National Oceanic and Atmospheric Administration

Scientific Programs to Support Coastal Ocean Decisionmaking



October 1988 Office of Oceanography and Marine Assessment Charles N. Ehler, Director Rockville, Maryland

U.S. Department of Commerce C. William Verity, Secretary

National Oceanic and Atmospheric Administration William E. Evans Undersecretary for Oceans and Atmosphere and NOAA Administrator

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Introduction

Through its Office of Oceanography and Marine Assessment (OMA), the National Ocean Service of the National Oceanic and Atmospheric Administration provides decisionmakers with comprehensive scientific information on characteristics of the oceans and of coastal and estuarine areas of the USA. This information ranges from strategic, national marine environmental quality assessments to real-time information for navigation and hazardous materials spill response.

OMA's investigations are carried out through six major programs: 1) Tides and Water Levels Program, including the Next Generation Water Level Measurement System (NGWLMS); 2) Estuarine and Coastal Circulation Program; 3) National Status and Trends Program; 4) Strategic Assessment Program; 5) Hazardous Materials (HAZMAT) Response Program; and 6) Outer Continental Shelf Environmental Assessment Program (OCSEAP). These projects are implemented through OMA's three major divisions: the Physical Oceanography Division, the Ocean Assessments Division, and the Ocean Systems Division.

Using sophisticated monitoring and data-handling systems and



innovative computer-modeling and mapping capabilities to obtain and process accurate and reliable data, OMA's scientific programs use the results to develop a range of reports and other publications essential to understanding and evaluating trends in coastal and estuarine environments. These publications include real-time tidal, waterlevel and circulation data reports, forecasts, and data atlases; technical reports on physical oceanography and coastal ocean pollution; and a set of strategic assessment data atlases summarizing the best available information on physical and biotic environments, living marine resources, economic activities, and other indicators of environmental quality of the nation's coastal oceans.

OMA's Hazardous Materials Response Program provides critical scientific and technical support to other Federal, state, and local agencies for dealing with accidents involving hazardous materials in coastal and estuarine areas. The Outer Continental Shelf Environmental Assessment Program reports on its extensive scientific studies of the diverse habitats and living marine resources of Alaska's coastal and estuarine waters.

This pamphlet describes activities, services, and information products provided by OMA programs in support of decisionmaking on coastal ocean issues. For general information on the OMA, write to Charles N. Ehler, Director, Office of Oceanography and Marine Assessment, 6001 Executive Boulevard, Rockville, MD 20852; telephone: 301/ 443-8487. Through its National Water Levels Observation Network (NWLON), OMA monitors the rise and fall of water levels at about 225 coastal, estuarine, and Great Lakes locations throughout the USA; predicts the times and levels of high and low tides at 6200 locations; and provides water level information critical to national defense, safe navigation, marine boundary determination, environmental quality management, and coastal engineering.

About 75 water level stations have been in continuous operation for over 20 years. (The Presidio station in San Francisco has been operating since 1854.) About 40 of the NWLON stations have telephone telemetry, which provides real-time water level data for navigation, tsunami, and storm surge warnings. OMA's historical water level data base is the longest continuous geophysical data set available for assessing global climate change.

For more information, write to Mr. Harold M. Stanford (N/OMA1), Acting Chief, Physical Oceanography Division, NOAA/NOS, 6001 Executive Blvd., Rockville, MD 20852; telephone 301/443-2357.

Tides ABC

• Tides ABC is a software program designed for use with IBMcompatible personal computers and modems to acquire real-time water level data;

• Currently used at 26 stations, the program eventually will be installed at 225 stations along the U.S. coast;

• Actual water level is measured every 6 minutes and displayed for periods of 1-6 days; predictions are available for any 6-day period from 1983-1997;

• Video graphic displays compare actually recorded water levels to levels predicted in NOAA tide tables, and predicted water levels to anomalies.



Tide Tables

• Provide predicted time and height of tides for 200 coastal and estuarine reference stations worldwide; and for 6200 dependent secondary stations;

• Contain supplementary information regarding tide determinations, time and unit conversions, and some astronomical data;

• World coverage is published in four volumes: East Coast of North and South America (including Greenland); West Coast of North and South America (including the Hawaiian Islands); Central and Western Pacific Ocean and Indian Ocean; and Europe and Coast of West Africa (including the Mediterranean Sea);

• Principal users: commercial shippers, maritime pilots, recreational boaters, coastal engineers, disaster response teams, and the military.

Great Lakes Water Level Tables

• Include 52 water level stations located throughout the Great Lakes Basin;

• 24 stations equipped with state-of-the-art measurement systems with telephone telemetry to provide real-time data;

• Data products: telemetered water level data; hourly, daily, monthly, and yearly water level means and extremes; hydrography of lake levels; monthly mean elevations and discharge; monthly mean flow diversions; precipitation summaries for the basin; and benchmark descriptions;

• Principal users: International Joint Commission (IJC) for the Great Lakes, NOAA offices, research institutions for climate and environmental studies, U.S. Army Corps of Engineers, and other Federal agencies.

SEATTLE, WASHINGTON, 1987 Time and Height of High and Low Tides MAY JUNE Time Time Height Height Time Height Time Height Day Dav Dav Day h m ft m h m ft m 7.60 00 49 6.90 16 00 36 1 02 21 1 2.10 2.30 7.50 2.30 16 02 37 6.60 2.00 05 31 9.90 Sa 05 09 10.90 M 06 13 F 3.00 3.30 8.80 2.70 Tu 07 05 9.20 2.80 12 50 -1.10 -0.30 12 42 -3.30 -1.00 13 44 -0.60 -0.20 14 08 -1.30-0.4020 27 20 25 12.20 21 35 12.60 11.10 3.40 3.70 11.50 3.50 21 40 3.80 2 01 36 7.30 2.20 17 01 36 7.80 2.40 2 03 21 7.10 2.20 17 03 49 5.50 1.70 Sa 06 03 9.40 2.90 Su 05 56 10.40 Tu 07 08 3.20 8.20 2.50 w 08 28 8.30 2.50 13 31 -0.70 -0.20 13 34 -2.70 -0.80 14 28 0.20 15 01 0.10 0.40 0.10 21 22 11.00 3.40 21 24 12.10 3.70 22 13 11.40 3.50 22 22 12.40 3.80 3 02 34 7.50 2.30 18 02 45 3 04 30 6.50 2.00 7.60 2.30 18 04 58 4.10 1,20 06 39 8.90 Su 2.70 м 06 57 9.60 2.90 08 17 7.50 2.30 Th 10 05 7.60 2.30 14 16 -0.20 -0.10 14 27 -1.80 -0.50 15 14 1.10 0.30 15 59 2.20 0.70 22 15 10.90 3.30 22 18 12.10 3.70 22 49 11.30 3.40 23 03 12.10 3.70 03 43 7.60 19 06 00 4 2.30 19 04 05 1.70 7.00 2.10 4 05 22 5.50 2 60 0.80 M 07 30 8.40 2.60 Th 09 43 Tu 08 13 8.60 7.10 2.20 F 11 53 7.60 2.30 2.60 15 07 0.50 0.20 15 29 -0.50 -0.20 16 03 2.20 0.70 17 01 3.90 1.20 23 14 10.80 3.30 23 12 12.00 3.70 23 21 11.20 3.40 23 42 11.80 3.60

Sample page from the NOS Tide Tables.

Next Generation Water Level Measurement System (NGWLMS) Program

The NGWLMS is an integrated water level measurement, data acquisition, data transmission, processing, analysis, and information dissemination system that will replace the existing NWLON by 1992.

The NGWLMS will consist of acoustic water level sensors; microprocessor-based data acquisition and collection field units; telephone and satellite telemetry communications links; and a central data collection, processing, and dissemination system located in OMA offices in Rockville.

Since 1986, 20 prototype water level measurement units have been evaluated in the field and used as abasis for specifications of the production units. About 50 of the production units will be installed each year for the next four years. The OMA is currently working with NOAA's Geodetic Research and Development Laboratory to create a system to measure absolute sea level at NGWLMS stations that have been leveled geodetically through techniques based on the Global Positioning System (GPS) and Very Long Baseline Interferometry (VLBI). Some NGWLMS stations will become part of NOAA's Absolute Sea Level Monitoring Network, designed to monitor global climate change.



Communications options provided by new water level measurement system.



New global sea level monitoring network will include 250-300 monitoring stations, distributed throughout both northern and southern hemispheres.

For more information, write to Dr. Donald C. Beaumariage (N/OMA4), Chief, Ocean Systems Division, NOAA/NOS, 6001 Executive Blvd., Rockville, MD 20852; telephone: 301/443-8026.

Estuarine and Coastal Circulation Program

OMA uses the latest remote acoustic measurement technology and numerical modeling methods to provide the Nation with improved water circulation information within estuaries and along coastal areas. This includes real-time current data, tidal current predictions at 2870 locations, and model-generated circulation atlases.

OMA has the most extensive existing set of circulation data for the Nation's estuaries and coastal ocean. Circulation models have been applied successfully to the Columbia River and the Delaware River and Bay. Other applications include Cook Inlet, Long Island Sound, Charleston Harbor, and Miami Harbor.

Results of real-time measurements and circulation modeling will be used to develop new products; to update NOAA current prediction tables; and to produce circulation atlases for the nation's coastal areas.

For more information, write to Mr. Harold M. Stanford (N/OMA1) Acting Chief, Physical Oceanography Division, NOAA/NOS, 6001 Executive Blvd., Rockville, MD 20852; telephone: 301/ 443-2357.

Remote Acoustic Doppler Sensing (RADS) System

• Provides continuous real-time vertical profile measurements of currents based on remote acoustic measurement of water column;

• Consists of four bottom-mounted acoustic transceivers that emit pulsed high-frequency acoustic energy into the water column; records the Doppler shift of the return signal through microprocessor-based data acquisition and control units;

• Monitors accuracy of tidal current predictions, supports surveys for new predictions, and tests numerical circulation models of the Nation's coastal and estuarine waters.



RADS — Remote Acoustic Doppler Sensing Unit.



Acoustic Doppler Current Profiler—Principle of operation.

Circulation Modeling

• Computer-based numerical hydrodynamic modeling techniques describe total water circulation including the effects of tides, weather, and river flows;

• Improves traditional tide and tidal current predictions, which are based only on astronomical factors, and reduces costs of producing circulation information by reducing expensive field operations;

• Greatly improves spatial resolution of predictions; expands range of predictions to include areas other than those where data were obtained;

• Provides means to simulate circulation and water level changes for particular meteorological and tidal conditions. Simulations can be used to predict pollutant flows under different conditions to aid in cleanup and habitat protection;

• Products include circulation data atlases, realtime circulation data, and 6- to 36-hour water level and circulation forecasts.

• Show predicted times of maximum and minimum currents, along with speed and direction, for 55 coastal and estuarine reference stations throughout North America and Asia; and for about 2815 dependent secondary locations;

• Contain supplementary information on winddriven currents, coastal tidal currents, rotary currents, and current diagrams for selected locations;

• Predictions published annually in two separate volumes: Atlantic Coast of North America and Pacific Coast of North America and Asia;

• Principal users: maritime pilots, commercial shippers, recreational boaters, coastal engineers, disaster response teams, and the military.

Currents ABC

• A software program for use with IBM-compatible personal computers and modem to acquire real-time water current velocity from a Remote Acoustic Doppler Sensing (RADS) system;

• Interrogates RADS stations on demand and displays current data profiles of the water column for the previous 36 hours; the program generates graphic and tabular information for video and print display;

• Provides real-time information and predictions for use in navigation, channel dredging, search and rescue operations, and oil and hazardous materials spills response.

Tidal Circulation and Water Level Atlases

• Model-generated predictions of currents and water levels of major USA estuaries. Currents are depicted throughout estuaries, not just at locations where data are collected. The *Delaware River and Bay Tidal Circulation and Water Level Atlas* (1987) is the first in this new line of products;

• Tidal circulation and tidal height charts in the atlases show speed, direction, and height of tide for each hour of an average tidal cycle; charts are used to determine height of tide and circulation of tidal current for any time of any day at numerous locations throughout the body of water depicted in the atlas.

• Atlases show current data for many more locations than traditional Tidal Current Charts, which atlases will eventually replace. New data also include locations of special navigational and environmental interest where direct current measurements cannot be made using traditional instrumentation;

• Mean tidal height predictions for the first time are illustrated graphically over entire waterway for each hour of tidal cycle.

National Status and Trends Program

Since 1984, OMA's National Status and Trends Program has monitored the concentrations of toxic chemicals and trace elements in bottom-feeding fish, shellfish, and sediments at approximately 150 locations around the coastal USA. The goal of the program is to determine the status and long-term general trends of environmental quality in these estuarine and coastal areas.

The National Status and Trends Program includes several key components:

- Mussel Watch Project
- Benthic Surveillance
 Project
- Consequences of Contaminants Program
- Historical Trends Assessment Program
- Quality Assurance Program

Samples collected annually are analyzed to determine levels of synthetic chlorinated compounds (e.g., DDT), polychlorinated biphenyls (PCBs), polynuclear aromatic hydrocarbons (PAHs), and toxic trace elements (e.g., mercury and lead). Results from special projects in Long Island Sound, the Southern California Bight, and the southeastern U.S. will be used to assess the value of a denser national network of sampling sites and more frequent sampling.

A "specimen bank" of samples is being created using extra samples collected each year from about 10 percent of the sites and storing them at the National Bureau of Standards for future, retrospective analyses. A related program of directed research examines relationships between contaminant exposures and indicators of biological response in fish and shellfish.

All sampling and analysis conducted within the program are performed according to rigorous standards of quality assurance.

Related research focuses on biological consequences of contaminant exposure and on identification of meaningful measures of biological effects.

For more information, write to Dr. Andrew Robertson (N/ OMA3), Chief, Ocean Assessments Division, NOAA/NOS, 11400 Rockville Pike, Rockville, MD 20852; telephone: 301/443-8933.



Historical Trends Assessment Program

• Issues national assessments of PCB and chlorinated pesticide contaminant body burden in U.S. marine and estuarine fishes and invertebrates;

• Prepares historical assessments of environmental quality for specific regions. Current efforts are concentrated on the Southern California Bight, San Francisco Bay, and the Oregon Coast;

• Identifies biological responses to changes in chemical concentrations.

Consequences of Contaminants Program

• Focuses on the risks of contamination to marine resources and human health, as well as on methods by which the consequences of contaminants can be quantified and predicted;

• Determines the effects of contaminants on reproduction and larval development in fish and shellfish;

• Examines historical data for evidence of contaminant effects on population fluctuations in marine resources and for correlation of contaminant input with past trends in population;

• Quantifies the risk of gastroenteritis from consumption of raw shellfish.

Quality Assurance Program

• Ensures that all 'NOAA laboratories, contractors, and grantees that make quantitative measurements under the National Status and Trends Program conform to established quality assurance guidelines;

• Ensures that all proposals that include measurements of toxic organic chemicals and trace elements in sediments, water, or tissues; or measurements of other water quality parameters contain a quality assurance plan that conforms to these guidelines;

• Enhances intercomparability of results from the many research and monitoring activities of NOAA; ensures objective evaluation and high levels of confidence and reliability for marine environmental quality data.

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Benthic Surveillance Project

• Monitors toxic pollutants in surface sediments and in tissues of shellfish and selected bottomfish species. Sediments and sessile shellfish are measured because they are known to be reservoirs of contaminants; bottomfish can be a reliable indicator of pollutant levels near the sea floor;

• 50 sites along the coastal USA, including Alaska, are monitored annually. Both urban and industrial locations are sampled, as well as several pristine areas, which serve as reference sites;

• Surface sediments are analyzed for trace elements, PAHs, PCBs, chlorinated pesticides, coprostanol (a chemical tracer of sewage), grain size, and organic carbon and carbonate;

• Bottomfish are collected using "otter" trawls and are analyzed for trace elements. Other data are recorded, such as weight, length and visible lesions.



National Status and Trends Program Benthic Surveillance sites—Long Island Sound to the New York Bight.

Mussel Watch Project

• Measures toxic chemicals in both sediments and bivalve molluscs taken from the same area. Sentinel organisms, such as mussels, are sampled for contamination since they readily accumulate and retain contaminants;

• Mussels or oysters are collected from 150 sites nationwide, including Alaska and Hawaii, from November through March;

• Bivalve molluscs are analyzed for trace elements, PAHs, PCBs, and chlorinated pesticides. Other data collected include size, weight, gonadal index, and lipid content;

• Surface sediment samples from the mussel watch site are taken in conjuction with bivalve sample and analyzed for the same group of contaminants. Sediments are longer term integrators of contaminants.



National Status and Trends Program Mussel Watch sites—Southern California and Hawaii.

Assessment

Program

OMA collects, analyzes, synthesizes, and distributes comprehensive information on the use of the coastal and oceanic resources of the USA to identify compatibilities and con-

Strategic

flicts among multiple uses and to help determine research needs and priorities.

It has already published a series of thematic data atlases of major regions of the Exclusive Economic Zone, including the East Coast and Gulf of Mexico. A thematic atlas of the Bering, Chukchi, and Beaufort seas is in press, and one for the West Coast of North America is in preparation.

OMA maintains large data bases on physical charac-teristics of coastal and estuarine areas, on the distribution of biological resources and habitats within these areas, and on economic activities and their pollutant discharges. These individual data bases are currently being integrated in a user-friendly, microcomputerbased geographical information system that will facilitate accession and analysis of the information by outside users.

For more information, write to Dr. Andrew Robertson (N/ OMA3), Chief, Ocean Assessments Division, NOAA/NOS, 11400 Rockville Pike, Rockville, MD 20852, or telephone: 301/443-8933.

Living Marine Resources Life History Data Base

• Since 1982, the Strategic Assessment Program has been mapping the spatial and temporal distributions of species life histories (adult, juvenile, and reproductive life stages) within the regions covered by the Program's four strategic assessment data atlases;

• Additional information on areas of abundance, commercial and recreational harvesting, and migrations and movements is also included, as appropriate. Each map is accompanied by a summary of the legal status and management, population size and trends, habitat preferences, life history, behavior, and other attributes. Each species map is translated into digital form and entered into a computerized data system that is designed to provide straightforward access to information on both individual species and groups of species.

• The work is a cooperative effort of scientists and analysts from NOAA's National Ocean Service and National Marine Fisheries Service; other state and Federal agencies; and academic institutions.



Computer-generated map based on the Living Marine Resources Data Base— the distribution of an index of biological importance for 16 selected species of invertebrates in the Gulf of Mexico.

Strategic Assessment Data Atlases

• NOAA's strategic assessment data atlases synthesize the best information available on important characteristics of selected major coastal regions to provide decisionmakers in government agencies and the private sector with a source of accurate environmental facts for use in identifying and resolving coastal and oceanic resource-use conflicts;

• The strategic information presented in these atlases is intended to complement—not replace—the detailed, tactical information required to make site-specific decisions;

• The data atlases generally address six themes: physical environments, biotic environments, living marine resources, economic activities, environmental quality, and jurisdictions;

• Of the four data atlases planned, three have now been published: Eastern United States Coastal and Oceanic Data Atlas (1980); Gulf of Mexico Strategic Assessment Data Atlas (1985); Bering, Chukchi, and Beaufort Seas Strategic Assessment Data Atlas (1988).Publication of the West Coast of North America Strategic Assessment Data Atlas is planned for 1990.



Sample page from the Bering, Chukchi, Beaufort Seas Strategic Assessment Data Atlas (1988).

National Estuarine Inventory (NEI)

• A inventory of USA estuarine resources that facilitates comprehensive and timely comparison, analysis, and assessment of the use and health of the Nation's estuarine resources;

• Identifies 92 estuaries, with approximately 32,000 square miles of estuarine surface water and an average daily freshwater inflow of nearly two million cubic feet per second. Together these estuaries account for approximately 90 percent of the estuarine surface water and freshwater inflow along each of the three major coastal areas of the contiguous USA;

• Volume I (1985) contains information on physical and hydrological characteristics of each estuary; volume II (1987) presents land use information for each of the 92 estuaries for 7 categories and 24 subcategories of land use.

Inventory of Outdoor Public Recreation Facilities in Coastal Areas

• Presents detailed information on distribution and characteristics of publicly provided marine recreation activities in coastal areas of the contiguous USA (Great Lakes, Alaska, and Hawaii are currently excluded);

• Provides survey information from more than 1,700 Federal, state, and local agencies in 22 coastal states;

• Preliminary results show nearly 30,000 distinct public outdoor recreation areas located in the 328 counties within coastal areas of the USA;

• In fiscal year 82, of approximately \$7.2 billion in public funds spent on outdoor recreation in the 22 coastal states, \$4.5 billion was allotted to outdoor recreation facilities in the 328 coastal counties. Local agencies provided fifty-nine percent of the funding.



National Estuarine Inventory Data Atlas, Volume 1: Physical and Hydrologic Characteristics, sample page. 12

National Wetland Inventory

• A national assessment of the distribution and areal extent of coastal wetlands (excluding the Great Lakes) of the contiguous USA;

• Compilation based on existing Federal, state, and local wetland inventories describing wetlands in 242 of approximately 330 coastal counties in the contiguous USA;

• Existing data indicate more than 11 million acres of coastal wetlands in the contiguous USA, with almost half occurring in the Gulf of Mexico region;

• Consolidation of existing data into four general wetland categories: Salt marsh (4.4 million acres), fresh marsh (1.5 million acres), tidal flats (0.2 million acres), and swamp (5 million acres);

• In conjunction with the National Marine Fisheries Service, OMA product uses grid sampling techniqueas a reasonable alternative to more expensive and time-consuming techniques, with a acceptable degree of accuracy and detail;

• Data will eventually be integrated into the National Estuarine Inventory, described above.



Municipal wastewater from Publicly Owned Treatment Works discharged into estuarine and coastal waters, circa 1984 (from the National Coastal Pollutant Discharge Inventory).

National Coastal Pollutant Discharge Inventory (NCPDI)

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• A comprehensive, national assessment of pollutant discharges entering the estuarine, coastal, and oceanic waters of the contiguous USA;

- Covers three coastal regions: East Coast, West Coast, and Gulf of Mexico;
- Estimates of pollutant discharge are made for nine source categories: 1) point sources, 2) urban

storm runoff, 3) nonurban nonpoint runoff, 4) river-borne pollutants entering coastal areas, 5) oil and gas operations, 6) dredging operations, 7) marine transportation operations, 8) accidental spills, and 9) irrigation return flow;

• Nine types of pollutants are included in the NCPDI: 1) oxygen-demanding materials, 2) particulate matter, 3) nutrients, 4) heavy metals, 5) petroleum hydrocarbons, 6) chlorinated hydrocarbons, 7) pathogens, 8) sludges, and 9) wastewater.

Hazardous Materials Response Program

On-Scene Spill Model (OSSM)

• An interactive numerical model that predicts the movement and spreading of pollutants in the marine environment;

• Projects the trajectory of spilled pollutants based on analysis of coastal outlines, shoreline descriptors, bathymetry, numerical circulation models, statistical climatological simulations, location and type of spilled substance, oceanographic and meteorological observations, and other environmental data;

• Written in standard Fortran 77, the program is used on various systems in the USA, Kuwait, Australia, and Canada.

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On-Scene Spill Model print-out for an oil spill off Anacortes, Washington. Numbers indicate the distribution of oil in water.

Each year, OMA provides emergency scientific support to U.S. Coast Guard On-Scene Coordinators at about 200 spills of oil and hazardous materials into coastal environments. This support includes projections of spill trajectories, analyses of chemical hazards, and assessments of the sensitivity of coastal environments to spills.

The program provides similar support to the EPA's Regional Offices during emergency responses and cleanup at abandoned hazardous waste sites in coastal areas. A number of ocean and atmospheric products and operations have been developed and implemented to assist in these scientific support activities.

To fulfill its responsibility to the Secretary of the U.S. Department of Commerce, as a Federal trustee for living marine resources, OMA also conducts assessments of damages to coastal and marine resources from discharges of oil and hazardous materials.

For more information, write to Dr. Andrew Robertson (N/ OMA3), Chief, Ocean Assessments Division, NOAA/NOS, 11400 Rockville Pike, Rockville, MD 20852; telephone: 301/443-8933.

Computer-Aided Management of Emergency Operations (CAMEO)

• A mobile, microcomputerbased information management and communications system for use at the scene of chemical accidents; operated directly by trained firefighters or other first responders;

• Links detailed city maps, which include industrial and chemical storage facilities, with a chemical database identifying characteristics, response options, and safety measures for 2,629 commonly transported chemicals; and with an air plume model for estimating downwind hazard zones.

Response Information Data Sheet v 101 CHEMICAL HAME CHLORINE CAS NUMBER 7782505 Chlorine is a greenish yellow gas with a pungent suffocating odor. It is used to purify water, bleach woodpulp, and to make other chemicals. It is toxic by inhalation. It is slightly soluble in water. HAZARDS It reacts explosively or forms explosive compounds, with many common chemicals. It is normally shipped as a liquid in cylinders or FIRE PROPERTIES tank cars. Contact with liquid should be avoided as it can cause HEALTH HAZAROS frostbite. The liquid readily vaporizes to a gas. Chlorine does not PROTECTIVE CLOTHING burn but will support combustion (lets other articles burn). The FIRST vapors are much heavier than air and tend to settle in low areas. NON-FIRE RESPONSE Contact CHEMITREC to activate chlorine response team (800 424-9300 or 202 483-7616). ((C)AAR, 1986) CHEMTREC (800 424-9300 OR 202 483-7616)

Part of CAMEO display screen showing general information about chlorine.

Areal Locations of Hazardous Atmospheres (ALOHA)

• An air plume model for estimating movement and dispersion of a pollutant gas or vapor resulting from a spill;

• Estimates pollutant concentrations downwind of the spill source at different times after release;

• Runs on a microcomputer or in conjunction with the Computer-Aided Management of Emergency Operations (CAMEO) Program.



Areal Locations of Hazardous Atmospheres (ALOHA) display showing downwind pollutant concentration resulting from a hypothetical spill. The plume has been plotted on a gridded city map to indicate the actual dispersion threat zone.

Circulation Spill Models

• Three circulation models— Streamline Analysis of Currents (SAC), Diagnostic Analysis of Currents (DAC), and Wind-Driven Analysis of Currents (WAC)—are used to establish circulation patterns, which are then applied to the On-Scene Spill Model (OSSM);



Tanker Vessel Amoco Cadiz oil spill off the coast of France.

• SAC is used for developing river-flow and tidal-current patterns; DAC is used for producing current patterns in areas where geostrophy is important, such as areas along the continental shelf; and WAC solves the time-dependent, nonlinear, shallowwater wave equations;

• All three circulation models are available on the CSOS and XENIX IBM 9000 computers, as well as on the Macintosh.

Port Studies

• Consists of studies of oil and hazardous substances planning and response considerations for major ports in the USA including: Portland, ME; Narragansett Bay, RI; Boston, MA; Philadelphia, PA; Baltimore, MD; Hampton Roads, VA; Jacksonville, FL; Los Angeles, CA; Tampa, FL; Mobile, AL; and New York, NY;

• Each port study includes several maps and analyses of the distribution of major waterfront petroleum terminals and facilities for bulk storage of chemicals; identifies routes and materials transported by water, rail, trucking, and pipeline industries; determines spatial distribution of historical pollution incidents; includes hydrological and climatological considerations; reports the distribution of environmentally sensitive shorelines and biological resources at risk; identifies hazardous materials and describes the chemical behavior of those materials; and identifies pollution response strategies and recommendations for contingency planning;

• Port Studies are a valuable tool used at Federal, state, and local levels by Federal On-Scene Coordinators, NOAA Scientific Support Coordinators, fire departments, pollution response planners, and natural resource and environmental quality management agencies.



Microcomputer-generated Port Study map indicating the distribution of natural resources.

Outer Continental Shelf Environmental Assessment Program (OCSEAP)

Since 1974, OMA has managed for the Minerals Management Service (MMS), U.S. Department of the Interior, a large scientific program that makes environmental assessments of the effects of oil and gas leasing on the Alaskan outer continental shelf. OMA also provides MMS with scientific data and information needed to predict environmental disturbances and to resolve multiple-use conflicts associated with offshore oil and gas development in Alaska.

The OCSEAP has conducted environmental research and assessment activities in all the Alaskan Outer Continental Shelf Planning Areas proposed for leasing by the MMS, including the Arctic Ocean, the Bering Sea, and the Gulf of Alaska.

General areas of investigation include development of models of pollutant distribution; transport and fate; and studies on the abundance, distribution, and productivity of living marine resources and their sensitivities both to pollutants and to disturbances associated with oil and gas development.

For more information, write to Dr. Andrew Robertson (N/

OMA3), Chief, Ocean Assessments Division, NOAA/NOS, 11400 Rockville Pike, Rockville, MD 20852, or telephone 301/443-8933.

Environmental Assessments

• Studies on the distribution and abundance of living marine resources;

• Modeling of the distribution, transport, and fate of pollutants through use of: pollutant transport and weather modeling, circulation modeling, oil spill risk analysis, and trophic interaction models;

• Studies of the effects of contaminants—particularly those from offshore oil and gas lease areas—on living marine resources through use of environmental risk analysis and direct monitoring of living resources.

