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EPA Contaminated Sediments News

Sediment Oversight Technical Committee Meeting

The last meeting of the Sediment Oversight Technical Committee (SOTC) was held December 2, 1993, in the EPA Auditorium of Waterside Mall in Washington, DC. The SOTC meets twice a year and is composed of staff from each Headquarters program office and representatives from various Regions and ORD labs with experience in contaminated sediments issues.

The meeting was open to all EPA employees and invited guests interested or working in the area of contaminated sediments. The meeting, jointly sponsored by the Office of Water and the Office of Research and Development, was intended to highlight the activities being conducted under the ORD Contaminated Sediment Research Initiative. Personnel from the laboratories at Duluth, Narragansett, and Cincinnati presented information on sediment quality criteria development and validation, sediment bioassay development and standardization, and innovative remedial techniques for contaminated sediments.

The second day of the meeting was open only to regular members of the committee. Updates were given on the National Contaminated Sediment Inventory; prioritization of the Region 5 Contaminated Sediment Inventory; and activities in Regions 1, 2, and 5 and the Great Lakes National Program Office.

A special session was held on bioaccumulation, with presentations on the joint ORD/OW document *Assessment and Control of Bioconcentratable Contaminants in Surface Waters*, the *National Study of Chemical Residues in Fish*, and the activities of the Office of Water's Fish Contamination Program. For more information on the meeting contact Bev Baker at (202) 260-7037.

Contaminated Sediment Activities Timeline

February 1-3. *Great Lakes Sediment Summit.* Chicago, Il. Contact: Howard Zar, Region 5, at (312) 886-1491.

March 1. *Remediating Hazardous Waste and Groundwater Contamination Sites: New Approaches.* Miami, FL. Contact Libby Strickland, Water Environment Federation, 601 Wythe Street, Alexandria, VA 22314-1994. (703) 684-2400.

March 6-9. *Innovative Solutions for Contaminated Site Management.* Miami, FL. Contact Nancy Blatt, Water Environment Federation, 601 Wythe Street, Alexandria, VA 22314-1994. (703) 684-2400.

April 10-12. *Fourth ASTM Symposium on Environmental Toxicology and Risk Assessment.* Montreal, Quebec. Contact Thomas La Point, Clemson University, P.O. Box 709, Pendleton, SC 29670. (803) 646-2237.

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These documents issued by the Fish Contamination Program are available from the Office of Water Resource Center at (202) 260-7786.

EPA 822-R-92-001 *Consumption Surveys for Fish and Shellfish - A Review and Analysis of Survey Methods.*

EPA 823-B-93-003 *National Fish Tissue Data Repository User Manual - Version 1.0.*

EPA 823-R-93-002 *Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories. Vol. 1 - Fish Sampling and Analysis.*

EPA 823-R-93-003 Proceedings: *USEPA's National Technical Workshop (PCBs in Fish Tissue) May 10-11, 1993, Washington, DC.*

Regional Activities

REGION 1

Blackstone River Initiative

Flowing from Worcester, Massachusetts, to the Seekonk River in Pawtucket, Rhode Island, the Blackstone River has a length of 48 miles and a drainage area of 540 square miles. The Blackstone is an important resource to Massachusetts and Rhode Island, and it provides the second-largest source of fresh water to Narragansett Bay, a productive and diverse estuary. The river has a long history of pollution problems dating back to the industrial revolution and is considered a major source of pollutants to Narragansett Bay. Industrial and municipal wastewater discharges, combined sewer overflows (CSOs), nonpoint source pollution, water withdrawals, dams, and hydropower operations all contribute to water quality problems on the river.

In recognition of the Blackstone's importance, the Blackstone River Initiative was organized. U.S. EPA Region 1 and the Massachusetts Department of Environmental Protection, in cooperation with the University of Rhode Island and the Rhode Island Department of Environmental Management, conducted dry-weather and wet-weather surveys. The surveys included analysis of chemistry and toxicity in the water column, sediments, and selected effluents, as well as a benthic macroinvertebrate community analysis. Although numerous other studies have been conducted on the river, this marks the first time the entire river has been assessed during common temporal periods with uniform methods.

The sediment work included analysis of total metals (Cd, Cr, Cu, Ni, Pb, Zn) and toxicity in surficial whole sediments and sediment pore water, and analysis of PAHs in surficial whole sediment. Two rounds of toxicity testing were conducted on samples from seven impoundments on the Blackstone River and three reference sites. Collection of round 1 samples was split between two events, one each in July and August of 1991. Round 2 samples were collected together in late October of 1991. Fourteen-day tests with survival as the observed endpoint using the chironomid *Chironomus tentans* and the amphipod *Hyallela azteca* were run on the whole sediments. Forty-eight-hour acute tests with *Ceriodaphnia dubia* and the fathead minnow, *Pimephales promelas*, were used for the pore water tests. Financial constraints limited analysis of metals and PAHs to the first round.

The whole sediment tests yielded inconclusive results. While it appears that sediments from several of the Blackstone sites were toxic to one or both of the test species, poor survival in the reference sediments was also observed in several cases.

With the exception of one unsatisfactory control, the laboratory control water and reference sediment pore waters yielded 94% to 100% survival for both species in both rounds in the pore water tests. In the first-round testing, pore waters from the Blackstone river sites were not toxic to *Ceriodaphnia*, whereas the pore water from one site was toxic to fathead minnows (0% survival).

Sediment work included analysis of total metals and toxicity in surficial whole sediments and pore water, and analysis of PAHs in surficial whole sediment.

Toxicity was observed more frequently in pore waters from the Blackstone sites during the second-round testing. *Ceriodaphnia* survival was 0% to 7% in samples from three of the sites, and fathead minnow survival was 0% to 3% in samples from four sites. A fifth site yielded 43% survival of fathead minnows. Pore water from one Blackstone site was not toxic to either species in either round. Forty-eight-hour acute definitive tests were conducted with fathead minnows using two of the most toxic pore waters from the second-round samples. The two pore waters yielded LC_{50} values of 36.6% and 10%.

Round 1 whole sediment chemistry data for metals and PAHs were compared to NOAA indices of potential for biological effects and the EPA Region 5 Great Lakes Sediment Classification Scheme. For the seven Blackstone sites, lead and zinc

***CS News* is produced by EPA-OST to exchange information on contaminated sediments and to increase communication among interested parties. To obtain copies of this report or to contribute information, contact Beverly Baker, EPA HQ, at (202)260-7037.**

To be added to the mailing list or to make changes to your address, please contact Charlie MacPherson, Tetra Tech, at (703) 385-6000, or fax your changes to (703) 385-6007.

concentrations exceeded the NOAA effects range median (ERM) values at five sites. (The ERM is the concentration that might affect 50% of the exposed organisms.) ERM values for copper and zinc were exceeded at three sites, and the ERM values for cadmium and nickel were exceeded at one and two sites, respectively. In a few instances, metals concentrations in the reference sediments also exceeded NOAA ERM values. Several of the sites are considered "highly polluted" for numerous metals when assessed in accordance with the Great Lakes Classification Scheme. The ranges of measured metals concentrations in the Blackstone whole sediments, in micrograms per gram (µg/g), were as follows: cadmium 4-96, chromium 50-845, copper 115-173, nickel 16-260, lead 79-723, and zinc 225-2160. Total PAH concentrations fell between the NOAA ERL and ERM in all samples. ERL refers to the effects range low, or the concentration that might affect 10% of the exposed organisms.

The ranges of sediment pore water metals concentrations in round one Blackstone samples, in micrograms per liter (µg/l), were as follows: cadmium 3-6, chromium 6-58, copper 20-260, nickel 10-40, lead 7-79, and zinc 23-278. Reference site pore water concentrations exceeded the high end of these ranges for chromium (172 and 178 µg/l) and lead (100, 112, and 210 µg/l). Hardness-adjusted EPA ambient water quality criteria were exceeded for several metals in several pore water samples.

Definitive determination of cause-and-effect relationships between observed toxicity and the chemical composition of the whole sediments and pore waters was not part of the study. However, comparison of the toxicity results with the metals and PAH data did not indicate a strong relationship. Such a comparison was impeded by the absence of chemical analysis of the second-round samples. For more information contact Bill Beckwith, Region 1, at (617) 565-3539.

REGION 3

RI/FS at Dixie Caverns

Under the Alternative Remedial Contracting Strategy (ARCS), EPA performed a Remedial Investigation/ Feasibility Study (RI/FS) at the Dixie Caverns site in southwestern Virginia. The Dixie Caverns Landfill was used to dispose of unknown amounts of municipal refuse, scrap metal, electric arc fly ash (K061), and industrial by-products over a 15-year period. Closed in 1975, the landfill was found to contain approximately 9,000 cubic yards of stockpiled K061 ash. In addition, approximately 1,500 cubic yards of K061 ash was found to have moved off-site into small headwater streams, affecting more than 4,000 feet of stream channel. The multi-media RI included evaluating groundwater, surface and subsurface soil, and surface water contamination. Among the RI findings were extremely high stream sediment metals concentrations: zinc, lead, and cadmium levels as high as 22%, 4.5%, and 0.2%, respectively. The headwater streams empty into the Roanoke River, a waterway with significant importance as a potable water source and a sustaining waterbody for Federally Protected Species (Roanoke Logperch).

As of this time, several issues related to stream remediation have been addressed including:

- Developing clean-up goals after consideration of the results from bioassessment, toxicological bioasseys, and ambient water quality criteria;
- Establishing consensus between various federal and state regulatory agencies;
- Physical constraints of the impacted headwater streams and technological limits (problems related to removal of sediment from small, narrow streams with bedrock outcrops, sinking streams, and management of relatively clean large-diameter sediment/ rock); and
- Establishing oversight requirements to ensure PRP remediation activities.

The ongoing emergency removal remediation effort is focused on removal of sediment and stockpiling of contaminated sediment on-site. A second, later phase will provide for treatment and eventual disposal of excavated sediment. K061-enriched sediment is being removed using vacuum truck technology to pull small-diameter sediment (less than 3 inches in diameter) out of the stream channel and several hundred feet to a processing area. In addition, standard excavation processes are being used in areas of heavy deposition. Excavated sediment is currently being stored in bulk containers (6-cubic-yard dumpsters). Disposal options for K061-enriched sediment are currently being considered. One of the likely candidates is EPA's Best Demonstrated Available Technology (BDAT) for low-zinc K061 - stabilization and landfilling.

For more information contact Melissa Whittington, Region 3, at (215) 597-1286.

REGION 5

Region 5 Inventory of Contaminated Sediment Sites

The USEPA Region 5 Water Division would like to announce the public availability of the Region 5 Inventory of Contaminated Sediment Sites (interim

version). To facilitate public access to the Inventory, Region 5 has placed it on the Nonpoint Source Electronic Bulletin Board System (BBS) maintained by the Office of Wetlands, Oceans and Watersheds. The telephone number of the BBS is (301) 589-0205. Copies of the BBS User's Manual can be obtained from Sylvia Singleton at (202) 260-7074. The BBS contains the database files in compressed format along with an instruction file.

The Inventory does not contain all available data points for a given site, but rather presents a summary (minimum, maximum, and median) of sediment chemistry, fish tissue, and sediment bioassay information. In addition, other site summary and characterization information, such as latitude and longitude, receiving waters, fish advisories, and use impairments, is included. At this point, the Inventory contains summary information on 393 sites including all of Minnesota and Wisconsin, the basins of Lake Superior and Lake Michigan, and the southeast Michigan area.

At present, the Inventory is considered to be interim because parts of the Region are yet to be added and because errors or omissions may exist. Therefore, information from the Inventory should be used with care. In particular, the information as it exists in the Inventory should not be relied on to make regulatory decisions. Rather, the original sources of the data should be consulted to determine data accuracy (data sources are included). As a screening tool and basic data resource, however, the Inventory should prove very useful.

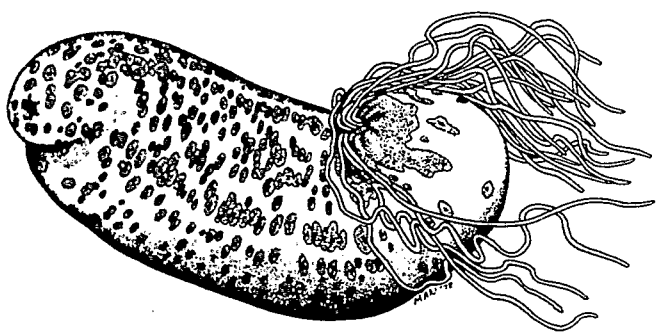
For more information contact Howard Zar, Region 5, at (312) 886-1491, or Kenneth Klewin, Region 5, at (312) 886-4679.

REGION 6

Urban NPS Project

During FY93 a project designed to reduce sediment contamination in Town Lake located in Austin, Texas, was funded by EPA's Office of Science and Technology. A grant was awarded to the Texas Natural Resource Conservation Commission (TNRCC), and funding was provided through a contract to the City of Austin. This project includes installation of storm drain inlet filters, enlargement of an existing stormwater detention pond, and construction of an oil and grease/grit treatment system for a large parking lot. In November the Region reviewed and approved, with comments, the draft Quality Assurance Project Plan (QAPP), which addresses all monitoring to be conducted during the project. The City is presently awaiting approval by the TNRCC before proceeding. For more information contact Phillip Crocker at (214) 655-6644.

Creature Feature



Don't mistake this for the one you chop up and put in your salad. Answer on page 11.

ORD Activities

ERL-NARRAGANSETT/ NEWPORT

ERL-Narragansett/Newport is currently working on the following topics within the Sediment Research Issue:

Exposure Assessment Modeling for Aquatic Disposal of Dredged Materials

- Modeling Sediment Transport and Fate in Marine Environments

The lab is validating the Corps of Engineers DIFID (Disposal From an Instantaneous Dump) model for transport of dredged material after dumping in aquatic systems. Model development is being conducted to improve modeling of processes particularly relevant to dredged material disposal in deep and very shallow ocean environments.

- Testing and Use of Acoustic Techniques for Characterizing Sediments and Sediment Transport

The lab is evaluating techniques in the Gulf of Mexico including:

- *Chirp Sonar*—used to determine dredged material footprint, to determine footprint thickness, to characterize density and grain size.

- *Side Scan Sonar*—can determine the location of dredged material mounds.

- *Acoustic Profiling of Water Column Particulates*—a useful qualitative tool for determination of relative abundance of particulate material in the water column.

- Application and Further Development of Technique for Measuring Sediment Erodibility

The Particle Entrainment Simulator (PES) is being used to characterize erodibility and factors that affect erodibility of marine sediments.

For more information, contact Edward Dettmann (401) 782-3039.

Ecosystems Analysis Team–Use of "CaT" Scan Technology to Determine Impacted Ecosystems

Sediment cores along a pollution gradient in Narragansett Bay were analyzed for benthic species composition and the degree of sediment utilization as measured by the surface area of benthic organisms' tubes. The latter was performed by exposing cores to x-rays and then analyzing the transmitted x-rays with "CaT" (computer-aided tomograph) software. Both species richness and tube surface area were found to be correlated with the pollution gradient; however, tube area was over an order of magnitude more sensitive than species richness. Future studies include equating tube surface area signatures to specific pollution point sources in New Bedford Harbor.

For more information contact Kenneth Perez at (401) 782-3052.

ORD DULUTH

Standardized Test Method Available Soon

ORD Duluth and the U.S. Fish and Wildlife Service are nearing completion of a test method document consisting of three standardized test methods to be used in assessing contaminated sediments. Two of the methods focus on freshwater toxicity tests for *Chironomus tentans* and *Hyallela azteca*, and the third method consists of a standardized approach for bioaccumulation tests with *Lumbriculus variegatus*. This testing document is scheduled for completion by the end of 1993. In addition, researchers are currently developing test methods for chronic toxicity that are scheduled for completion in the next one and a half to two years. For more information contact Gary Ankley, ORD Duluth, at (218) 720-5603.

Zinc Field Study Nearing Completion

ORD Duluth is completing a field study of a site contaminated with zinc to examine the role of acid volatile sulfide (AVS) in a field setting relative to bioavailability. This effort supports the development of criteria for metals. For more information contact Gary Ankley, ORD Duluth, at (218) 720-5603.

PAHs More Toxic in Sunlight

ORD Duluth is initiating research into the role photoactivation plays in the toxicity of polycyclic aromatic hydrocarbons (PAHs). It has been shown that PAHs can be more toxic in sunlight than in laboratory conditions, indicating that the toxicity of these compounds in the field may be underestimated in the laboratory. Researchers are investigating the toxic effect of sediment exposure on organisms to PAHs under sunlight conditions. For more information contact Gary Ankley, ORD Duluth, at (218) 720-5603.

Great Lakes National Program Office

Sediment Sampling Using the R/V *Mudpuppy*

The Great Lakes National Program Office (GLNPO) has been working with states to better assess and characterize sediment problems at selected Great Lakes Areas of Concern (AOCs) to support the development and implementation of Remedial Action Plans. The sampling is being conducted with the R/V *Mudpuppy*, a GLNPO vessel specifically designed and built for sediment sampling during the ARCS Program. It is a flat-hulled boat that is able to access very shallow areas and has a vibrocoring unit that allows cores up to 6 meters in length to be taken. These deep cores allow for the characterization of sediment both surficially and at depth, and provide a 3-dimensional representation of the sediment contamination at a particular location. In 1993, sediment surveys using the *Mudpuppy* were conducted on the Raisin River, MI; Ashtabula River, OH; Duluth/Superior Harbor and St. Louis River, MN/WI; Fox River, WI; and Trenton Channel, MI. A variety of additional sites are planned for sampling for this coming field season. For more information contact Marc Tuchman, GLNPO, at (312) 353-1369.

NOAA

The Incidence of Toxicity Associated with Toxicants in Sediments

Based on an evaluation of existing data, the incidence of toxicity and other adverse biological effects was

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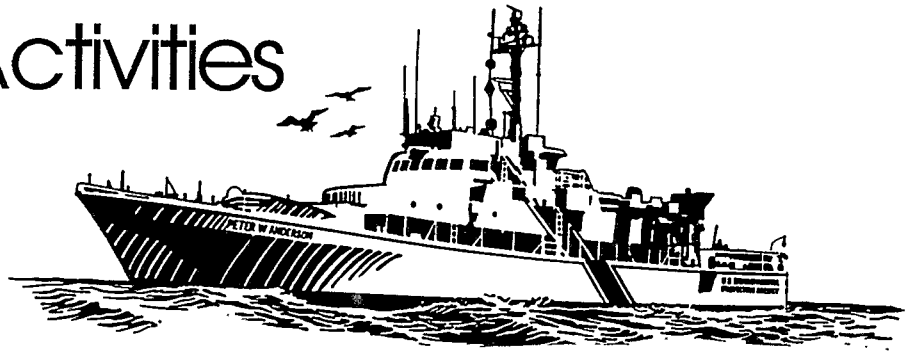
Focus: OSV Anderson Sediment Sampling Activities in Region 2



Sediment Survey of the Lower Passaic and Hackensack Rivers and Newark Bay

On January 8-12, 1993, a survey was conducted aboard the OSV *Anderson*, and subsequent surveys were conducted aboard the U.S. Army Corps of Engineers Vessel *Hudson* in areas that were too shallow for the *Anderson*. The study area consisted of the Hackensack and Passaic Rivers, Newark Bay, and ports of the Arthur Kill. The survey was part of a multi-agency cooperative effort involving the National Oceanic and Atmospheric Administration, the U.S. Fish and Wildlife Service, and EPA Region 2. The primary objective of this study was to assess the severity and spatial extent of sediment toxicity along a gradient of known toxicant contamination in the New York/New Jersey Harbor Complex. Data from this study are being used by the EPA Region 2 Sediment and Oceans Section, which is responsible for Region 2's Contaminated Sediments Program, (1) to evaluate sediment contaminant levels and areas of amphipod toxicity to establish where contaminated and toxic sediments are bioavailable and (2) to evaluate dredging areas and "screen" for problem sediments. The results of this study will be published in a joint EPA/NOAA/FWS report sometime in 1994. For more information contact Ed Long, NOAA, at (206) 526-6338; Eric Stern, EPA Region 2, at (212) 264-5283; or Douglas Pabst, EPA Region 2, at (212) 264-5674.

The OSV *Anderson*

The OSV *Anderson* is EPA's 165-ft research vessel that is used to collect water quality, sediment, and benthic data to support EPA programs. The ship is equipped with three laboratories, on-board survey equipment, and a computerized survey center from which survey operations are conducted.

Plume Tracking of Dredged Material Containing Dioxin

EPA Region 2 and its contractor, Battelle Ocean Sciences (BOS), conducted a plume tracking survey aboard the OSV *Anderson* June 7-11, 1993. Four dredge plumes were tracked during the survey period. The purpose of the survey was to track the plumes resulting from dredge scows as they disposed of dredged material at the Mud Dump Site. The primary instrument used was the Battelle Ocean Sampling System (BOSS). The BOSS is a towed "fish" equipped with two transmissometers (different path lengths), a CTD unit, and a pump. Seawater is pumped from the "fish" through Teflon tubing into the ship's laboratory, where it is collected for sampling. By calculating the lag time (the time it takes for the sample to travel from the pump to the laboratory), it is possible to sample at exact moments and locations in the water column. The BOSS instruments relay their information to a computer terminal inside the laboratory and to the bridge of the *Anderson*. Real-time readings of water column characteristics are thus displayed, enabling analysts to track the plumes effectively and sample at various intervals inside and outside the plume.

Survey measurements carried out included:

- Location of the plume centroid
- Velocity of the plume centroid
- Radius of the plume
- Density difference between the plume and ambient water
- Dioxin concentration in the plume
- Suspended sediment concentration in the plume (including both the volume and concentration of each sediment fraction identified in the initial material characterization done from the barged material)

The data from this plume tracking survey will be used for additional validation and verification of the Corps of Engineers' Automated Dredging and Disposal Alternatives Management System (ADDAMS),

DIFID, and *DIFHD* (disposal from an instantaneous and hopper discharge) water column dispersion models, which were issued with the 1991 EPA/Corps national "Green Book," *Evaluation of Dredged Material Proposed for Ocean Disposal.*

All the data from this survey are not yet available, but preliminary information has enabled EPA Region 2 to successfully determine that the dioxin-contaminated dredged material plumes moved out of the disposal site within the first hour, probably due to the close proximity of the disposal to the southern boundary of the Mud Dump Site. The dioxin analysis on the water samples collected is proceeding, and additional information will be gathered to assess the fate of dioxin in dredged material plumes. For further information contact Douglas Pabst, EPA Region 2, at (212) 264-5674.

Sediment Quality of the NY/NJ Harbor System and the Regional Validation of EMAP-Like Indicators of Sediment Quality

The sediment quality survey was conducted on October 2-5, 1993, aboard the OSV *Anderson*. This survey enabled EPA Region 2 to successfully complete the first-year Regional Environmental Monitoring and Assessment Program (REMAP). The OSV *Anderson* provided the necessary platform to sample Long Island Sound and the New York Bight Apex. Four other sub-basins in the NY/NJ Harbor Estuary were sampled using EPA Region 2's Harbor Survey Vessel Clean Waters. REMAP is a 2-year study designed to provide information that will support resource management decisions related to pollution control and remediation throughout the Region and to assist the NY/NJ Harbor Estuary Program (HEP) in developing a contaminated sediment management strategy to be included in the Comprehensive Conservation and Management Plan for HEP. Specifically, the objectives are as follows:

1. Characterize with known confidence the sediment quality of the Region's benthic environment as "degraded," "not evidently degraded," or "marginal" by means of the following indicators of sediment quality: benthic macroinvertebrate structure, sediment toxicity tests, concentration of sediment contaminants, and bottom dissolved oxygen concentrations.

2. Objective 1 requires validation of a benthic invertebrate indicator of sediment quality that is reliable on a regional scale.

3. Based on REMAP data, HEP will determine the probable causes of benthic degradation.

4. Based on REMAP data, HEP will recommend management strategies addressing the causes of degraded sediments.

5. Develop and validate a managerially useful index of environmental quality for the NY/NJ Harbor Estuary, based on the condition of benthic macroinvertebrate assemblages.

For further information contact Darvene Adams, EPA Region 2, at (908) 321-6700; Seth Ausubel, EPA Region 2, at (212) 264-6779; or Douglas Pabst, EPA Region 2, at (212) 264-5674.

Additional Surveys Conducted by the OSV *Anderson* to Support Sediment Activities in 1993

- **Broward County. FL.** Examined fate of Broward County, FL, wastewater outfall using carbon and nitrogen stable isotopes to determine the effects and impact on benthic communities from sedimentation from the sewage treatment plants.
- **Charleston, SC.** Monitored the Charleston, SC, Ocean Dredged Material Disposal Site (ODMDS) to assess the area surrounding the site.
- **Long Island Sound.** Monitored an ocean disposal site to assess adverse biological effects occurring at the disposal site.
- **Pensacola, FL.** Conducted seafloor mapping, water quality assessment, and biological assessment of the Pensacola ODMDS as part of site management.
- **Key West, FL.** Deployed sediment traps and buoys in support of section 403(c) ocean discharge criteria for the Key West outfall.

For more information on the OSV *Anderson*, contact Ed McLean, at (410) 573-6888.

Articles for the Next Issue of *CS News*!

The next issue of *Contaminated Sediments News* is scheduled for March 1994. If you have any information related to contaminated sediment activities, relevant publications, or notices of upcoming meetings, please call Charlie MacPherson, Tetra Tech, at (703) 385-6000, or fax the information to (703) 385-6007.

estimated for ranges in chemical concentrations in sediments. Matching biological and chemical data from several hundred individual studies of sediment quality in saltwater were reviewed. The data from these studies that passed quality assurance screens were entered into a large database. The data for each chemical toxicant were arranged in ascending order according to concentration. Following methods reported by Long and Morgan (1990, NOAA Tech. Memo NOS OMA 52), the lower 10th percentile and the 50th percentile (median) of the data points that reflected an adverse biological effect associated with that particular chemical were determined as the effects range low (ERL) and the effects range median (ERM).

The data from freshwater studies included in Long and Morgan (1990) were excluded and a considerable number of new data from saltwater studies were added. About 30% to 50% of the data used in the present analysis came from the previous database. Despite these major changes to the database, the previous and new ERL and ERM values differed very little. The average ratio between the previous and new ERL values was 1.88 (n=25). The average ratio between the previous and new ERM values was 1.63 (n=25).

The ERL and ERM values were used to define ranges in chemical concentrations (<ERL, ERL-ERM, >ERM). The total number of data entries within each range in which an adverse effect was associated with that particular chemical was divided by the total number of entries to determine the incidence of studies indicating adverse biological effects. The data for 9 trace metals, total PCBs, 2 pesticides, 13 polynuclear aromatic hydrocarbons (PAHs), and 3 classes of PAHs were sufficient to warrant analysis. In most cases the incidence of effects increased steadily and markedly with increasing chemical concentrations. For example, at concentrations of lead below the ERL value 8.0% (7 of 87) of the studies indicated adverse effects, whereas at concentrations above the ERM value 90.2% (37 of 41) of the studies indicated an adverse effect associated with this chemical. For all trace metals the incidence of effects was 2% and 9% at concentrations below the ERL value. Except for mercury and nickel, the incidence of effects ranged from 63% to 95% at concentrations above the ERM value. For all PAHs and classes of PAHs, the incidence of effects ranged from 10.3% to 27.3% at concentrations below the ERL values and 66.7% to 100% at concentrations above the ERM values.

These data are summarized in a manuscript prepared by E.R. Long, D.D. MacDonald, S.L. Smith, and F.D. Calder that has been accepted for publication in *Environmental Management* journal. The data should be useful in estimating the likelihood of toxicity in ambient sediments. For more information, contact Ed Long, NOAA, at (206) 526-6338.

Available ARCS Documents

These reports have either been previously published by USEPA or the US Army Corps of Engineers for the ARCS Program or are currently in press. Copies of all documents are available from GLNPO, while supplies last. Contact Susan Dykes (LAI contractor) at (312) 886-6049.

An Evaluation of Solidification/Stabilization Technology for Buffalo River Sediment.

ARCS Risk Assessment and Modeling Overview Document. EPA-905-R93-007.

Baseline Human Health Risk Assessment: Ashtabula River, Ohio, Area of Concern. EPA-905-R92-007.

Baseline Human Health Risk Assessment: Buffalo River, New York, Area of Concern. EPA 905-R93-xxx.

Baseline Human Health Risk Assessment: Saginaw River, Michigan, Area of Concern. EPA 905-R92-008.

Baseline Human Health Risk Assessment: Sheboygan River, Wisconsin, Area of Concern. EPA 905-R92-001.

Biological and Chemical Assessment of Contaminated Great Lakes Sediment. EPA 905-R93-006.

Information Summary, Area of Concern: Ashtabula River, Ohio.

Information Summary, Area of Concern: Buffalo River, New York.

Information Summary, Area of Concern: Grand Calumet River, Indiana.

Information Summary, Area of Concern: Sheboygan River, Wisconsin.

Pilot-Scale Demonstration of Thermal Desorption for the Treatment of Buffalo River Sediments. EPA-905-R93-005.

Hazardous Substance Research Center

Particle Broadcasting

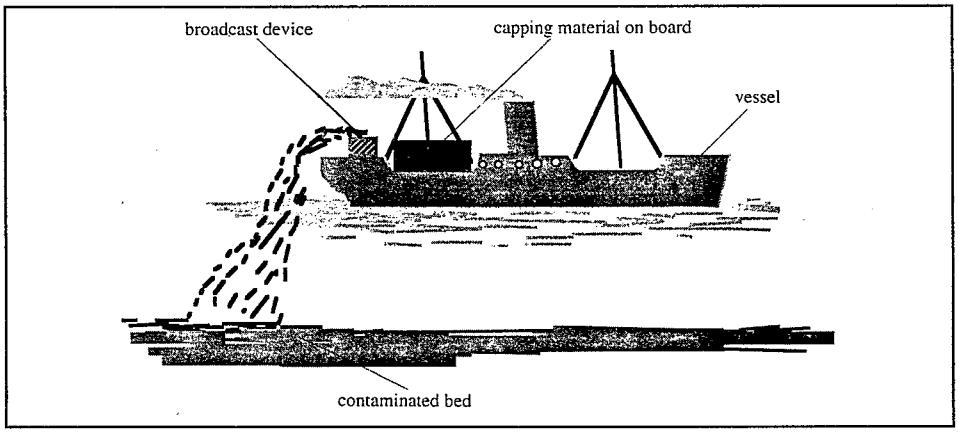
The Hazardous Substance Research Center/South and Southwest (HSRC S/SW) is exploring particle "broadcasting" as a new approach to the remediation of contaminated sediments. Capping contaminated bed sediment in situ with a layer of clean particles is an operational technology undergoing continued theoretical and laboratory development at the Center (*Environmental Science Technology*, Vol. 27, No. 12, 1993). Based on 2,4,6-trichlorophenol as the hydrophobic organic chemical, isolation by this process can be extremely effective. These new results support earlier theoretical predictions of the effectiveness of capping in isolating toxic constituents from the aquatic environment for centuries. However, capping with 30- to 50-cm layers has some drawbacks, both in an operational sense and, in some cases, for the ecosystem.

Particle broadcasting is an in situ capping process that more closely mimics ongoing processes in nature by distributing sand or silt particles very slowly onto the bed surface (slowly in the sense of bed accretion rates of millimeters per year) rather than placing a thick cap instantaneously onto the bed. The fresh material falls through the water column after being "broadcast" dry from a vessel, pipeline-wet from a vessel, and through existing sewer outfalls and tributary streams. Obviously, better control and cap uniformity can be obtained by distributing the particles from a floating vessel.

As the natural and/or "engineered" particles arrive on the bed surface, they reside there for a while; however, primarily because of bioturbation and other bed-side processes, these clean particles move through the sediment-water interface and into the bed. In addition to diluting the concentration of contaminants in the original bed, surfaces of the clean particles provide sorptive sites for both organics and metals, further reducing contaminant levels in the bed. This down-mixing and adsorptive chemical process is capable of reducing contaminant release rates to the water column. Obviously, the higher the particle delivery rate (i.e., 0.1 to 10 mm/y), the more effective the contaminant retention. Also, as time proceeds after the initial application, beneficial effects of retarding contaminant mobility decrease. This occurs because the bioturbation process also delivers contaminated particles from deep within the bed to the sediment-water interface. In this regard, a design variable is the frequency of particle broadcasting.

The particle broadcasting idea is at the conceptual stage and much work, both theoretical and laboratory, needs to be performed. This work must explore the applicability of the process for delivering nutrients to the bed to enhance ongoing natural bioremediation processes. In the case of metal contaminants, the particles deliver reactants. An example is to broadcast sulfur-coated particles for the "fixation" of mercury in bed sediment.

The HSRC S/SW is a consortium consisting of Georgia Institute of Technology in Atlanta, Rice University in Houston, and Louisiana State University (LSU) in Baton Rouge. The particle broadcasting work is in its initial stages, and the investigators are Louis Thibodeaux, Danny Reible, and K.T. Valsaraj of LSU. Information on capping can be obtained by contacting Rosalind Segesta at (504) 388-6770).



Example of particle broadcasting from a vessel using dry material.

MARAD To Study Dredging Process

The Maritime Administration (MARAD) has formed an interagency working group on the dredging process composed of EPA, the Department of the Army, the National Oceanic and Atmospheric Administration, the Department of the Interior, and other federal agencies. The working group was established to review the dredging and disposal process and identify ways of improving interagency coordination, information gathering, criteria reviews, and development of long-term management strategies for dredged material at national and local levels. MARAD is planning a series of listening meetings in January and February to solicit public input. These meetings are in the process of being scheduled in ten port cities throughout the U.S. For more information on these meetings, call Francis Mardula, MARAD, at (202) 366-5181.

European Sediment Workshop Held in the Netherlands

The Workshop on Sediment Toxicity Assessment (WOSTA) was held November 8-10, 1993, in Renesse, the Netherlands. The workshop of 40 participants was sponsored by SETAC Europe. The objectives of the meeting were to:

- Gather European and selected North American experts from the regulatory, academic, and industrial sectors with practical experience in sediment toxicity tests and bioassays;
- Discuss the ways in which whole sediment toxicity tests and bioassays with marine and freshwater systems may be standardized and used to provide useful regulatory information;
- Produce a guidance document for scientists, notifiers of chemicals, and regulators in this field; and
- Indicate any future necessary scientific research.

The workshop consisted of six working groups: (1) materials, (2) organisms, (3) chemistry, (4) design, (5) interpretation of toxicity assays, and (6) interpretation of bioassays. The workshop focused on whole sediment testing issues in the laboratory and did not address liquid phase testing to any significant degree. The North American participants included Donna Bedard (Ontario Ministry of the Environment and Energy), Allen Burton (Wright State University), and John Giesy (Michigan State University). Consensus on the key guidance issues was achieved by the conclusion of the workshop. The guidance document is scheduled to be published in May 1994. For more information contact Allen Burton, at (513) 873-2201.

ASTM UPDATE

The ASTM Subcommittee E47.03 met in Houston, Texas, November 13, 1993, before the 14th Annual SETAC meeting. Results were discussed during the Subcommittee meeting for a:

- Subcommittee ballot: (1) revision to E1383-93 (freshwater invertebrate toxicity): Annex A7 on *Diporeia* (negatives persuasive, will be revised) and (2) revision to E1525-93 (sediment design): Annex 2 on sediment resuspension testing (negatives persuasive, will be revised).

- Concurrent Subcommittee and Main Committee ballot: (1) polychaete testing (negative withdrawn with editorial revision, ballot at Society level); (2) fish bioaccumulation (negatives persuasive, will be revised); (3) earthworm testing (negatives not persuasive, ballot at Society level after test acceptability section is revised); (4) revision to E1383-93: definition of a replicate (negatives persuasive, will be revised); (5) revision to E1383-93: Annex A5 on mayflies (ballot at Society level); (6) revision to E1391-90 (sediment collection, storage and manipulation; negatives not persuasive, ballot at Society level after missing pages are balloted); (7) revision to E1525-93 (sediment design): Annex A1 on statistics (negative persuasive, will be revised); (8) revision to E1525-93: general information (negative withdrawn with editorial revision, ballot at Society level).

There were no actions since the last Subcommittee meeting on the following: (1) Guide for Conducting Sediment Toxicity Tests with Bioluminescent Bacteria, (2) Toxicity Testing with *Lumbriculus Variegatus*, (3) Reference Toxicant Testing, (4) Sediment Toxicity Tests with Oysters, (5) Sediment Toxicity Tests and Echinoderms, (6) Bioaccumulation of Sediment-Associated Contaminants by Benthic Invertebrates.

Future directions of the Subcommittee were discussed:

- Standard Test Methods for Measuring the Toxicity of Sediment-Associated Contaminants with Estuarine and Marine Amphipods. These test methods will be balloted as a revision to E1367-92.

- Standard Test Methods for Measuring the Toxicity and Bioaccumulation of Sediment-Associated Contaminants with Freshwater Invertebrates. A revised version of the USEPA manual will be balloted concurrently at the Subcommittee and Main Committee levels in January 1994. This proposed ASTM document may eventually replace ASTM E1383-93.

The next Subcommittee meeting will be held during the annual ASTM meeting Sunday, April 10, to Thursday, April 14, 1994, at La Centre Sheraton in Montreal, Quebec. Please contact Chris Ingersoll at (314) 875-5399, FAX (314) 876-1896, if you would like more information concerning the Subcommittee meeting or the activities of the Subcommittee.

Tentative Schedule for the 15th E47.03 Sediment Toxicology Subcommittee Meeting During the Annual ASTM Meeting Sunday, April 10, to Thursday, April 14, 1994, at La Centre Sheraton in Montreal, Quebec

1. Revision to E1383-93 (freshwater invertebrate toxicity): Annex A5 on *Hexagenia* sp. (Draft #5, dated 07/92; Task Group Chair: Donna Bedard, Ontario Ministry of the Environment, Rexdale, Ontario, (416) 235-5970).

2. Revision to E1383-93 (freshwater invertebrate toxicity): Annex A7 on *Diporeia* sp. (Draft #3, dated 05/93; Task Group Chair: Peter Landrum, GLERL, NOAA, Ann Arbor, MI, (313) 741-2235).

3. Standard Test Methods for Measuring the Toxicity and Bioaccumulation of Sediment-Associated Contaminants with Freshwater Invertebrates (Task Group: Chris Ingersoll, Jim Dwyer, Parley Winger, NBS, Columbia, MO, (314) 875-5399; Allen Burton, Wright State University, Dayton, OH, (513) 873-2201).

4. Revision to E1367-92 (marine and estuarine amphipod toxicity): Test Methods from Guidance (Task Group Chair: Janet Lamberson, USEPA, Newport, OR, (503) 867-4043).

5. Standard Guide for Conducting Sediment Toxicity Tests with Marine and Estuarine Polychaetous Annelids (Draft #7, dated 07/15/93; Task Group Chair: Don Reish, California State University-Long Beach, Long Beach, CA, (213) 431-7064).

6. Standard Guide for Conducting Soil Toxicity Tests with Earthworms (Draft 2.0, dated 07/93; Task Group: Dave Wilborn, Mantech, Corvallis, OR, (503) 754-4600; Greg Linder, Mantech, Mike Bollman, Mantech, Clarence Callahan, USEPA, Corvallis,OR).

7. Revision to E1391-90 Standard Guide for Collection, Storage, Characterization, and Manipulation of Sediment for Toxicological Testing (Draft #3, dated 08/05/93; Task Group Chair: Allen Burton, Wright State University, Dayton, OH, (513) 873-2201).

8. Standard Guide for Determination for the Bioaccumulation of Sediment-Associated Contaminants by Benthic Invertebrates (Draft #5, dated February 1991; Task Group Chair: Henry Lee, USEPA, Newport, OR, (503) 867-4042).

9. Standard Guide for Determination of the Bioaccumulation of Sediment-Associated Contaminants by Fish (Draft #4, dated 07/26/93; Task Group Chair: Donna Bedard, Ontario Ministry of the Environment, Rexdale, Ontario, (416) 235-5970).

10. Revision to E1525-93 (sediment design): Annex 1 on Statistical Guidance (Draft #3, dated 08/93; Task Group Chair: Gail Bragin, Exxon Biomedical Sciences, Inc., East Millstone, NJ, (908) 873-6174).

11. Revision to E1525-93 (sediment design): Annex 2 on Sediment Resuspension Testing (Draft #1, dated 06/01/93; Task Group Chair: Gail Bragin, Exxon Biomedical Sciences, Inc., East Millstone, NJ, (908) 873-6174).

12. Standard Guide for Conducting Sediment Toxicity Tests with Bioluminescent Bacteria (Draft #5, dated 10/14/93; Task Group Chair: Mal Greene, Microbics Corp., Carlsbad, CA, (619) 438-8282).

13. Revision to E1525-93 (sediment design): Annex 3 on Reference Toxicant Testing (Task Group: Janet Lamberson, USEPA, and Jim Dwyer, NBS).

14. Standard Guide for Conducting Sediment Toxicity Test with Oysters (Task Group Chair: Paul Dinnel, University of Washington, Seattle, WA, (206) 543-7345).

15. Standard Guide for Conducting Sediment Toxicity Test with Echinoderms (Task Group Chair: Paul Dinnel, University of Washington).

Creature Feature answer from page 4: Sea Cucumber (*Holothuria*) spewing tubules of Cuvier.

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