record on the worksheet next to the correct dilution.

Calculate the MPN (for each dilution) using the IDEXX MPN tables or the Quanti-Tray® 2000 computer program.

Multiply the result by the dilution factor.

16. Method performance:

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17. Pollution prevention:

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18. Data assessment & acceptance criteria for QC measures:

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Interpretation

Do not read samples before 24 hours. Samples can be incubated up to 28 hours. After 28- hours, lack of fluorescence is a VALID NEGATIVE TEST and can be reported as such.
Fluorescence after 28 hours is an INVALID result and **should not** be reported.

Note: Use an Enterolert® negative (sterility) control with each sample read. This control tray should be stored in the dark between uses.

- Detect fluorescence using the IDEXX viewing box and UV Lamp. Any fluorescence is positive for enterococcus.

- Mark each + well with a black marker.
- Ask a supervisor to check each tray for confirmation of fluorescence, if possible.

Reporting Rules

- Use a tray that has between 30 and 80 positive (fluorescing) wells (small + large) if available.
- If 2 trays fall in the 30-80 range, use the average of the extended counts.
- If no trays fall in the 30-80 range, use the average of the extended counts.
- If both trays are >2420, use the higher dilution.
- If both trays are <0.99, use the lower dilution.
- If only one tray is < or >, use the other tray.
- Round the result to 2 significant figures.
- All calculations should be audited by a supervisor before distribution of reports.
- Report results as enterococcus MPN/100 mL

19. Corrective actions for out-of control data:

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20. Contingencies for handling out-of control or unacceptable data:

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21. Waste management:

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22. References:

- SM 9230B - 2016
- 40 CFR 503.32 Pathogens.

23. Tables, Diagrams, flowcharts, validation data:

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