# NESDI Program Demos Technologies & Collects Knowledge to Enhance Readiness

## Recent Successes Include Better Water Quality Management Tools & Enhanced Anodizing Process

**THE MISSION OF** the Navy Environmental Sustainability Development to Integration (NESDI) program is to provide solutions by demonstrating, validating and integrating innovative technologies, processes, and materials; and filling knowledge gaps to minimize operational environmental risks, constraints and costs while ensuring Fleet readiness. The program seeks to accomplish this mission through the evaluation of cost-effective technologies, processes, materials and knowledge that enhance environmental readiness of naval shore activities and ensure they can be integrated into weapons system acquisition programs.

Each year, the NESDI program has published a "Year in Review" report which profiles some of the program's ongoing and recently completed projects including the following projects undertaken in Fiscal Year (FY) 2009.

### Toward Safer Water, Fewer Violations: Projects Aim to Improve Drinking Water Quality

The NESDI program has funded two important projects dealing with water safety over the last three years—Potable Water Quality Management and Demonstration of Real-Time Drinking Water Quality Monitoring Technologies.

#### Potable Water Quality Management

Water quality management is all about creating the right balance. Disinfecting drinking water is necessary to remove potential contaminants—but the same chemicals that remove contaminants in drinking water can produce carcinogenic by-products. In 2004, the Safe Drinking Water Act (SDWA) was amended to require new standards to balance these risks.

In FY 2004, to combat a growing number of SDWA Notices of Violation, the Naval Facilities Engineering Command (NAVFAC) Water Media Field team identified the need for a guidance document.

The NESDI program responded by sponsoring the development of a document that addresses topics such as:

- Unidirectional flushing—the process of flushing out sediment that accumulates in the pipes
- Disinfection strategies
- System monitoring practices
- Potential upgrades to drinking water treatment and distribution systems.

The Potable Water Quality Management Guidance Document (UG-2077-ENV) was distributed Navy-wide for use by drinking water program managers in the fall of 2007. It is available in hardcopy and CD form from the NAVFAC Engineering Service Center (ESC).

#### Demonstration of Real-time Drinking Water Quality Monitoring Technologies

Contamination of water systems may be caused by natural events, accidents, or intentional acts, all of which threaten mission readiness and the well-being of Navy personnel. The single most effective way to mitigate water contamination issues is to detect contamination early enough to allow for a timely response.

The current practice for water quality compliance is to manually collect samples for laboratory analysis on a weekly or quarterly basis. This practice does not allow staff adequate time to respond to changes in water quality and may also miss many poor water quality events occurring outside "normal" sampling events. For overseas bases, the analysis turnaround time is even longer.

Real-time water monitoring along with an automated notification system could rectify this situation. However, most Navy water utilities have not implemented a real-time monitoring strategy due to a lack of proven technologies as well as the associated high costs.

The NESDI program is currently sponsoring a demonstration project of continuous and real-time water quality monitoring technologies at the NAVFAC ESC at Naval Base Ventura County in Port Hueneme, CA. The demonstration project aims to provide managers with a cost-effective version of this technology.

The one-year demonstration was started in June 2009. An interim report will be issued in 2010 and will provide the performance data necessary to help Naval field activities with their system procurement decisions.

## Advanced Anodizing Technology Brings Multiple Benefits

For years, the Navy's Fleet Readiness Centers (FRC) have been anodizing aluminum aircraft parts to increase corrosion resistance and durability. Anodizing is an electrochemical oxidation treatment used to form a protective coating on aluminum. The traditional method of anodization, which relies on manual adjustments, has several disadvantages:

- Inconsistent results
- Higher risk of defects and rejects
- Toxic materials added to waste stream.

A NESDI-sponsored project at the FRC Southeast (FRCSE) in Jacksonville, FL demonstrated an improved methodology that takes advantage of commercial off-the-shelf solutions such as Metalast™ technology. This technology automates the process through the use of an Integrated Process Controller (IPC) and an Interface Controller and introduces a chemical additive for the bath chemistry.

Water quality monitoring equipment panel installed at Bolles Field site, Naval Base Ventura County.

The advantages to this method are expected to include:

- Reduced contaminant build-up
- Improved uniformity
- Lower labor costs
- Reduced worker exposure to hexavalent chromium.

Also as part of this project, FRCSE has demonstrated the use of Trivalent Chrome Post-treatment (TCP) as a seal on anodized aluminum alloys.

The specification that governs the aluminum alloy anodizing is military specification MIL-A-8625F. This specification identifies the different types of anodizing. The target types for this project are the following:

- Type II. Sulfuric acid anodizing, conventional coatings produced from sulfuric acid bath
- Type IIB. Thin sulfuric acid anodizing, for use as a non-chromate alternative
- Type III. Hard anodic coatings.

The Metalast™ anodizing process has been successfully demonstrated at FRCSE for Types II, IIB and III anodizing under this project. Based on preliminary data from this study, authorization for producing Type IIB oxides using the Metalast™ process will be pursued and implemented across all Navy sites. Additionally, based on the performance of the TCP process as a sealer, the Naval Air Systems Command (NAVAIR) enterprise is pursuing the authorization and implementation of TCP in 2010 via maintenance manual changes and NAVAIR approval letter.

With a payback period of less than two years, the Metalast™ system will provide a total cost avoidance of around $56,000 per year.

**Optimizing the Anodizing Process. This project successfully demonstrated and integrated technologies to optimize the application of anodized coatings to aircraft components and parts at FRCs in Jacksonville, FL and Cherry Point, NC with potential integration at the FRC in San Diego, CA.**

## Global Climate Change & the Navy: A First Step for What's Next

Beginning in 2008, the NESDI program sponsored a research initiative that, in addition to summarizing the climate change effects that are expected to occur in the next century, also provides an assessment of the likely impacts on naval infrastructure and operations. The Climate Change Initiation Decision Report (CC IDR) identifies gaps in the knowledge base specific to the influence of climate change on Navy shore operations, facilities and infrastructure, and also provides descriptions of evolving technologies designed to help limit and/or adapt to climate change.

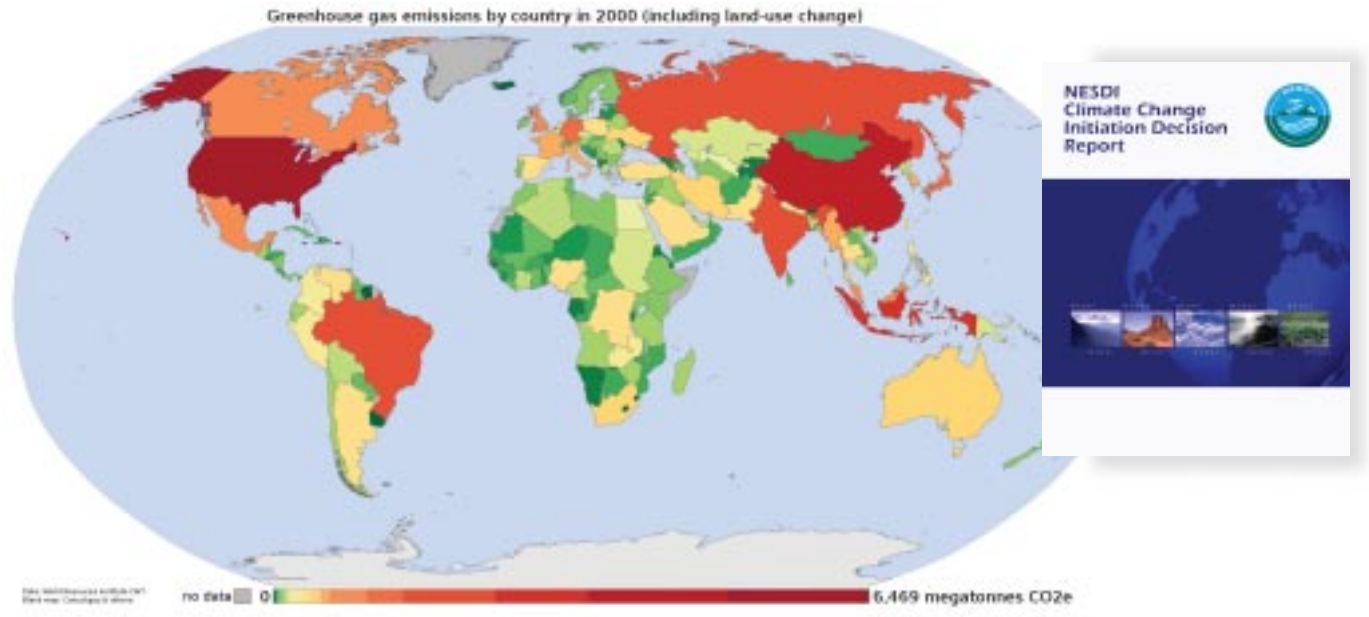
Completed in 2009, the CC IDR identified the following technology and management strategies as high-priority solutions for sustaining mission readiness:

- Regulatory compliance strategy
- Facilities impact strategies to preserve resources and minimize risk
- Mitigation strategies to sustain air quality standards, natural resources management, and energy efficiency
- Adaptation strategies to minimize the severity of climate change to natural resources and infrastructure
- Intervention strategies—long-term strategies for reducing carbon dioxide levels.

The goal of the CC IDR is to provide knowledge about climate change, make recommendations, and improve Command compliance as regulatory strategies and responding technologies continue to evolve. Inserting new processes and technologies as early as possible in the Department of Defense's (DoD) acquisition process will improve success in meeting the Navy's climate change goals.

## Chemicals on the Hit List: Hazardous Chemical Lists a Major Step Toward DoD-wide Elimination

Reducing or eliminating prohibited and controlled chemicals is an ongoing effort in all branches of the military. Because of the large number




of hazardous chemicals required in maintenance operations, acquisition program offices are often unsure of which chemicals to focus on first. In an effort to provide guidance on this issue, the Naval Sea Systems Command (NAVSEA) turned to the NESDI program for financial support and guidance, and the Naval Surface Warfare Center (NSWC) Carderock for technical assistance in creating a standard chemical avoidance list for new acquisition programs—the Prohibited and Controlled Chemical List (PCCL). Through the use of one standardized, comprehensive list, the Navy will be better able to achieve its goal of 50 percent hazardous material usage reduction as specified in Executive Orders (EO) 13148 and 13423.

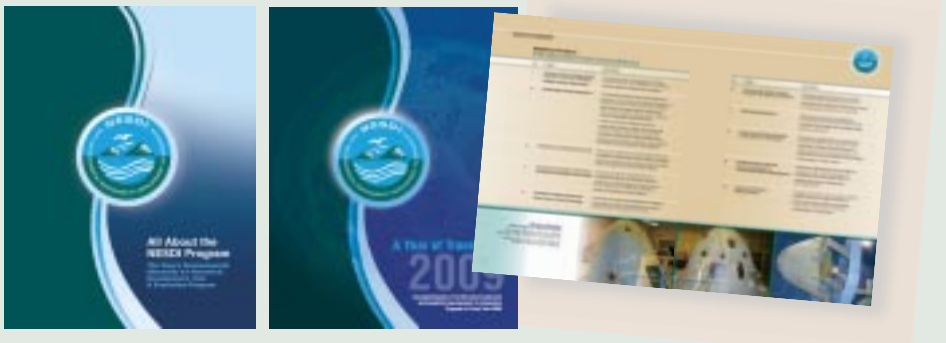
The PCCL is generated through a computer algorithm using specific health, safety and environmental regulatory impact factors weighted by hazard severity. The most recent environmental regulations, safety and occupational health standards, as well as anticipated legislation are considered.

NAVSEA stakeholders, industrial hygiene professionals and technical warrant holders provided input on selection criteria, prioritization methodology and implementation of the PCCL. Completed in 2006, the PCCL is being

## Learn More

**TO LEARN MORE** about the NESDI program, read the brochure entitled "All About the NESDI Program." For even more insights about the program–its mission, objectives, investment areas–read the program's FY09 annual Year in Review report, entitled "Accomplishments of the Navy Environmental Sustainability Development to Integration Program in Fiscal Year 2009: A Year in Transition." The report highlights the program's accomplishments in FY09 and shares its strategic objectives for FY10.

The NESDI brochure and annual report are both available for downloading via the NESDI web site at www.nesdi.navy.mil. For a hard copy of both reports, contact Lorraine Wass at ljwass@surfbest.net or 207-384-5249.



## EVALUATING FLEET NEEDS

**THE NESDI PROGRAM** selects projects to invest in based on an annual evaluation of Fleet needs. In FY 2010, the NESDI program collected and ranked 58 needs and received 20 pre-proposals on the following 13 highly ranked needs:

| Reference | Command | Need | Description |
|---|---|---|---|
| N-0688-10 | NAVSEA | Water Jet Waste Waste Water Treatment | Ultra high-pressure water cleaning and stripping operations currently performed at Navy ports during contractor maintenance activities produce a large volume of contaminated water. This water must be properly disposed of at ever-increasing rates. A need exists to control/reduce these emissions while negating the rising costs. |
| N-0686-10 | NAVFAC | Mitigation of Sound During Pile Driving Activities | Pile driving activities are often associated with military construction projects occurring around waterfront areas. Sound propagation during pile driving is a major environmental issue for a variety of organisms through direct exposure and indirect interactions. Marine mammals, sea turtles and fish may be negatively affected through direct sound propagation during pile driving. A need exists to mitigate sound during pile driving activities. |
| N-0676-10 | NAVSEA | Reduction & Control of Emissions During Metal Cutting Operations | There is a need to develop alternative, environmentally friendly metal cutting methods for use when refurbishing or dismantling naval vessels to reduce emissions in order to comply with air operating and water discharge permit requirements. |
| N-0677-10 | NAVFAC | In Port Hull Maintenance | There is a need to demonstrate and validate corrosion and pollution control equipment to prevent unauthorized discharges to navigable waters during in port surface coatings touch up/hull maintenance operations. |
| N-0680-10 | NAVFAC | Effectiveness Of Modulated Ultra-Violet Light To Clean Optical Windows | There are several different uses of light to measure characteristics of a water column including turbidity sensors, chlorophyll fluorometers, oxygen sensors and photosynthetically active radiation sensors. Within minutes of immersing a clean surface in water, molecules of dissolved organic matter will adhere to it, and within hours, bacteria will colonize and form a biofilm. Degradation of data through the natural process of biofouling is a major concern. There is a need to demonstrate and validate the most effective method to prevent optic windows from biofouling. |
| N-0703-10 | SPAWAR | Implementation Of Passive Sampling Devices For Risk Assessment & Long Term Monitoring at Navy Contaminated Sediment Sites | Simple and effective assessment and monitoring tools that account for contaminant bioavailability are needed to reduce unnecessary cleanup actions and burdensome long term monitoring requirements at Navy contaminated sediment sites. |

utilized by several current NAVSEA acquisition programs. The list is also being integrated into the 2010 Naval Vessel Rules, and is being shared with other DoD services and contractors.

NAVSEA has also created a focused subset of chemicals specific to future research and development—the NAVSEA Target Chemical List (NAVSEA TCL).

It is expected that both the PCCL and NAVSEA TCL will drive future research and development efforts in reducing and eliminating hazardous materials.

### Assessing the Effects of Unexploded Ordnance on the Marine Environment

Warfare and training exercises over the past few decades have left unexploded munitions in the world's oceans and waterways. In 2002, the NESDI program initiated a series of studies of the potential toxicity, degradation and bioaccumulation of these materials in the marine environment.

The project team posed the following four questions:

1. What is the fate of explosives leaking from unexploded ordnance on marine food chains? They have a low propensity to bioaccumulate in invertebrates, the lowest rung of the food chain.
2. What is the fate of explosives when associated with different types of sediments? The explosives studied undergo extensive degradation upon contact with water and marine sediment.
3. What concentrations of explosives in the water cause toxic effects in

## EVALUATING FLEET NEEDS (CONT.)

| Reference | Command | Need | Description |
|---|---|---|---|
| N-0704-10 | NAVFAC | Safe, Sustainable & Regulatory Compliant Potable Water Systems for Navy Shore Facilities | Navy drinking water systems are becoming out of compliance with increasingly stringent environmental drinking water regulations. Water system operators are also challenged with implementing high priority water conservation mandates. There is a need to identify the most vulnerable water systems for analysis, assess the problems therein and provide recommendations for achieving compliance. |
| N-0705-10 | NAVFAC | In-Situ Sediment Toxicity Testing for Use in Clean-Up & Compliance | Realistic toxicity information is important for risk assessment and clean-up goals, as well as for compliance programs. Site-specific risk assessment and development of risk-based clean-up goals during a Baseline Ecological Risk Assessment is a requirement of both Navy policy and guidance. This requires knowledge of the actual bioavailability and site-specific characteristics that the contaminants of concern possess in-situ. Specific techniques for performing scientifically-defensible in-situ testing are needed. |
| N-0712-10 | NAVFAC | Demonstration/Validation of Delivery/Placement of In-Situ Amendments for Contaminated Sediments at Active, Deep Water Navy Sites & Structural Areas | While contaminated Navy sediment sites continue to progress from risk assessment towards remedy, the development of active amendment material that can be used to sequester and/or degrade contaminants is ongoing. The demonstration of amendments that address a range of organic and inorganic contaminants simultaneously could provide an effective solution where either cost or other issues might prevent implementation of a more traditional remedy. |
| N-0713-10 | NAVFAC | Copper & Zinc Source Identification, Quantification & Reduction in Stormwater Discharges | There is a need to develop Best Management Practices to reduce and/or eliminate the sources of copper and zinc in stormwater drainage areas. |
| N-0715-10 | NAVSEA | Applicability of Multi-Incremental Sampling (MIS) for Ecological Toxicity Testing Restoration Sites | There is a need to determine if MIS protocols, a form of compositing and sample manipulation resulting in one sample being provided to the chemical laboratory, are applicable to contaminants other than explosive residues and/or sampling objectives as part of an Ecological Risk Assessment. |
| N-0718-10 | NAVAIR | Non-Chrome Primer Evaluations for Aircraft Coatings | There is a need to determine the true relative performance rankings of the non-chrome primers for naval aircraft. |
| N-0719-10 | NAVAIR | Electrical Connectors Without Cadmium and/or Hexavalent Chromium | There is a need to perform a Navy/Marine Corp internal evaluation of cadmium plating alternatives for electrical connectors in many DoD applications. |

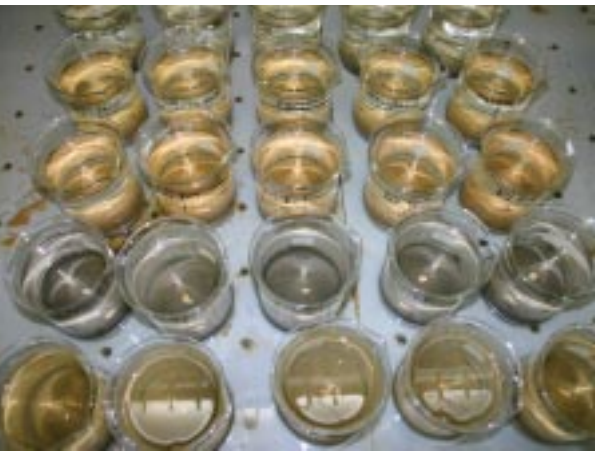
marine invertebrates and fish? The concentrations found were too low to produce toxic effects.

4. Are explosive compounds accumulated in invertebrates transferred to fish and therefore potentially available to human consumers? The chemicals have virtually no potential for transfer from invertebrates to fish so very little likelihood of transfer to the human food chain.

These studies were used as a resource by the Agency for Toxic Substances and Disease Registry in a response to a request by the Northern Marianas Commonwealth to determine the effect of underwater ordnance on pelagic fish. The Agency cited the data to conclude that "Pelagic fish caught in open waters are not likely to contain high levels of explosive residues and will not pose an imminent public health hazard to people who eat them." Citing existing research instead of conducting a new study saved the Navy $300,000 to $400,000.

The results of these studies may assist in addressing regulatory concerns in other underwater munitions sites as well, such as the island of Vieques (a former Navy firing and bombing range in Puerto Rico). By demonstrating that there are few if any associated ecological risks, the Navy may be able to leave in place unexploded ordnance if they do not pose an explosive safety risk. Priorities can then be focused on potential explosive safety and minimizing associated risks. In the interim, the Navy will continue to support investigation of scientific efforts relating to munitions contaminants in the marine environment.

Tank containing mussels exposed to TNT in seawater.
*Gunther Rosen*



Toxicity testing chambers containing benthic invertebrates, seawater and munitions constituents mixed in sediment.
*Gunther Rosen*

Researchers studied the effects of explosive chemicals on juvenile fish, mussels and benthic invertebrates.
*Gunther Rosen*

Significant progress was also made on several other key projects in FY 2009 including:

1. Environmental Effects of Lasers on Biota in the Marine Environment
2. Web-based Joint Interagency Environmental Model Server
3. Direct-push and Point-and-detect In Situ Sensors for Perchlorate in Ground or Surface Water
4. Containment and Long-term Monitoring Strategies for Contaminated Sediment Management
5. Underwater Ordnance Corrosion Prediction Model

It should be noted that the FY 2010 process generated 58 needs in all—far more than the program can financially support. The NESDI program increasingly relies on the leveraging of efforts to meet the needs of its community. The preceding 13 high-priority needs were validated by members of the program's Technology Development Working Group and resource sponsor.

In addition, technically proficient solutions may not be proposed or feasible within the current year.

Those needs, if still valid, are resubmitted for consideration to the NESDI program the following fiscal year as funding allows.

## Help NESDI Help You

The NESDI program relies on all Navy personnel to help identify environmental concerns and support the implementation of resultant solutions. In addition to familiarizing yourself with and using NESDI products, you can help NESDI help you by:

- Submitting and validating environmental needs,
- Reviewing technologies already in development,
- Supporting transition efforts in your organization or at your installation,
- Acting as a Principal Investigator on one of its projects,
- Providing demonstration sites for various program projects.

Stay up-to-date on program activities and learn more about the program by visiting www.nesdi.navy.mil.

The NESDI program is the Navy's environmental shoreside technology demonstration and validation (6.4) program, sponsored by the Chief of Naval Operations Energy and Environmental Readiness Division, and managed by NAVFAC. ⚓

**CONTACT**

Leslie Karr
Naval Facilities Engineering Command
805-982-1618
DSN: 551-1618
leslie.karr@navy.mil