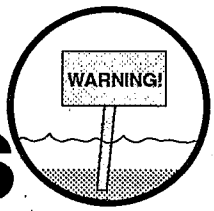
United States
Environmental Protection
Agency

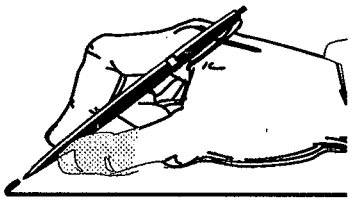
Office of Water
(4305)

EPA-823-N94-003
Number 12
September 1994

EPA Contaminated Sediments News



Contaminated Sediment Management Strategy Signed by EPA Administrator



On August 22, 1994, EPA Administrator Carol Browner signed the *Federal Register* notice of availability of *EPA's Contaminated Sediment Management Strategy*. The proposed Strategy describes specific actions that EPA will take to reduce environmental and human health risks associated with contaminated sediment. The Strategy does not propose new regulation. EPA is acting under existing statutory and regulatory authority to implement policies to consistently prevent, assess, and remediate contaminated sediment. Because the proposed Strategy is a unique plan of action developed to address a significant national environmental problem, and to streamline decision-making within and among EPA programs, the Agency is taking the unusual step of requesting public comment on this internal EPA work plan.

Requests for copies of the Strategy (EPA 823-R-94-001) should be sent to the U.S. EPA National Center for Environmental Publications and Information, 11029 Kenwood Road, Building 5, Cincinnati, OH 45242; (513) 891-6561, FAX (513) 891-6685. The public comment period will end in late October. For more information on the Strategy, contact Tom Armitage, EPA/OST, at (202) 260-5388.

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 Jane Farris, EPA OST, at (202) 260-8897

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

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Contaminated Sediment Activities Timeline

October 31-November 3, 1994. *1994 International Hazardous Material Spills Conference.* Buffalo, NY. Contact Sarah Bauer at (202) 260-8247.

October 30-November 3, 1994. *15th Annual Meeting of the Society of Environmental Toxicology and Chemistry.* Denver, CO. Contact Bill Stubblefield, Program Chair, at (303) 493-8878.

November 15-16, 1994. *Symposium on Ecological Risk Assessment: Use, Abuse and Alternatives.* Corvallis, OR. Contact the conference assistant, Oregon State University, at (503) 737-2329.

November 29-December 2, 1994. *Meeting on Water Quality Standards/ Criteria and Related Programs.* Seattle, WA. Contact Liz Hiett, Tetra Tech, at (703) 385-6000.

December 5-9, 1994. *Meeting on Water Quality Standards/Criteria and Related Programs.* Chicago, IL. Contact Liz Hiett, Tetra Tech, at (703) 385-6000.

February 13-16, 1995. *National Estuary Program Coastal Technology Transfer Conference.* New Orleans, LA. Abstracts due **September 30, 1994.** Contact Betsy Tam, USEPA, at (202) 260-6466.

March 29-April 1, 1995. *Gulf of Mexico Symposium.* Corpus Christi, TX. For more information call 1-800-699-GULF.

March 10-14, 1996. *Sixth Federal Interagency Sediment Conference.* Las Vegas, NV. Abstracts due **December 16, 1994.** Contact Jerry Bernard, Technical Program Chairman, at (202) 720-5356.

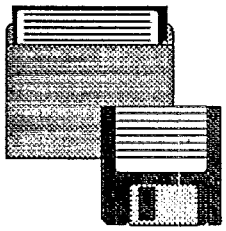
Headquarters Activities

Regional Review of National Sediment Inventory Data Completed

This summer, all 10 EPA Regions have been busy reviewing the sediment chemistry data from their Regions contained in the National Sediment Inventory (NSI). The data will be used to develop the first biennial Report to Congress on contaminated sediments in the United States. Specifically, the Regions were asked to:

(1) verify sites (i.e., waterbody segments) targeted as potential areas of concern;
(2) identify sites that may have been incorrectly targeted as potential areas of concern;
(3) identify potential areas of concern that were not targeted but should have been; and
(4) provide EPA Headquarters with additional sediment quality data that should be included in the NSI to make it more accurate and complete.

To assist them in their review, EPA Headquarters provided each Region with a copy of *The National Sediment Inventory: Preliminary Evaluation of Sediment Chemistry Data, Vol. 1: Approach and National Results* and *Vol. 2: Regional Results*, as well as the actual sediment chemistry data in a dBASE 3+ format and various options for approaching this labor-intensive effort. In addition, conference and one-on-one calls were held throughout the summer to answer any questions the Regions might have had during their review of the information.



The Regional review of the NSI sediment chemistry data was very successful due to the hard work and dedication of the EPA Regions and the states (NY and WA) that assisted them. Special thanks go to Matt Liebman, Region 1; Audrey Massa, Region 2; Marilyn Gower, Region 3; Doug Johnson, Region 4; Ken Klewin, Region 5; Phil Crocker, Suzy McKinney, and Paul Koska, Region 6; Lyles Cowles, Region 7; Phil Johnson, Region 8; Erika Hoffman, Region 9; and John Malek, Region 10. Regions also submitted important data sets that will be added to the NSI to make it more complete. For more information on the NSI, contact Catherine Fox, EPA OST, at (202) 260-1327.

EPA and Industry Working Together to Better Understand and Prevent Sediment Contamination

Over the past several years there has been a growing effort by EPA and a variety of industries to work together to identify and address contaminated sediment issues. In response to EPA's effort to develop sediment quality criteria, sediment bioassays, and supporting methodologies, a variety of industries have taken the initiative to better understand the potential impacts caused by contaminants that when released into the environment are deposited to sediments. These joint efforts are typically focused on (1) field studies near existing contaminant release areas to determine whether ongoing activities might result in degraded benthos, (2) laboratory studies to understand the processes by which contaminants and natural sediments interact, or (3) a combination of both approaches. In some cases only technical recommendations are provided by EPA on a proposed study design. In other cases the study is conducted jointly, with industry and EPA having different responsibilities but sharing the resulting data.

Early involvement by the regulated community has definite advantages to both EPA and the industries involved. Such collaboration allows a more complete understanding of the science and related issues by all parties and provides a basis for more meaningful comments and research. This information can be used by EPA to better address problems in the early stages of an effort. Modifications to methodologies that are made early in an effort can be more readily incorporated into program strategies. The additional data generated from cooperative efforts helps shape and support developed methodologies. Opportunities for early review and comment by the public were particularly apparent with the recent review of the first five sediment criteria. Prior to the *Federal Register* notice announcing the availability of the criteria for public review and comment, there were two opportunities for informal review and comment on the criteria documents and supporting methodology. As a result of these reviews, fewer individual commenters found it necessary to provide comments during the formal public review.

Industry groups representing the manufacture of petroleum products, soap and detergents, chemicals, and photographic film have either completed or are in the process of conducting contaminated sediment studies. Other institutions are considering similar efforts. Cooperative efforts between EPA and industry are an effective way to address environmental problems without relying on traditional command and control measures.

Regional Activities

Region 5

LTV Steel Dredging Begins

On July 27, 1994, Ron Kovach of EPA Region 5 led an information-gathering tour of a sediment remediation project being conducted at the LTV Steel East Chicago, Indiana, steel plant. The remediation project began July 1 pursuant to a Clean Water Act Consent Decree that requires the facility to remove and remediate all of the sediment (approximately 110,000 cubic yards) in its No. 2 Intake Flume. The remediation consists of both sediment removal via diver-assisted vacuuming of the sediment and deoiling/dewatering of the sediment via coagulation/flocculation in conjunction with final sand filtration of the discharge and belt filter pressing of the sludges. The deoiled/dewatered belt filter press solids are landfilled in a special waste landfill in Wyatt, Indiana. Reclaimed oils from the project are recycled back into the facility's waste oil reclamation system. Final discharge of any waters from the remediation project is through a regulated NPDES-permitted outfall. For more information contact Ron Kovach, Region 5, at (312) 886-1441.

Region 6

Channels Evaluated for Sediment Contamination

Region 6 initiated a project last year with Battelle Ocean Sciences to evaluate the extent of sediment contamination by dioxins, furans, hexachlorobenzene, and polychlorinated biphenyls in seven dredged channels in Texas and Louisiana. The channels of interest in Texas are Matagorda Ship Channel, Freeport Harbor/Brazos River, Houston Ship Channel/Galveston Bay and Channel, and Sabine-Neches Ship Channel; in Louisiana, Mississippi River Southwest Pass, Mississippi River Gulf Outlet, and the Calcasieu River and Pass.

The Region conducted a literature survey and data search using publications, agency reports, and available databases. As anticipated, large data gaps were identified for the majority of compounds in the areas of interest.

This coming year, through continuation of the contract, the Region will develop a sampling plan and will collect and analyze sediments from these channels and their respective reference areas for the compounds of interest. The Region will use the data to assist in decisions regarding the disposal of dredged material. For more information contact Suzy Cantor-McKinney, Region 6, at (214) 665-6693.

Sediment Study at Patrick's Bayou

The Region is working with the Texas Natural Resource Conservation Commission on a study of contaminants in Patrick's Bayou. Patrick's Bayou is a small, tidally influenced, effluent-dominated tributary of the Houston Ship Channel. Sampling took place July 25-27, 1994. Chemical analyses are being performed for water and sediment samples collected from 10 stations. Parameters monitored include standard field parameters, conventional parameters, and priority pollutants in water and sediment. At selected sites benthic macroinvertebrate community assessments and toxicity tests on water and sediment elutriates, using marine chronic toxicity tests, are being conducted. Recent data have shown that this bayou has several inorganic and organic contaminants of concern in bottom sediments, as the water column and sediment toxicity have demonstrated. This study will aid in determining the distribution of contaminants within the bayou and possible sources. For more information contact Philip Crocker, Region 6, at (214) 665-6644.

Region 10

Biological Indicators Developed for Superfund Site

A year-long project has culminated in the development of biological indicators to be used as performance standards for the sediment cap at the St. Paul Waterway Area Remedial Action and Habitat Restoration Project (the Project) at the Commencement Bay Nearshore/Tideflats Superfund Site, Tacoma, Washington. The performance standards are designed to assess the protectiveness of the clean-up remedy at the Project. Development of biological indicators by Simpson Tacoma Kraft Company and Champion International Corporation, with approval by the U.S. EPA, is required by the 1991 St. Paul Waterway Consent Decree and the Monitoring, Reporting, and Contingency Plan (Exhibit A to the Federal Consent Decree).

Biological indicators for the marine benthic community are described in the document *Biological Indicators, St. Paul Waterway Area Remedial Action and Habitat Restoration* (Parametrix, June 1994). For the past year, EPA has been working very closely with Simpson, Champion, and consultants to develop this comprehensive and detailed biological indicators approach. During its development, the previous 5 years of site-specific benthic infauna data were thoroughly reviewed, and approximately 60 biological experts

(continued on p. 7)

FOCUS

Draft Inland Testing Manual (ITM) Now Available for Comment

Introduction

The draft Inland Testing Manual (ITM) contains up-to-date procedures to implement requirements in the Clean Water Act (CWA Section 404(b)(1) Guidelines) for the evaluation of potential contaminant-related impacts associated with the discharge of dredged material in fresh, estuarine, and saline (near-coastal) waters.

Formally titled *Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S.—Testing Manual (Draft)*, the manual was prepared by a joint Environmental Protection Agency/Corps of Engineers workgroup. The draft ITM is currently being released for public review and comment and will be finalized in early 1995 in response to comments received.

The ITM addresses:

- contaminant-related impacts associated with discharges of dredged material in open water disposal areas
- contaminant-related impacts to surface water and surrounding environs associated with dredged material effluent discharged from confined disposal areas.

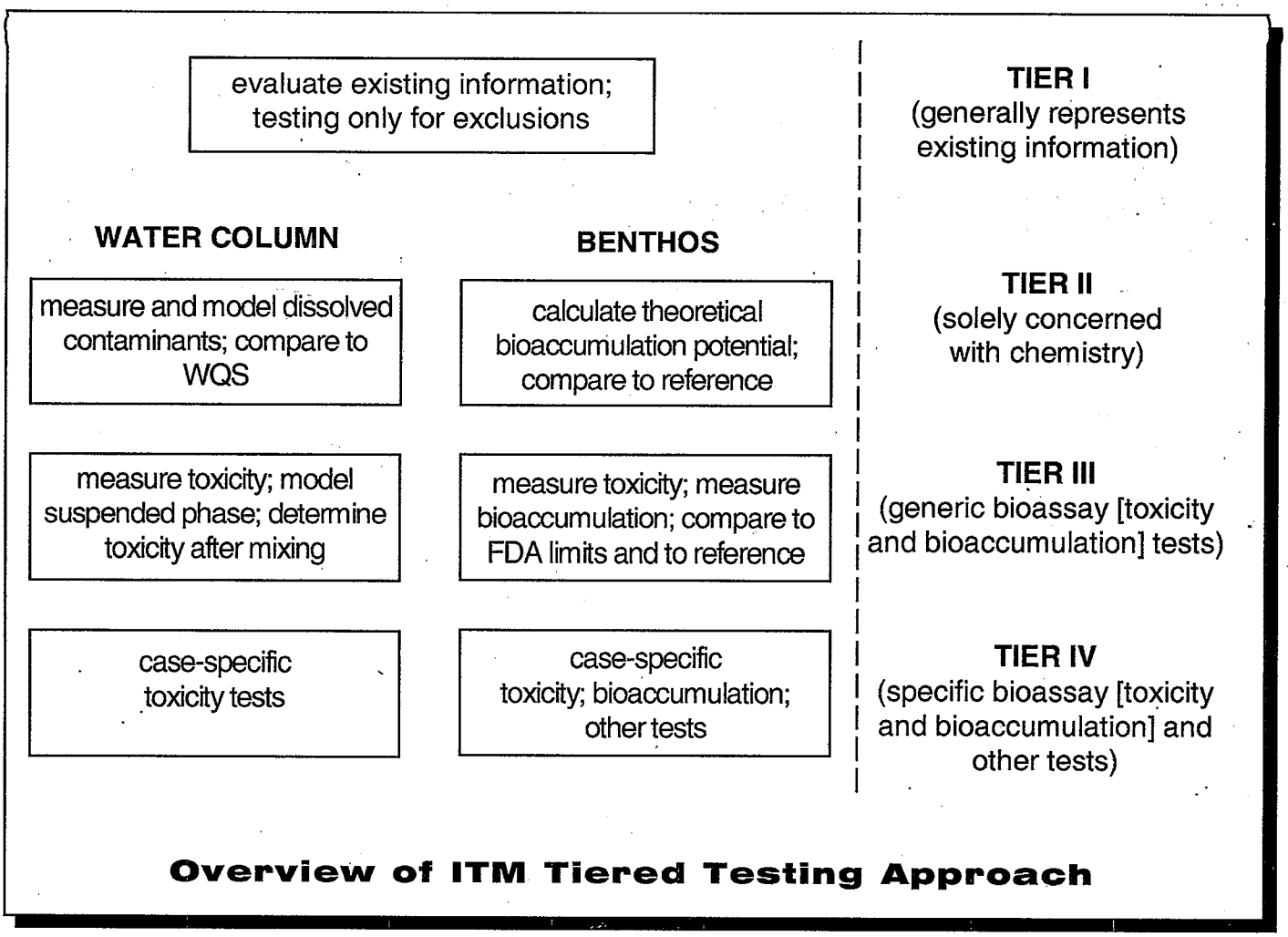
The ITM does not address:

- impacts associated with the dredging activity itself
- impacts associated with the discharge of fill material (except where dredged material is used for fill and there is a reason to believe that contaminants might be released).
- impacts associated with the discharge of dredged material in the ocean, under the Marine Protection, Research and Sanctuaries Act (MPRSA).

The ITM provides a national

The ITM includes

- Statutory and Regulatory Background
- Scope and Applicability
- Overview of Testing and Evaluation
- Technical Guidance
  - Sampling and Analysis
  - Physical and Chemical Evaluations
  - Bioassays (Toxicity and Bioaccumulation)
  - Quality Assurance/Quality Control
  - Evaluation of Discharges from Confined Disposal Facilities
  - Evaluation of Mixing
  - Statistical Methods
  - Identification of Ammonia Toxicity



Overview of ITM Tiered Testing Approach

testing framework that constitutes one element of an overall decision-making process for determining whether dredged material can be discharged into CWA section 404 waters. The ITM is intended to provide for consistency between dredged material evaluations under CWA and MPRSA. In recognition of the importance of site- and situation-specific concerns, regional flexibility in implementation and application is allowed within this national framework.

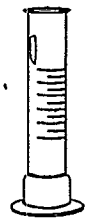
Tiered Testing Approach

The ITM uses a tiered testing approach as described below:

Tier I - Involves an examination of existing information to (1) determine whether there is "reason to believe" that the dredged material needs to be tested for potential adverse effects and (2) identify any contaminants of concern relative to testing in later tiers. Material may be excluded from further testing if there is reasonable assurance that (1) it is not a carrier of contaminants or (2) it is adjacent and similar to the disposal site material, and dispersal of the discharge can be controlled. Some limited testing might be necessary to confirm such exclusions.

Tier II - Is concerned solely with sediment and water chemistry. Tier II provides useful information through screening tools, but not all possible determinations can be reached at this tier. It presently consists of

(1) measuring dissolved contaminants, (2) evaluation of state Water Quality Standard (WQS) compliance using a numerical mixing model, and (3) evaluation of theoretical bioaccumulation potential for nonpolar organic chemicals.



Tier III - Employs well-defined, nationally accepted bioassays including (1) water column laboratory toxicity tests, (2) whole sediment laboratory toxicity tests, and (3) whole sediment bioaccumulation tests. Appropriately sensitive organisms are recommended, including benchmark species for evaluating the sensitivity of regional species. Summaries of test conditions and test acceptability criteria for all recommended bioassay species are also provided. Toxicity testing emphasizes acute responses, generally survival. Water column toxicity evaluations consider mixing of the dredged material at the discharge site. Benthic bioaccumulation testing provides for the determination of bioavailability through 28-day exposure tests. Tier III testing will usually provide sufficient information for use in the overall decision-making process for compliance with the Guidelines.

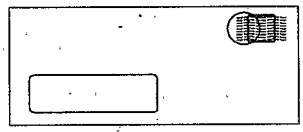
Tier IV - Will be used only in certain cases, where results from tests in earlier tiers are insufficient to determine the potential adverse effects of the material to be discharged. Tier IV, like Tier III, uses toxicity and bioaccumulation tests; however, (1) toxicity tests may involve field (rather than laboratory) exposures, different endpoints (e.g., chronic rather than acute), different species, or longer laboratory exposures; (2) bioaccumulation tests may involve field (rather than laboratory) exposures using transplanted or resident organisms, or longer laboratory exposures. Tier IV can also include benthos studies.

Reference Sediment - Is the key to the evaluation of dredged material. Results of tests using reference sediment provide the point of comparison (reference point) to which effects of dredged material are compared. Reference sediment is generally collected outside the influence of previous disposal operations at the disposal site, but near enough to the disposal site that the reference sediment is subject to all the same influences (except previously disposed dredged material) as the disposal site. It should not be located in the immediate vicinity of spills, outfalls, or other significant sources of contaminants, and it should have a grain size as similar as practicable to that of the dredged material. The reference sediment concept is the subject of a CWA rulemaking that will be proposed in the *Federal Register* for public comment prior to issuance of the final ITM.

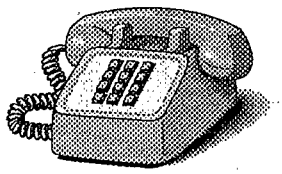
Contacts

A copy of the draft ITM can be obtained from Shirley Walker, U.S. Army Corps of Engineers Waterways Experiment Station, at (601) 634-2571.

Comments can be mailed or delivered to Mike Kravitz as per the July 21, 1994, *Federal Register* notice announcing the availability of the draft ITM (59 FR 37234).



For more information contact Mike Kravitz, U.S. EPA Office of Science and Technology, at (202) 260-8085; or Kirk Stark, U.S. Army Corps of Engineers, Office of the Chief of Engineer, at (202) 272-1786.



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from around the United States were interviewed. This information was used to build a suite of analytical processes using marine benthic data that will allow observations of biological change at the Project site. Use of the biological indicators approach will enable EPA to determine whether the natural habitat at the Project has been restored to support a productive biological community, and will allow evaluation of any potential sediment recontamination in the upper layers of the sediment cap.

Region 10 believes that this biological indicators approach represents a noteworthy advance in establishing performance standards that can be used to evaluate and manage marine sediment restoration projects. EPA anticipates approving this document by September 1994.

For more information contact Karen Keeley, Region 10, at (206) 553-2141, or John Malek, Region 10, at (206) 553-1286.

ORD Activities

ORD-Duluth

Use of AVS in a Field Setting

ORD-Duluth recently completed a field study to determine the appropriateness of using acid volatile sulfide (AVS) in a field setting to predict the bioavailability of metals. Sediments collected from a pond were spiked with various concentrations of zinc and then returned to the pond so that the effects on benthic community structure could be observed. Results seen in the field were consistent with predictions made based on laboratory data. Where no effects were predicted, i.e., at metal:AVS ratios less than one, there was no observable effect on the benthic community structure. For more information contact Gary Ankley, ORD-Duluth, at (218) 720-5603.

Phototoxicity of PAHs

ORD-Duluth is currently conducting mechanistic laboratory studies to determine the phototoxicity of polycyclic aromatic hydrocarbons (PAHs) relative to the intensity of sunlight to which an organism is exposed, as well as the concentration of the PAH. The PAHs used in these experiments are fluoranthene, anthracene, and pyrene. Researchers hope to develop a joint toxicity model to make hazard predictions. Contact Gary Ankley, ORD-Duluth, at (218) 720-5603.

Workgroup Formed for Sediment TIEs

A workgroup has recently been formed to continue research on sediment toxicity identification evaluations (TIEs). The workgroup consists of members from ORD-Duluth, Narragansett, and the National Biological Survey. The members hope to develop an advanced methods document for sediment TIEs within the next year and a half. For more information contact Gary Ankley, ORD-Duluth, at (218) 720-5603.

ERL-Narragansett

EMAP-E Statistical Summaries Available for Virginian and Louisianian Provinces

The Statistical Summaries for EMAP-Estuaries Virginian Province - 1991 and for the Louisianian Province - 1992 are now available for distribution. The Virginian Province summary contains results from annual monitoring of indicators of the ecological condition of bays and estuaries from Cape Cod, Massachusetts, to Cape Henry, Virginia, during July, August, and September of 1991. The Louisianian Province summary contains results from sampling the estuaries of the Gulf of Mexico during July and August of 1992. Data were collected at more than 300 stations and included water quality (temperature, salinity, water clarity, and dissolved oxygen concentrations), sediment contamination, sediment toxicity, benthic community structure, fish community structure, fish gross pathology, and fish tissue contamination. The data are used to estimate the current status of the ecological condition of Province resources and to provide a baseline for identifying future trends.

For copies of the Statistical Summaries, contact Darryl Keith, EMAP-Virginian Province Manager at ERL-Narragansett, (401) 782-3135; and John Macauley, EMAP-E Louisianian Province Manager, ERL-Gulf Breeze, at (904) 934-9353.

ERL-Gulf Breeze

EMAP-E Sediment Contaminant Distributions

The Environmental Monitoring and Assessment Program (EMAP) is a long-term program developed by the U.S. EPA in conjunction with the National Oceanic and Atmospheric Administration (NOAA) and the National Biological Survey. It will provide the public, scientists, and Congress with information that can be used to evaluate the overall health of the Nation's ecological resources. The EMAP-Estuaries (EMAP-E) component will provide information on the ecological condition of the Nation's estuaries as part of this larger program.

During the period from 1990 to 1993, EMAP-E investigated the ecological condition of the Virginian Province and the Louisianian Province, which encompass all coastal waters, bays, and estuaries from Cape Cod, Massachusetts, to Cape Henry, Virginia (the Virginian Province), and the estuaries of the Gulf of Mexico from Anclote Anchorage, Florida, to the Rio Grande, Texas (the Louisianian Province). Scientists collected data on sediment chemistry, benthic community structure, and fish pathology, as well as physical parameters such as salinity, temperature, and dissolved oxygen.

EMAP-E has examined nearly 1200 sediment samples from both the Virginian and Louisianian Provinces for 125 different contaminants, including PAHs, PCBs, pesticides, heavy metals, alkanes, and butyltins.

In general, contaminant concentrations in the sediment are at moderate levels. Thirty-four percent (±3 percent) of the Virginian Province and 6 percent (±2 percent) of the Louisianian Province have a concentration of any contaminant above the Effects Range Medium (ERM) criterion. The ERM criterion is the concentration of a contaminant that will result in ecological effects approximately 50 percent of the time based on scientific literature studies. In the Virginian Province, ERM values are exceeded for PAHs in 1 percent (±1 percent) of the sediments; for PCBs, less than 1 percent; for pesticides, 1-2 percent; and for heavy metals, 25-33 percent.

A more protective indicator of contaminant concentrations is the Effects Range Low (ERL) criterion, which is the concentration of a contaminant that will result in ecological effects about 10 percent of the time. In the Virginian Province, sediments exceed the ERL values for any contaminant in 65-82 percent of the estuarine area. PAHs exceed this criterion in 6 to 9 percent of the sediments; PCBs, in less than 1 percent of the sediment; pesticides, in 10-15 percent of the sediments; and heavy metals, in 65-80 percent of the sediments.

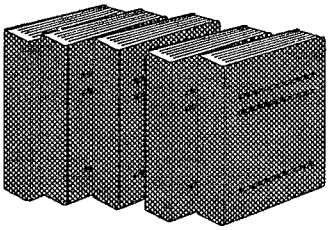
EMAP-Estuaries
Biogeographical Provinces
Continental United States

Louisianian Province sediments rarely exceed the ERM criterion. PAHs exceed the criterion in less than 1 percent of the sediments, and mercury exceeds the criterion in 2 percent of the sediments. There are no exceedances for PCBs, pesticides, or other heavy metals. Tributyltin (TBT) and alkanes were also measured in the Louisianian Province, although no criteria exist for these contaminants. Three to four percent of the sediments had TBT concentrations greater than 5 ppb and 8-9 percent had total alkanes concentrations greater than 7000 ppb. Using the more protective ERL criterion in the Louisianian Province, PAHs exceed the criterion in 3 to 4 percent of the sediments, pesticides in 23-34 percent of the sediments, and heavy metals in 11-22 percent of the sediments.

There are distinct differences in the suites of contaminants in the two provinces. The Virginian Province is characterized by industrial contaminants and some urban pesticides (e.g., chromium, zinc, DDT, and chlordane). The Louisianian Province is characterized primarily by agricultural contaminants (e.g., dieldrin, chlordane, mercury, and arsenic).

Sediment toxicity reflects the bioavailability of contaminants and directly demonstrates the potential for effects on aquatic life. Nineteen percent (±3 percent) of sediments in the Virginian Province were toxic to test animals exposed to the sediments for 10 days. Toxicity is defined as greater than 15 percent mortality during the exposure. Sediments in the Louisianian Province are toxic in 9 percent (±3 percent) of the estuarine area.

EMAP-E scientists also analyzed data on fish tissue and water quality. These results will be published in a Report to Congress in the fall. For more information on the EMAP-E program, contact Kevin Summers, ERL-Gulf Breeze, at (904) 934-9244.



Availability of Toxicity Test Manuals

As part of EPA's Proposed Contaminated Sediment Management Strategy, all EPA program offices have agreed to use consistent chemical and biological test methods to determine whether sediments are contaminated. Solid-phase acute sediment toxicity tests and bioaccumulation tests, selected by the EPA's Sediment Tiered Testing committee, have been developed for Agency-wide use in assessing sediment quality. The tests selected are:

1) Ten-day freshwater acute toxicity test using *Hyalella azteca* and *Chironomus tentans.*
2) Twenty-eight day freshwater bioaccumulation test using *Lumbriculus variegatus.*
3) Ten-day marine and estuarine acute toxicity test using the amphipods *Ampelisca abdita, Rhepoxynius abronius, Hyalella azteca, Eohaustorius estuarius,* and *Leptocheirus plumulosus.*
4) Twenty-eight day marine bioaccumulation test using *Macoma nasuta* and *Neries* spp.

The documents are currently being printed, and copies will be distributed by EPA's Center for Environmental Research Information (CERI) in mid-October. The two methods documents are titled *Methods for Measuring the Toxicity and Bioaccumulation of Sediment-Associated Contaminants with Freshwater Invertebrates* (EPA 600/R-94/024) and *Methods for Measuring the Toxicity of Sediment-Associated Contaminants with Estuarine and Marine Amphipods* (EPA 600/R-94/025). To obtain copies of the methods documents call CERI at (513) 569-7562.

The marine bioaccumulation method is available in a separate document entitled *Guidance Manual: Bedded Sediment Bioaccumulation Test* (EPA/600/x-89-302).

Creature Feature answer: *Isurus oxyrinchus*, Shortfin mako shark. This baby weighed in at 658 lbs, caught by none other than EPA's Chris Zarba.

CREATURE FEATURE:

Name the Genus and species of this flesh-eating voracious predator. (Hint: it's not the one with the trendy aqua socks). Answer on p. 9.

Announcements

Call for Papers

The Sixth Federal Interagency Sedimentation Conference will be held on March 10-14, 1996, in Las Vegas, Nevada. The theme for the conference is "Sedimentation Technologies for Management of Natural Resources in the 21st Century." The conference is being sponsored by the Subcommittee on Sedimentation of the Interagency Advisory Committee on Water Data. Topics include data collection, reservoir management, research and practical applications, sediment quality, modeling, coastal and estuary sedimentation, floodplain management, processes, watershed management, nonpoint source, remote sensing/GIS applications, data sharing, and wetland sedimentation. Abstracts are due by December 16, 1994. For more information contact: Jerry Bernard, Technical Program Chairman, P.O. Box 2890, Washington, DC 20013. (202) 720-5356.

Symposium on Ecological Risk Assessment: Use, Abuse and Alternatives

This symposium will be held on November 15-16, 1994, in Corvallis, Oregon. The purpose of this symposium is to explore the philosophical basis for the use of risk assessment in solving ecological problems.

The symposium is being sponsored by the Center for Analysis of Environmental Change.

For more information contact:
Conference Assistant
College of Forestry
Oregon State Univesity
Corvallis, OR 97330
Tel: (503) 737-2329
FAX: (503) 737-2668

Gulf of Mexico Symposium

The Gulf of Mexico Program is announcing the Third Biennial Gulf of Mexico Symposium to be held March 29-April 1, 1995, in Corpus Christi, Texas. The symposium, "Steering a Course to the Future", is an opportunity for scientists, teachers, students, citizens, industry, and government officals to discuss and learn about the issues relating to the Gulf.

Opportunities for making oral and poster presentations are available. For more information on participating in or attending the symposium, please call 1-800-699-GULF.

Call for Abstracts

The National Estuary Program Coastal Technology Transfer Conference will be held February 13-16, 1995, in New Orleans, Louisiana. The conference is being hosted by the U.S. EPA and the Barataria-Terrebonne National Estuary Program. Abstracts are due September 30, 1994. For more information contact Betsy Tam, Oceans and Coastal Protection Division, U.S. EPA, 401 M Street, SW, Washington, DC 20460. (202) 260-6466, FAX (202) 260-9960.

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