INTERVIEW CHECKLIST

ORGANIZATIONAL INFORMATION (WHO)

- Agency (Name, Address)

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- Mandate

Environmental Reconnaissance, Sediment Contaminants

- Organizational Structure

Work Performed for Salton Sea Authority

- Sampling Programs:
  - Project/Program Description

An investigation of the physical and chemical characterization of sediments in and around Salton Sea, Imperial and Riverside Counties, California, was undertaken in the winter of 1998–1999. The study was implemented in two phases. The first phase sampled sediments on December 15 through 22, 1998, and analyzed contaminant concentrations and particle size distribution in the bottom sediment of the Sea plus approximately 1 mile up each of three of its main tributaries: the Whitewater, the Alamo, and the New rivers. Phase I sediment samples were collected from 42 grab sampling sites and 6 core sampling sites.

Based on results of the first phase of investigation, a second phase of sediment sampling was conducted from January 19 through 22, 1999, to further assess and measure contaminant concentrations and evaluate particle size distribution in the bottom sediment. This second sampling phase focused on the significant areas of interest identified during Phase I and included sediment sampling at 15 grab sites and 10 core sites.

MATERIALS AND METHODS

RESULTS AND DISCUSSION

  - Project/Program Contact

Richard A. Vogl, Principal Hydroeologist

  - Project/Program Purpose/Reason

Reconnaissance level investigation of sediment size distribution and sediment contaminant concentration throughout the entire Salton Sea.

LOCATION (WHERE)

- Where are the samples taken (lat/long, altitude, etc.)?

Too many to list. 73 sediment sampling locations throughout sea floor and three tributaries (Alamo River, New River, and Whitewater River).

- How are the sampling locations identified (e.g. GPS, Thomas Bros. Map, etc.)?

GPS readings for each sample location.

- What are the water body types (e.g. surface water: stream, canal, wetlands, etc.; groundwater)?

Seventy sampling locations were in open lake water; three were within open river water.

- What are the sampling point types (e.g. entry point to the distribution system, end of distribution line, etc.)?

Main tributaries, deltaic sediments, and open lake sediments.

SAMPLE MEDIUM (WHAT)

- What are the sampling categories/types (e.g. water, tissue, plant, sediment, etc.)?

Sediment.

- What are the parameters for each sample medium?

Each sediment sample was analyzed for particle size, total inorganic metals consisting of the California Code of Regulations 17 metals series (antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, lead, mercury, molybdenum, nickel, selenium, silver, thallium, vanadium, and zinc) using EPA Method 7000S, volatile organic compounds using EPA Method 8260, semi-volatile organic compounds using EPA Method 8270, chlorinated pesticides and PCBs using EPA Method 8081, organophosphate and nitrogen pesticides using EPA Method 8141, and chlorinated herbicides using EPA Method 8151. A number of sediment samples were also analyzed for chlorinated pesticides using EPA Method 8270 as a confirmatory measure.

- How many samples (of each parameter/category) are taken?

118 samples were analyzed for all listed parameters.

- What is the sample type (e.g. field sample, confirmation sample, repeat sample, etc.)?

Field samples.

- What is the digital format of the source medium?

Word, Excel, GIS.

DATE / TIME (WHEN)

- Starting date of the sampling – for each parameter (year/month/day)?

One time event, two phases. The first phase sampled sediments on December 15 through 22, 1998. A second phase of sediment sampling was conducted from January 19 through 22, 1999, to further assess and measure contaminant concentrations and evaluate particle size distribution in the bottom sediment.

- Sampling frequency (e.g. 24hrs cycle/weekly/monthly/other)?

One time event.

- Planned duration of sampling?

Two one week events.

SAMPLE COLLECTION METHOD (HOW)

- What is the method used to collect the sample - for each parameter (e.g. grab, pump, collection filter, etc.)?

A stainless-steel modified Birge-Ekman-style box sediment sampler, 15.24 cm by 15.24 cm by 15.24 cm in size (6 inches by 6 inches by 6 inches), was used to collect samples at the 57 grab sample locations of the 73 sampling sites.

The core samples were collected using an AMS stainless-steel soft sediment sampler that can produce a 5-cm (6-inch) diameter by 182-cm (6-foot) long square core. The corer can take up to 182 cm of undisturbed samples from soft sediment, provided that rocks or dense materials are not encountered. The AMS soft sediment sampler consists of two stainless steel, 182-cm (6-foot) long, right-angle-shaped sampler halves, each with a pointed lower end, that create a 5.08-cm (6-inch) square when locked together. One half contains a riveted sediment trap that engages when the sampler is pulled from the sediment. Sediment samples obtained using the stainless steel corer were collected from a boring advanced down to a maximum of 182 cm (6 feet) below ground surface (bgs), with samples for laboratory analyses taken at 30-cm (1-foot) intervals. As with the grab samples, these samples were transferred to clean, laboratory-grade glass jars using a stainless steel trowel that was cleaned between samples.

- What are the sample sizes?

For each grab and core sample, up to 24 ounces of material was retained for inorganic and organic chemical analyses, depending on sample recovery. Sediment samples were transferred directly from the sampling equipment into clean, laboratory-grade glass jars using a stainless-steel trowel.

- At what water level are the samples taken?

Sediment samples were collected at various depths within the lake (minimum 1 foot, maximum 52 feet). Second number in sample number denotes depth below water surface in feet.

- How are the samples described/identified?

The cores were carefully measured for total length and different layers of sediment without disturbing the sediment-water interface. Cored samples and grab samples were lithologically described and classified using the Unified Soil Classification System. Each sample was given a unique sample number using the prefix GB for grab samples and CR for cores followed by the sample number. The second number used represents the depth below the surface of the lake that the sample was collected, in feet, and the third number is the date the sample was collected (i.e. GB-1-34.5-121598 and CR6-18-122198).

SAMPLE ANALYSIS

- What is the sample analysis measurement type?

Percentage of constituents for grain size analysis (clay, silt, sand) and concentration in milligrams per kilogram or micrograms per kilogram.

- What is the sample analysis average period?

One to two week laboratory turnaround time.

- What is the precision and accuracy of each measurement method used?

Depends on analysis. Reported by analytical laboratory for each analysis.

- What are the quality assurance procedures and requirements?

A Quality Assurance Project Plan (QAPP) was prepared for the sampling program according to EPA protocols. The QAPP outlined the quality assurance procedures and requirements for all aspects of the project, sample collection, data collection, and laboratory analysis.

- What are the sample result valid indicators (indicate whether the sample met all the Quality Assurance and Quality Control Standards)?

The sample procedures and laboratory analysis were within the standards outlined in the QAPP. Duplicate samples were also collected to validate the sample results and were in general agreement with the primary sample results. The only exception to this was the slightly elevated laboratory detection limits for chlorinated pesticides. The detection limit problem resulted from the characteristics of Salton Sea sediments, which contain very high levels of organic carbon and sulfur. For each analysis, the laboratory attempted to achieve the lowest detection limit possible based on the available sample size and matrix sampled. In addition, for a number of these samples that were most likely to contain elevated pesticide concentrations, additional testing was performed with an alternative laboratory method that achieved a much lower detection limit.

REASON FOR SAMPLE COLLECTION (WHY)

- Reconnaissance, Trend Analysis, Permit Compliance, Pollution Event, Storm Event, Research, Other?

Reconnaissance.

FINDINGS

- What are the findings/results?

Sediments sampled on the bottom of the Sea consisted of silt, clay, and finer grained sands. The shallow sediment also included abundant barnacle shells and occasional fish bones. The surface sediment composition included a high percentage of sand outside Salton City and extending into the central, deeper parts of the Sea. Sand percentages near the mouths of the New and Alamo rivers were also high, as expected, from deposition of these heavier particles from higher velocity inflows into the Sea. The lower velocity Whitewater River delta, on the other hand, was predominantly silt. Silt was also abundant along the southwest near-shore area and along the shallow water bays near the New and Alamo rivers. A shallow layer of clay blankets the southwestern corner of the Sea and extends toward the center, near the deepest part of the Sea. Clay is also abundant near shore and offshore just north of Desert Shores. The majority of the deeper sediment sampled consisted predominantly of varied amounts of silt and clay, with lesser amounts of fine sand.

Concentrations of inorganic chemicals in the sediments were found to be higher in the northern part of the Sea. Concentrations were generally higher in the upper 30 cm (1 foot) of sediment. The chemical concentrations were compared against background and available sediment quality screening criteria commonly used in sediment assessment studies of saline environments: maximum "baseline value" for soils of the western United States (Severson and others, 1987; modified from Shacklette and Boerngen, 1984) and National Oceanic and Atmospheric Administration (NOAA, 1991) effects range low (ERL) and effects range medium (ERM). For selenium, California Regional Water Quality Control Board, San Francisco Region, criteria for wetlands creation (Wolfenden and Carlin, 1992) were used because no ERLs or ERMs exist. NOAA ERL and ERM levels were used as a preliminary screening tool to define apparent elevated concentrations within the Sea. Based on these screening criteria, the following chemicals were determined to be elevated and of potential ecological concern: cadmium, copper, molybdenum, nickel, zinc, and selenium, with the most elevated inorganic constituent being selenium.

Concentrations of cadmium ranged from 0.67 to 5.8 mg/kg. The highest reported concentrations of cadmium were found in the north-central part of the Sea. Concentrations of copper ranged from 8.1 to 53 mg/kg. The highest concentrations were found near the mouth of the Whitewater River. Concentrations of molybdenum detected in the north and central part of the Sea ranged from approximately 11 to 194 mg/kg. The range of reported concentrations for nickel was from 3.3 to 33 mg/kg. The highest concentrations of nickel were detected at the mouth of the Whitewater River and in the deeper portion of the Sea. The range of concentrations for zinc was from 5.4 to 190 mg/kg. The highest concentrations of zinc were found at the mouths of the Whitewater River and Salt Creek. Concentrations of selenium detected at the Sea ranged from 0.086 to 8.5 mg/kg. The highest concentrations of selenium were found just offshore of Desert Shores. In general, inorganic and organic chemical concentrations were elevated over much of the northern half of the Sea.

Elevated concentrations of organic chemicals were detected in sediment predominately in the northern part of the Sea. Of the 118 sediment samples analyzed for volatile organic compounds, 114 samples contained detectable concentration of acetone, carbon disulfide, and/or 2-butanone. These three detected chemicals are believed to be present as a result of natural biological processes occurring within Salton Sea sediment. Acetone concentrations ranged from 32 to 840 µg/kg. The highest concentrations of acetone were located near the mouth of the New River. Carbon disulfide concentrations ranged from 15 to 1,800 µg/kg. The highest concentrations of carbon disulfide were near the mouth of the Whitewater River. Concentrations of 2-butanone ranged from 11 to 150 µg/kg. The highest concentration of 2-butanone was located in the northern portion of the Sea, offshore from Salton Sea State Park.

Only two other sediment samples contained other detectable concentrations of volatile organic compounds, including o-xylenes, 1,3,5-trimethylbenzene, 1,2,4-trimethylbenzene, naphthalene, and n-propylbenzene. These chemicals appeared to be very localized and non-pervasive.

One of the most significant findings of this study was that semi-volatile organic compounds, chlorinated pesticides, PCBs, organophosphate and nitrogen pesticides, and chlorinated herbicides were not detected in the sediment samples analyzed. Although low concentrations of organochlorine pesticides may not have been detected in this study because of elevated reporting detection limits, a number of previously detected concentrations for these pesticides were above the laboratory detection limits for this study, yet nothing was detected even from our much larger data set.

- What is the validity of the findings?

High.

DATA SOURCE (WHO OWNS IT)

- Data Owner: Name, address, telephone number of organization to direct questions about the sample analytical results.

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- Sampling Entity: Name, address, telephone number of the organization to direct questions about the sample collection.

Same as above.

- Laboratory: Name, address, telephone number of the organization to direct questions about the laboratory analysis.
  What are the lab analysis methods for each parameter (accuracy and precision for each parameter!)?

Each sediment sample was analyzed for particle size, total inorganic metals consisting of the California Code of Regulations 17 metals series (antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, lead, mercury, molybdenum, nickel, selenium, silver, thallium, vanadium, and zinc) using EPA Method 7000S, volatile organic compounds using EPA Method 8260, semi-volatile organic compounds using EPA Method 8270, chlorinated pesticides and PCBs using EPA Method 8081, organophosphate and nitrogen pesticides using EPA Method 8141, and chlorinated herbicides using EPA Method 8151. A number of sediment samples were also analyzed for chlorinated pesticides using EPA Method 8270 as a confirmatory measure. The accuracy and precision are reported in the QA/QC documentation in each laboratory report and in the QAPP. These documents are available in the Salton Sea Authority project files.

Quality assurance methods?

See approved QAPP in Salton Sea Authority project files.

DATA AVAILABILITY/PUBLICATION

- How sensitive is the sampled data?

Not sensitive.

- In what format is the data available (digital, hard copy, etc.)?

Hard copy is available from Salton Sea Authority. Available digitally in PDF format from LFR as CD.

- Is it available to the public?

Yes. Hard copy through Salton Sea Authority or as PDF file from LFR.

ISSUES AND OPPORTUNITIES