

GENERAL SITE INFORMATION, CHARACTERISTICS, AND STATUS

Project Name	<u>PALOS VERDES SHELF</u>	ProjectID: 09-01
Last Updated:	07/16/01	
City:	Torrance	
County:	Los Angeles	
State:	CA	
Country:	USA	
Bodies of Water:	Coastal waters near Palos Verdes Peninsula, CA	
US EPA Region:	IX	
Status (Active, Complete, or Monitoring Only):	Active	
Date On NPL:	1989 (for Montrose Chemical site); Palos Verdes Shelf is not part of the NPL site.	
ROD/ESD Date:	N/A	
Operable Unit:	N/A	
Areas of Concern (length or acres):	17-27 square miles of the Palos Verdes Shelf and deeper ocean floor, off the coast of Southern California.	
Other Characteristics of Water Body:	<p>The major area of interest is the Palos Verdes shelf and slope located off the Palos Verdes peninsula which separates Santa Monica and San Pedro Bays. The shelf and slope are generally defined as the offshore area extending from Point Vicente southeast to Point Fermin. Three Los Angeles County Sanitation District sewer outfall diffusers discharge onto the shelf approximately two miles offshore of Whites Point in approximately 200 feet of water.</p> <p>The shelf varies in width from approximately 0.6-3.7 miles and extends offshore to the shelf break at water depths of approximately 230-330 ft. The bottom slope on the shelf generally increases with water depth, with slopes of approximately 1 to 2 degrees at water depths of 100-230 ft. The slope increases to approximately 6 to 7 degrees at depths of 230-330 ft. At the 330 ft. depth, the slope increases to 13 to 18 degrees. Mean wave heights are 3.2 ft. with significant wave heights greater than 3.2 ft. occurring only 45 percent of the time and wave heights greater than 4.9 ft. occurring only 18 percent of the time. Higher waves generally approach from the west to south. Subsurface currents on the shelf are generally low.</p>	
Contaminants of Concern:	DDT; PCBs	
Source of Contamination:	Transport of DDT through the Los Angeles sanitary sewer system outfall. Discharges of wastewater containing DDT originated on the 13 - acre Montrose Chemical site -- a plant that manufactured DDT. The DDT was manufactured from 1947-1971. Also, transport of PCBs reportedly occurred from a Westinghouse Electric facility (or facilities). DDT may also have originated from runoff from agricultural fields.	
Contaminated Area Physical Characteristics:	The native sediments of the shelf are silty sand. Since the first sewer outfall diffusers became operational in 1937, particulate matter discharged through the outfalls has settled out and built up an effluent-affected (EA) sediment deposit on the shelf and slope. This EA deposit which contains levels of organic matter and chemical contaminants higher than the native sediments is the focus. The EA deposit forms a band that extends from approximately the 100 ft. isobath offshore to water depths in excess of 1,300 ft. at a distance of approximately 1.9-2.5 miles offshore and in an alongshore direction from Point Fermin to an area northwest of Point Vicente, a distance of 7.5-9.3 miles. The EA deposit is absent from approximately the 100 foot water depth shoreward because of the higher wave energy. The most contaminated sediments on the shelf occur approximately 4 to 12 inches below the sediment-water interface.	
Type of Regulatory Action:	CERCLA investigation by EPA Region IX, started in 1996.	

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Overall Status Summary:

A natural resources damage suit against Montrose Chemical and six other firms was dismissed by a federal judge in early 1995 (the suit was subsequently reinstated). An EPA decision was made in 1996 to investigate these coastal waters under CERCLA as an extension of response actions at the Montrose site. The EPA decision was influenced by federal and state natural resource trustees. Highest contaminant levels of DDT and PCBs are reportedly in a 3 square mile area of sediments on the Palos Verdes Shelf. Capping is being evaluated. A fish consumption ban is in effect based on DDT and PCBs. Tests at Michigan State University in 1998 using marine sediments from the Palos Verdes Shelf have demonstrated biodegradation of DDT, suggesting a possible natural remedy.

In a June 7, 1999 presentation to the National Research Council (Reference E-113), a consultant for the PRPs described (1) the primary issues regarding the Palos Verdes Shelf, (2) EPA's position on characterization and remediation, (3) EPA's proposed capping remedy, and (4) the results of the PRPs analysis, as follows:

Primary Issues

- Fate and transport of organo-chlorine compounds (PCB and DDT metabolites) now located on the Palos Verdes Shelf;
- Human health and ecological risks associated with these compounds;
- Actions proposed by EPA to deal with these perceived risks; and
- Risks associated with EPA's proposed actions.

EPA's Position

- DDT and PCB compounds are leaking from the sediments;
- Fish (white croaker) eat benthic creatures that contain DDT and PCBs;
- Allegedly high ecological and human health risks; and
- Sediments on the Palos Verdes Shelf should be capped to reduce risks.

EPA's Proposed Capping Remedy

Discharging clean sediments from barges:

- in up to 200 ft of water;
- over an operating ocean outfall;
- on bottom slopes much steeper than any previous capping effort; and
- within a few minutes so as to achieve placement.

PRPs Analysis

- Negligible DDT is leaking from the sediments;
- DDT and PCBs are biodegrading in situ;
- Human health risk is actually insignificant;
- Studies show no sediment toxicity due to DDT;
- Steep bottom slopes make capping extremely risky; and
- Program is not in conformity with stated EPA policy.

Developments in the Year 2000 have included:

- In March 2000, EPA completed an Engineering Evaluation/Cost Analysis (EE/CA) for the Palos Verdes Shelf. As part of the EE/CA, EPA proposed a three-prong strategy of short-term

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actions to limit consumption of fish containing elevated levels of DDT and PCBs, including (1) enforcement of the commercial fishing ban and recreational catch limit for white croaker along the Palos Verdes coast, (2) educating people about fish consumption advisories, and (3) monitoring contaminant levels in commercially sold fish to evaluate the effectiveness of enforcement measures.

- In August 2000, EPA began a pilot in-situ capping project on an area of the Palos Verdes Shelf. Clean sediment was deposited, to provide a thin-layer cap to isolate the contaminants and reduce the amount of DDT and PCBs transferred to the water and marine life. The pilot project included evaluation of short-term results and cap placement methods. The EPA will use the data from this project, along with other relevant information, to decide whether to propose full-scale capping as a remedy for the Palos Verdes Shelf site.
- The first load of capping material was placed on August 2, 2000 and all cap placement activity was completed by September 14, 2000. Three discrete areas, or "cells," were capped. The field work for the baseline monitoring in the pilot capping cells was started in mid-May 2000, and the final post-cap monitoring activity was completed September 15th, shortly after the last load was placed. Analysis of data is still underway. A final report is expected in Summer 2001.

The three capping cells covered a total area of 135 acres (45 acres per cell). Water depths ranged from 150-200 feet. Projected cap thicknesses are 6 to 18 inches (measurements of actual post-placement thicknesses achieved are still being interpreted). About 135,000 cubic yards were placed, transported in 102 loads. Placement was by an 85 meter long split hull hopper dredge. The great majority of the material used for capping came from an on-going navigational dredging project in Long Beach Harbor, about one mile away from the capping areas. One of the three cells received 91,314 cy in an attempt to cover the cell completely with a cap of uniform thickness. The other cells were only partially capped in the center portions, receiving 13,895 cy and 29,834 cy respectively.

EPA reports that the following specific objectives are being addressed by this pilot project:

- Evaluating cap construction methodologies using two different cap materials;
- Evaluating related short-term impacts on the marine environment;
- Determining the effects of cap material, bottom slope, water depth, and placement method (e.g., conventional versus spreading) on displacement and/or resuspension of the in-place contaminated sediment; and
- Demonstrating the ability to monitor operations and assess cap placement impacts.

Upcoming activities in 2001 and beyond include (a) performance of supplemental coring activities on the in-place cap, b) long-term monitoring, c) issuance of a construction report by the Corps of Engineers and a construction monitoring report by the oversight contractor, d) updating the EE/CA by the regulatory agency, and e) completing ecorisk studies.

Ultimately, 3-4 additional square miles of shelf may be a candidate for capping. Much of the shelf, however, may not be amenable to capping due to its slope.

- On December 19, 2000, the U.S. Dept. of Justice and the California Attorney General announced a settlement of the natural resources damages suit with Montrose Chemical Corporation of California, Aventis CropScience USA Inc., Chris-Craft Industries Inc., and Atkemix Thirty-Seven Inc., for \$73 million. Approximately \$30 million from the settlement, filed in U.S. District Court in Los Angeles, is targeted for restoration of natural resources, and

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reportedly is the largest sum ever paid for environmental injuries resulting from pollution other than oil. Another \$43 million from the settlement will reportedly be available to remediate the offshore contamination. Montrose, at one time the world's largest manufacturer of DDT, was owned and operated by the predecessor to Aventis CropScience USA Inc., and by Chris-Craft Industries Inc. and its predecessors. Atkemis Thirty-Seven currently owns the property where the now-defunct DDT plant is located.

The United States and California previously had reached similar settlements totaling \$64.5 million with County Sanitation District No. 2 of Los Angeles, which operated the sewers that conveyed the DDT to the ocean; about 150 municipalities that discharged other substances through the sewers; and three other corporate defendants – Potlach, Simpson, and CBS/Westinghouse – that allegedly discharged PCBs through the sewers and into the ocean.

Remedial Action Planned: ☒

Risk Assessment: ☐

Remedial Action Implemented: ☒

Status of Dredging ☐

PRPs: ☒

Contacts: ☒

References: ☒

Modeling: ☒

Fishing Advisory: ☒

Key Conditions: capping, hydrodynamic modeling, natural recovery, navigational dredging component, pilot/demonstration test, post monitoring, tidal fluctuations

REMEDIAL ACTION PLANNED

Project Name	<u>PALOS VERDES SHELF</u>	ProjectID: 09-01
Last Updated:	07/16/01	
Target Sediment Cleanup Standards (TSCS):	N/A	
How TSCS Established:	N/A	
Target Bank and Floodplain Cleanup Levels (if applicable):	N/A	
Other Target:	Refer to "Agency Position on Sediment Removal"	
Environmental Sample Data References:	<ul style="list-style-type: none">• Sediment:• Water:• Fish:	
Estimated Target Volume:	N/A	
Planned Disposal Method:	N/A	
Estimated Calendar Time to Implement Remedy:		
Estimated Time to Implement Remedy:	Weeks	
Estimated Cost to Implement Remedy:	Not available	
Stated Remedial Action Objectives (and Source):	<p>As described in Reference E-151:</p> <p>“The overall objective of the field pilot study was to demonstrate that a cap can be placed on the shelf as intended by the design and to obtain field data on the short-term processes and behavior of the cap as placed.”</p> <p>“Specific objectives addressed as a part of the pilot included:</p> <ol style="list-style-type: none">1. Demonstrate that an appropriate cap thickness can be placed with an acceptable level of variability in cap thickness.2. Demonstrate that excessive resuspension of existing sediments and excessive mixing of cap and contaminated sediments can be avoided.3. Demonstrate that excessive losses of cap materials can be avoided.4. Determine, to the degree possible, the effect of variable cap material type, bottom slope, water depth, and placement method (e.g., conventional versus spreading) on cap thickness and sediment displacement and resuspension.5. Demonstrate the effectiveness of the cap with respect to short-term isolation of contaminants during the initial advective flow resulting from sediment consolidation.6. Demonstrate the ability to monitor operations and measure success.7. Evaluate and modify, where needed, all operational and monitoring approaches.8. Improve the knowledge base contributing to decisions on implementation of a full scale cap.”	

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Measures of Success to be Used:

Planned Monitoring and Restoration:

As described in Reference E-151:

“The construction of the field pilot study cap was anticipated to occur over a time period of several weeks, and the associated monitoring effort therefore focused on short term processes associated with cap construction. The pilot study therefore meets several objectives related to capping operations and processes occurring during and shortly after cap material placement. A full-scale monitoring program to be conducted during any placement of a full-scale cap and in the years to follow would additionally include activities aimed at long-term processes which could not be easily observed during the time period available for a pilot study (e.g., erosion during storm events or migration of contaminants due to diffusive processes). The monitoring scope developed for the pilot project did not include far field or long term monitoring. Depending on the time scales in which the pilot cap is left in place prior to any full scale cap placement, there may be opportunity to obtain data from the pilot area related to such long-term processes, but such activities were not included in the pilot scope.”

Agency Position on Sediment Removal (and Source):

As described in Reference E-151:

“The areas considered for capping were on the order of several square kilometers in surface area. The range of site conditions varies including water depth and sediment properties. A rationale was therefore required to choose the best possible location(s) for the pilot cap placements. Considerations for selection of the pilot placement locations included: areas representative of the overall range of conditions; areas reflecting differences in water depth, bottom slope, and sediment characteristics; the need to demonstrate different placement methods and cap materials; and potential for resuspension of sediment during cap placement.”

“Based on the above considerations, a layout of four 1000 by 2000 foot capping placement cells was initially recommended for the pilot. The cells were designated as LU (Landward Upcurrent), LD (Landward Downcurrent), SU (Seaward Upcurrent), and SD (Seaward Downcurrent), with one pair of cells in a comparatively shallow location with comparatively flat bottom slope (130-150 foot depth contour with an average slope across the cell of about 1.5 degrees), and a second cell pair in a comparatively deeper location with steeper bottom slope (200-230 foot depth contour with average slope across the cell of about 2 degrees). The two cells within each pair were separated by a full cell length in the along-shore direction and by a full cell width in the perpendicular direction to avoid the potential for interferences during monitoring.”

“During contract negotiations for the pilot project, it became apparent that the project scope would have to be decreased to stay within budget. Eliminating placement of capping material and monitoring from the least critical cell would keep the project within budget. It was determined that cell SD could be deleted from the pilot project without sacrificing significant information gathering. Therefore, the final pilot project was composed of three cells, LU, LD, and SU. (Pilot placements occurred within the limits of these three cells (with the exception of a single hopper pumpout load placed between cells LU and LD), but the baseline program was conducted for the originally selected four cells, and the total area monitored during the pilot extended to adjacent cells.)”

REMEDIAL ACTION IMPLEMENTED

Project Name:	<u>PALOS VERDES SHELF</u>	ProjectID: 09-01
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Physical Target:	Three 45 acre areas (cells) with DDT contamination on the Palos Verdes Shelf, which separates Santa Monica and San Pedro Bays off the coast of California.	
Goals:	<p>Specific objectives of the pilot capping project, per Reference E-151, included to:</p> <ul style="list-style-type: none">• "Demonstrate that an appropriate cap thickness can be placed with an acceptable level of variability in cap thickness.• Demonstrate that excessive resuspension of existing sediments and excessive mixing of cap and contaminated sediments can be avoided.• Demonstrate that excessive losses of cap materials can be avoided.• Determine, to the degree possible, the effect of variable cap material type, bottom slope, water depth, and placement method (e.g., conventional versus spreading) on cap thickness and sediment displacement and resuspension.• Demonstrate the effectiveness of the cap with respect to short-term isolation of contaminants during the initial advective flow resulting from sediment consolidation.• Demonstrate the ability to monitor operations and success.• Evaluate and modify, where needed, all operational and monitoring approaches.• Improve the knowledge base contributing to decisions on implementation of a full scale cap."	
Primary Contractor:	U.S. Army Corps of Engineers, Los Angeles District	
Other Contractors:	Placement by North Atlantic Trailing Company (NATCO); field monitoring by Science Applications International Corporation (SAIC)	
Generic Remediation Method:	Capping	
Equipment:	<p>The NATCO Manhattan-class hopper dredge Sugar Island was used for the pilot placements. The Sugar Island has a split-hull hopper opening mechanism that can be used to control the rate of release. The Sugar Island is 85 meters in length with a hopper capacity of 3,577 cy. This dredge is also equipped with a hopper pumpout capability over the bow and water jets to aid in pumpout operations. Pumpout can also be accomplished through the adjustable skimmers within the hopper. NATCO indicated that, with minor modifications, pump-out could be accomplished through one of the two dragarms, allowing for a submerged point of discharge which would reduce the water column losses of fine sediments. Any of these methods of placement could potentially have been used during the pilot, though only the drag arm pumpout method was tested (Reference E-151).</p>	
Material Handling:	<p>The following description is from Reference E-151.</p> <p>"Dredging for the Queen's Gate navigation channel deepening project in Long Beach Harbor was on-going during the timeframe for developing the pilot study. Queen's Gate sediment had been earlier identified as a possible source of capping material for the PV shelf project in Palermo et al. (1999). NATCO was the dredging contractor for the Queen's Gate project, and a hopper dredge was being used by NATCO for the project. Therefore, contractual arrangements were made with NATCO for the pilot placements using Queen's Gate sediment."</p> <p>"The pilot included a combination of small placement volumes and larger placed volumes. It was determined that data on various placement methods and variable material types should be obtained from a few hopper placements with small placement volumes. The most likely placement method and material type to be employed full scale was evaluated for construction of a full cap design thickness over a sufficient area to determine the process of cap thickness buildup for adjacent placements. Since the bottom slope only slightly increases with water depth for areas between the</p>	

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40 and 70 meter (130-230 ft.) depth contours, it was deemed that a comparison of shallow and deeper placement areas for the pilot would provide the needed information for both depth and to some degree, bottom slope.”

“Cap placement operations were conducted using the hopper dredge by (1) releasing material at selected placement points in the conventional manner at the water surface, (2) spreading material by partially opening the split hull during placement with the dredge maintaining slow forward motion, and (3) pumpout through the hopper dragarms. At the Queen’s Gate entrance channel, the Sugar Island would spend approximately 2 hours dredging to obtain a 1,000 cubic meter load (1,300 cy) then take about 50 minutes to transit to the PV Shelf area, then spend about 5 minutes performing a point disposal. Dredging would coincide with SAIC’s monitoring.”

“The capping activity conducted during the pilot project is summarized below:

Cell LU

Water Depth: Shallow 148 ft.
Cap Material: Queen’s Gate
Placement Method: Conventional
Projected Cap Thickness/Area: 15-45 cm (6-18”) over entire cell
No. of Loads: 71
Volume (cy): 91,314

Cell LD

Water Depth: Shallow 148 ft.
Cap Material: Borrow Site
Placement Method: Spreading
Projected Cap Thickness/Area: < 4 inches in center lane only
No. of Loads: 9
Volume (cy): 13,505

Water Depth: Shallow 148 ft.
Cap Material: Queen’s Gate
Placement Method: Pumpout thru drag arm
Projected Cap Thickness/Area: N/A (1 load only)
No. of Loads: 1
Volume (cy): 390

Cell SU

Water Depth: Deep 197 ft.
Cap Material: Queen’s Gate
Placement Method: Conventional
Projected Cap Thickness/Area: 6” in center portion of cell
No. of Loads: 21
Volume (cy): 29,834

Totals:

No. of Loads: 102
Volume (cy): 135,043

Volume Removed: N/A

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Calendar Time:	mid-May - Sep 15, 2000 including pre and post-monitoring; actual capping was from August 2 through Sep 14, 2000	
Time To Implement:	Actual capping: 1.5 months	
Total Cost:	Not available	
Dredging Cost:	N/A	
Disposal of Sediment:	N/A	
Volume of Water:	N/A	
Method of Water Treatment:	N/A	
Water Discharge Limit:	N/A	
Air Monitoring During Remediation:	N/A	
Water Monitoring During Remediation:	N/A	
Outcome:	<p>Three 45-acre areas on the Palos Verdes Shelf were covered with a thin-layer cap of clean material, obtained from a nearby navigational dredging project. The source cap material had an in-situ mean grain size of about 0.1 mm. Approximately 135,000 cy were placed in water depths ranging from 150-200 feet. A minimum cap thickness of 6 inches was targeted. The entire 45 acres of one cell, Cell LU, were covered with 91,314 cy. Only the center portions of the other two cells were covered, Cells LD and SU, receiving 13,895 cy and 29,834 cy, respectively.</p> <p>Major monitoring efforts for the pilot included cap thickness as placed, mixing of cap and contaminated sediments, resuspension of contaminated sediments during cap placement, short-term cap benthic recolonization, and short-term physical and chemical characteristics of the cap and underlying sediments immediately after capping and following initial sediment consolidation.</p> <p>The field work for the baseline monitoring in the pilot capping cells was started in mid-May 2000. The monitoring program during cap placement involved 59 trips by survey vessels, with as many as three survey vessels on site at any one time. The bulk of the near-term post-cap monitoring activity was completed September 15, 2000, a few days after the last load was placed in cell LU. In early March 2001, additional sediment cores and sediment profile photos were collected to better define cap thickness and distribution, as well as to assess short-term benthic recolonization of the cap material (Reference E-151).</p> <p>Extensive details on outcome and monitoring data are contained in References E-151 through E-158.</p>	
Restoration and Post-Monitoring:	In progress.	
Site-Specific Difficulties:	<p>Areas of concern and potential difficulties that were monitored during the pilot capping project are identified below, and the reference providing the detailed monitoring results is identified.</p> <ul style="list-style-type: none">• To what extent do suspended sediment plumes result from the impact of the capping materials on the bottom sediments? References E-153 and E-154.• Does the downward momentum of the descending cap material get converted to horizontal	

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momentum, causing a near bottom surge current that would transport material a significant distance away from the placement location? Reference E-154.

- Can the hopper dredge be accurately positioned for placement and can the positions be monitored and documented? Reference E-155.
- Can the spatial distribution and thickness of cap material placed on the seafloor be monitored and measured? Also, does appreciable mixing of in-situ contaminated material and placed material occur? References E-156, E-157, and E-158.
- Does benthic recolonization occur in the cap material after placement? Reference E-156.
- What are the slope limitations for cap placement?

Monitoring Data

References:

- **Sediment**
- **Water:**
- **Fish:**

POTENTIALLY RESPONSIBLE PARTIES

Project Name **PALOS VERDES SHELF**

ProjectID: 09-01

PRP Name: PRP INFORMATION NOT RELEASED

PRPID:

Street Address:

City:

State:

KEY CONTACTS

Project Name **PALOS VERDES SHELF**

ProjectID: 09-01

Last Name: KEY CONTACT INFORMATION NOT RELEASED

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First Name:

Title:

Company:

Address:

City:

State:

Postal Code:

Work Phone # :

Other Phone #:

Fax # :

Email Address:

REFERENCES

Project Name **PALOS VERDES SHELF**

ProjectID: 09-01

Reference Type: A

ReferenceID: 26

Title: **Montrose and Del Amo Superfund Sites: EPA Proposes Groundwater Cleanup Plan**

Location: AEM

Category: Remedial Design

Prepared by/Author: US EPA Region IX

Preparer/Author Address: San Francisco, CA

Prepared For: General Public

Date Published: June 1998

Key Words and Phrases:

Reference Type: A

ReferenceID: 660

Title: **Cleaning Up the Palos Verdes Shelf: Pilot Capping Project: Summary of Activities**

Location: AEM

Category: Site Update

Prepared by/Author: US EPA Region IX

Preparer/Author Address: 75 Hawthorne Street
San Francisco, CA 94105

Prepared For: General Public

Date Published: December 19, 2000

Key Words and Phrases:

Reference Type: A

ReferenceID: 661

Title: **U.S., California Announce Settlement to Clean Up Toxic Pollution in the Pacific Ocean**

Location: AEM

Category: Legal

Prepared by/Author: U.S. Department of Justice

Preparer/Author Address: 950 Pennsylvania Avenue NW
Washington, DC 20530

Prepared For: Press Release

Date Published: December 19, 2000

Key Words and Phrases:

REFERENCES

Project Name **PALOS VERDES SHELF**

ProjectID: 09-01

Reference Type: A

ReferenceID: 662

Title: ***Cleaning Up the Palos Verdes Shelf: Background and History***

Location: AEM

Category: Site Update

Prepared by/Author: US EPA Region IX

Preparer/Author Address: 75 Hawthorne Street
San Francisco, CA 94105

Prepared For: General Public

Date Published: December 19, 2000

Key Words and Phrases:

Reference Type: A

ReferenceID: 663

Title: ***Cleaning Up the Palos Verdes Shelf: Timeline***

Location: AEM

Category: Site Update

Prepared by/Author: US EPA Region IX

Preparer/Author Address: 75 Hawthorne Street
San Francisco, CA 94105

Prepared For: General Public

Date Published: December 19, 2000

Key Words and Phrases:

REFERENCES

Project Name PALOS VERDES SHELF

ProjectID: 09-01

Reference Type: A

ReferenceID: 984

Title: *Field Pilot Study of In Situ Capping of Palos Verdes Shelf Contaminated Sediments*

Location: AEM

Category: Site Update

Prepared by/Author: (1) Thomas J. Fredette, (2) James E. Clausner, (3) Michael R. Palermo, (4) Steven M. Bratos, (5) Terry L. Prickett, (6) Billy H. Johnson, (7) Mamie S. Brouwer, (8) Joseph A. Ryan, (9) Lawrence J. Smith, (10) Eleanor E. Navarez, (11) Fredrick K. Schauffler, (12) Scott McDowell

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Newport, RI 02840

Prepared For: US EPA, Washington, DC

Date Published: September 2002

Key Words and Phrases:

REFERENCES

Project Name PALOS VERDES SHELF

ProjectID: 09-01

Reference Type: A

ReferenceID: 1074

Title: ***Memo re: CSTAG Recommendations on the Montrose/Palos Verdes Shelf Contaminated Sediment Superfund Site***

Location: AEM

Category: Contaminated Sediments: Overview of Issues

Prepared by/Author: Stephen J. Ells and Thomas R. Short, Co-Chairs

Preparer/Author Address: Contaminated Sediments Technical Advisory Group (CSTAG)
US EPA
Washington, DC 20460

Prepared For: Fred Schauffler, Remedial Project Manager, Region 9

Date Published: March 24, 2003

Key Words and Phrases:

Reference Type: A

ReferenceID: 1075

Title: ***Memo re: Region 9 Response to CSTAG Recommendations on the Montrose/Palos Verdes Shelf Contaminated Sediment Superfund Site***

Location: AEM

Category: Contaminated Sediments: Overview of Issues

Prepared by/Author: Fred Schauffler, Remedial Project Manager, Region 9

Preparer/Author Address: US EPA Region IX
75 Hawthorne Street
San Francisco, CA 94105

Prepared For: Stephen J. Ells and John Meyer, Co-Chairs
Contaminated Sediments Technical Advisory Group (CSTAG)

Date Published: May 29, 2003

Key Words and Phrases:

REFERENCES

Project Name **PALOS VERDES SHELF**

ProjectID: 09-01

Reference Type: B

ReferenceID: 117

Title: ***EPA National Priorities List: Montrose Chemical Corporation***

Location: AEM

Category: Site Update

Prepared by/Author: US EPA HQ

**Preparer/Author
Address:** Internet Website

Prepared For: Montrose Chemical Corporation

Date Published: December 1996

**Key Words and
Phrases:**

Reference Type: B

ReferenceID: 531

Title: ***National Remedy Review Board Recommendations for the Palos Verdes Shelf***

Location: AEM

Category: ROD/Proposed Plan/Action Memo/Decision Document

Prepared by/Author: Bruce K. Means, Chair

**Preparer/Author
Address:** National Remedy Review Board
Washington, DC 20460

Prepared For: Keith Takata, Director, Superfund Division, US EPA Region IX

Date Published: October 26, 1998

**Key Words and
Phrases:**

Reference Type: B

ReferenceID: 539

Title: ***EPA Announces Proposed Plan - Palos Verdes Shelf***

Location: BBL

Category: Site Update

Prepared by/Author: US EPA Region IX

**Preparer/Author
Address:** San Francisco, CA

Prepared For:

Date Published: March 2000

**Key Words and
Phrases:**

REFERENCES

Project Name **PALOS VERDES SHELF**

ProjectID: 09-01

Reference Type: B
Title: *Montrose Settlements Restoration Program*
Location: AEM
Category: Natural Resource Damages
Prepared by/Author: Susan Pastor
Preparer/Author Address: US EPA
Prepared For: Fox River Current
Date Published: May/June 2002
Key Words and Phrases:

ReferenceID: 714

Reference Type: B
Title: *Montrose/Palos Verdes Shelf, California*
Location: AEM
Category: Site Update
Prepared by/Author:
Preparer/Author Address:
Prepared For:
Date Published: 1998 circa
Key Words and Phrases:

ReferenceID: 750

Reference Type: C
Title: *Montrose cleanup may expand*
Location: AEM
Category: Site Update
Prepared by/Author:
Preparer/Author Address:
Prepared For: Superfund Week
Date Published: August 22, 1997
Key Words and Phrases:

ReferenceID: 18

REFERENCES

Project Name **PALOS VERDES SHELF**

ProjectID: 09-01

Reference Type: C

ReferenceID: 29

Title: *Montrose DDT removals, proposed plan set*

Location: AEM

Category: Site Update

Prepared by/Author:

Preparer/Author

Address:

Prepared For: Superfund Week

Date Published: April 14, 1995

**Key Words and
Phrases:**

Reference Type: C

ReferenceID: 30

Title: *EPA to study Palos Verdes contamination*

Location: AEM

Category: Site Update

Prepared by/Author:

Preparer/Author

Address:

Prepared For: Superfund Week

Date Published: July 19, 1996

**Key Words and
Phrases:**

Reference Type: C

ReferenceID: 126

Title: *Montrose Superfund Site listing in California may be amended*

Location: AEM

Category: Site Update

Prepared by/Author:

Preparer/Author

Address:

Prepared For: Pesticide & Toxic Chemical News

Date Published: August 20, 1997

**Key Words and
Phrases:**

REFERENCES

Project Name PALOS VERDES SHELF

ProjectID: 09-01

Reference Type: C

ReferenceID: 170

Title: *Sea Grant Research Finds DDT, PCBs Spreading from Coastal Sediments*

Location: AEM

Category: Site Update

Prepared by/Author:

**Preparer/Author
Address:**

Prepared For: HazTECH News

Date Published: January 28 and February 11, 1999

**Key Words and
Phrases:**

Reference Type: C

ReferenceID: 249

Title: *Natural remedy suggested for DDT*

Location: AEM

Category: Site Update

Prepared by/Author:

**Preparer/Author
Address:**

Prepared For: Superfund Week

Date Published: May 15, 1998

**Key Words and
Phrases:**

Reference Type: C

ReferenceID: 270

Title: *MSU Scientists Report DDE Biodegrading Naturally in California Marine Sediments*

Location: AEM

Category: Contaminated Sediments: Investigation/Delineation

Prepared by/Author:

**Preparer/Author
Address:**

Prepared For: HazTECH News

Date Published: May 7 - 21, 1998

**Key Words and
Phrases:**

REFERENCES

Project Name **PALOS VERDES SHELF**

ProjectID: 09-01

Reference Type: C

ReferenceID: 282

Title: *EPA Approves Two-Site Remedy*

Location: AEM

Category: Site Update

Prepared by/Author:

Preparer/Author

Address:

Prepared For: Engineering News-Record (ENR)

Date Published: April 12, 1999

**Key Words and
Phrases:**

Reference Type: C

ReferenceID: 298

Title: *"Natural" Remediation of DDT, PCBs Debated*

Location: AEM

Category: Contaminated Sediments: Treatment Technologies

Prepared by/Author: Rebecca Renner

Preparer/Author

Address:

Prepared For: Environmental Science & Technology, 1998, Vol. 32, No. 15, pp 360-363 A

Date Published: August 1, 1998

**Key Words and
Phrases:**

Reference Type: C

ReferenceID: 336

Title: *Feds, State also make Montrose pledge*

Location: AEM

Category: Site Update

Prepared by/Author:

Preparer/Author

Address:

Prepared For: Superfund Week

Date Published: November 13, 1992

**Key Words and
Phrases:**

REFERENCES

Project Name PALOS VERDES SHELF

ProjectID: 09-01

Reference Type: C

ReferenceID: 715

Title: *EPA Pilot Indicates Success in Capping Contaminated Sediments*

Location: AEM

Category: Site Update

Prepared by/Author: Inside EPA

**Preparer/Author
Address:**

Prepared For: General Public

Date Published: May 15, 2001

**Key Words and
Phrases:**

Reference Type: C

ReferenceID: 716

Title: *Settlement Near in DDT Contamination at Underwater Superfund Site Off Calif.*

Location: AEM

Category: Legal

Prepared by/Author:

**Preparer/Author
Address:**

Prepared For: Superfund Week

Date Published: November 10, 2000

**Key Words and
Phrases:**

Reference Type: C

ReferenceID: 731

Title: *DDT Makers to Pay \$73 Million to Settle Natural Resources Damage Case in California*

Location: BBL

Category: Site Update

Prepared by/Author: Carolyn Whetzel

**Preparer/Author
Address:**

Prepared For: Environmental Reporter (BNA, Inc.)

Date Published: January 5, 2001

**Key Words and
Phrases:**

REFERENCES

Project Name **PALOS VERDES SHELF**

ProjectID: 09-01

Reference Type: C

ReferenceID: 915

Title: ***Calif.: Montrose to Pay for Cleanup***

Location: AEM

Category: Site Update

Prepared by/Author:

Preparer/Author

Address:

Prepared For: Hazardous Waste/Superfund Week

Date Published: July 8, 2002

**Key Words and
Phrases:**

Reference Type: C

ReferenceID: 1082

Title: ***Factors Controlling the Rate of DDE Dechlorination to DDMU in
Palos Verdes Margin Sediments under Anaerobic Conditions***

Location: AEM

Category: Contaminated Sediments: Characteristics/Bioavailability

Prepared by/Author: (1) John F. Quensen, III, (2) James M. Tiedje, (3) Mahendra K. Jain, (4) Sherry A. Mueller

Preparer/Author (1) Department of Crop & Soil Sciences

Address: Michigan State University

East Lansing, MI 48824

(2) Center for Microbial Ecology

Michigan State University

East Lansing, MI 48824

(3) MBI International

P.O. Box 27609, 3900 Collins Road

Lansing, MI 48909-0609

(4) Ford Motor Company

Chemistry Department

SRL Building, MD 3083

P.O. Box 2053

Dearborn, MI 48121

Prepared For: Environmental Science & Technology, 2001, Vol. 35, No. 2, pp 286-291

Date Published: 2001

**Key Words and
Phrases:**

REFERENCES

Project Name PALOS VERDES SHELF

ProjectID: 09-01

Reference Type: D

ReferenceID: 39

Title: *Federal suit over DDT dumping is dismissed*

Location: AEM

Category: Legal

Prepared by/Author:

Preparer/Author

Address:

Prepared For: The Los Angeles (CA) Times

Date Published: March 23, 1995

**Key Words and
Phrases:**

Reference Type: D

ReferenceID: 224

Title: *Chemical Firms Settle DDT Suit*

Location: AEM

Category: Legal

Prepared by/Author: Marla Cone

Preparer/Author

Address:

Prepared For: The Los Angeles (CA) Times

Date Published: December 20, 2000

**Key Words and
Phrases:**

Reference Type: D

ReferenceID: 225

Title: *U.S. EPA Investigates Palos Verdes Shelf Contamination*

Location: AEM

Category: Site Update

Prepared by/Author: US EPA Region IX

Preparer/Author 75 Hawthorne Street

Address: San Francisco, CA 94105

Prepared For: Press Release

Date Published: July 10, 1996

**Key Words and
Phrases:**

REFERENCES

Project Name **PALOS VERDES SHELF**

ProjectID: 09-01

Reference Type: D

ReferenceID: 226

Title: ***U.S. EPA Proposes Plan to Address Contaminated Fish***

Location: AEM

Category: Site Update

Prepared by/Author: US EPA Region IX

Preparer/Author Address: 75 Hawthorne Street
San Francisco, CA 94105

Prepared For: Press Release

Date Published: March 29, 2000

Key Words and Phrases:

Reference Type: D

ReferenceID: 227

Title: ***Trial Over Huge Offshore Deposit of DDT Begins***

Location: AEM

Category: Legal

Prepared by/Author: Marla Cone

Preparer/Author Address:

Prepared For: The Los Angeles (CA) Times

Date Published: October 18, 2000

Key Words and Phrases:

Reference Type: D

ReferenceID: 228

Title: ***EPA testing plan on DDT deposit***

Location: AEM

Category: Site Update

Prepared by/Author: Marla Cone

Preparer/Author Address: Los Angeles Times

Prepared For: The Schenectady (NY) Gazette

Date Published: August 27, 2000

Key Words and Phrases:

REFERENCES

Project Name **PALOS VERDES SHELF**

ProjectID: 09-01

Reference Type: D

ReferenceID: 229

Title: **DDT Maker Agrees to Pay for Polluting Ocean**

Location: AEM

Category: Legal

Prepared by/Author: Marla Cone

**Preparer/Author
Address:**

Prepared For: The Los Angeles (CA) Times

Date Published: October 28, 2000

**Key Words and
Phrases:**

Reference Type: E

ReferenceID: 113

Title: **Remediation Risks: Palos Verdes Shelf, California**

Location: AEM

Category: Contaminated Sediments: Remedial Options/Guidance

Prepared by/Author: E. John List, Ph.D., P.E.

**Preparer/Author
Address:** Flow Science, Inc.

Prepared For: Presentation to National Research Council (Washington, DC)

Date Published: June 7, 1999

**Key Words and
Phrases:**

REFERENCES

Project Name **PALOS VERDES SHELF**

ProjectID: 09-01

Reference Type: E

ReferenceID: 151

Title: **Palos Verdes Shelf Pilot Capping: Description and Rationale**

Location: AEM

Category: Capping/Placement

Prepared by/Author: (1) M. Palermo, (2) F. Schauffler, (3) T.J. Fredette, (4) J. Clausner, (5) S. McDowell, (6) E. Nevarez

Preparer/Author Address: (1, 4) U.S. Army Corps of Engineers
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3909 Halls Ferry Road
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(2) US EPA Region IX
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(3) U.S. Army Corps of Engineers
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696 Virginia Road
Concord, MA 01742-2751
(5) Science Applications International Corporation
Admiral's Gate
221 Third Street
Newport, RI 02840
(6) U.S. Army Corps of Engineers
Los Angeles District
911 Wilshire Boulevard
Los Angeles, CA 90017

Prepared For: WEDA XXI, Houston, TX

Date Published: June 26-28, 2001

Key Words and Phrases:

REFERENCES

Project Name PALOS VERDES SHELF

ProjectID: 09-01

Reference Type: E

ReferenceID: 152

Title: *Palos Verdes Shelf Pilot Capping: Dredged Material Fate Modeling for Cap Placement*

Location: AEM

Category: Capping/Placement

Prepared by/Author: S.M. Bratos, B.H. Johnson, J.E. Clausner

Preparer/Author Address: U.S. Army Corps of Engineers
U.S. Army Engineer Research and Development Center
Coastal and Hydraulics Laboratory
Waterways Experiment Station
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Prepared For: WEDA XXI, Houston, TX

Date Published: June 26-28, 2001

Key Words and Phrases:

Reference Type: E

ReferenceID: 153

Title: *Palos Verdes Shelf Pilot Capping: Suspended Sediment Plume Monitoring During Cap Placement*

Location: AEM

Category: Capping/Placement

Prepared by/Author: S. McDowell, E. Tobey, P. Walter

Preparer/Author Address: Marine Environmental Sciences Division
Science Applications International Corporation
221 Third Street
Newport, RI 02840

Prepared For: WEDA XXI, Houston, TX

Date Published: June 26-28, 2001

Key Words and Phrases:

REFERENCES

Project Name PALOS VERDES SHELF

ProjectID: 09-01

Reference Type: E

ReferenceID: 154

Title: *Palos Verdes Shelf Pilot Capping: Moored Measurements of Near-Bottom Currents and Turbidity During Cap Placement*

Location: AEM

Category: Capping/Placement

Prepared by/Author: (1) S. McDowell, (2) S. Pace, (3) M. Wakeman, (4) J. Singer, (5) P. Hamilton

Preparer/Author Address: (1, 2, 3) Marine Environmental Sciences Division
Science Applications International Corporation
221 Third Street
Newport, RI 02840
(4, 5) Marine Environmental Sciences Division
Science Applications International Corporation
615 Oberlin Road
Raleigh, NC 27605

Prepared For: WEDA XXI, Houston, TX

Date Published: June 26-28, 2001

Key Words and Phrases:

Reference Type: E

ReferenceID: 155

Title: *Palos Verdes Shelf Pilot Capping: Monitoring of Hopper Dredge Operations During Placement of Cap Material*

Location: AEM

Category: Capping/Placement

Prepared by/Author: S. McDowell, S. Pace, D. Fischman

Preparer/Author Address: Marine Environmental Sciences Division
Science Applications International Corporation
221 Third Street
Newport, RI 02840

Prepared For: WEDA XXI, Houston, TX

Date Published: June 26-28, 2001

Key Words and Phrases:

REFERENCES

Project Name PALOS VERDES SHELF

ProjectID: 09-01

Reference Type: E

ReferenceID: 156

Title: *Palos Verdes Shelf Pilot Capping: Use of Side-Scan Sonar, Sediment Profile Imaging and Plan View Photography for Resolving Cap Material Distribution and Thickness*

Location: AEM

Category: Capping/Placement

Prepared by/Author: R. Valente, T. Waddington, J. Infantino, G. Tufts

Preparer/Author Address: Marine Environmental Sciences Division
Science Applications International Corporation
221 Third Street
Newport, RI 02840

Prepared For: WEDA XXI, Houston, TX

Date Published: June 26-28, 2001

Key Words and Phrases:

Reference Type: E

ReferenceID: 157

Title: *Geotechnical Results from Sediment Cores Acquired During the Palos Verdes Shelf Pilot Cap Monitoring Program*

Location: AEM

Category: Capping/Placement

Prepared by/Author: (1) P. Walter, (2) T.J. Fredette

Preparer/Author Address: (1) Science Applications International Corporation
221 Third Street
Newport, RI 02840
(2) U.S. Army Corps of Engineers
New England District
696 Virginia Road
Concord, MA 01742-2751

Prepared For: WEDA XXI, Houston, TX

Date Published: June 26-28, 2001

Key Words and Phrases:

REFERENCES

Project Name **PALOS VERDES SHELF**

ProjectID: 09-01

Reference Type: E

ReferenceID: 158

Title: ***Palos Verdes Shelf Pilot Capping: DDE Concentrations in Baseline and Post-Cap Cores***

Location: AEM

Category: Capping/Placement

Prepared by/Author: C. Phillips, J. Evans, V. Frank

Preparer/Author Address: Environmental Services Division
Science Applications International Corporation
10260 Campus Point Court
San Diego, CA 92121

Prepared For: WEDA XXI, Houston, TX

Date Published: June 26-28, 2001

Key Words and Phrases:

Reference Type: L

ReferenceID: 117

Title: ***Sediment Remediation Projects in the U.S. Using Capping or Burial***

Location: AEM

Category: Capping/Placement

Prepared by/Author: AEM, Inc.

Preparer/Author Address:

Prepared For: Distribution

Date Published: September 25, 2001

Key Words and Phrases:

REFERENCES

Project Name PALOS VERDES SHELF

ProjectID: 09-01

Reference Type: M

ReferenceID: 236

Title: *Final Functional Equivalent Document - Consolidated Toxic Hot Spots Cleanup Plan*

Location: AEM

Category: Miscellaneous

Prepared by/Author: California State Water Resources Control Board

**Preparer/Author
Address:**

Prepared For:

Date Published: June 1999

**Key Words and
Phrases:**

Reference Type: M

ReferenceID: 324

Title: *Options for In Situ Capping of Palos Verdes Shelf Contaminated Sediments (Technical Report EL-99-2)*

Location: BBL

Category: Capping/Placement

Prepared by/Author: M. Palermo, et al.

**Preparer/Author
Address:** U.S. Army Corps of Engineers
Waterways Experiment Station

Prepared For: U.S. Army Corps of Engineers Headquarters
Washington, DC

Date Published: March 1999

**Key Words and
Phrases:**

Reference Type: N

ReferenceID: 31

Title: *Notes from Presentation at WEDA XXI (Houston, TX)*

Location: AEM

Category: Site Update

Prepared by/Author: AEM, Inc.

**Preparer/Author
Address:**

Prepared For: Internal file

Date Published: June 27, 2001

**Key Words and
Phrases:**

MODELING

Project Name: PALOS VERDES SHELF

ProjectID: 09-01

Last Updated: 07/16/01

Modeling Performed: Yes

Modeling Objectives: Refer to "Modeling Summary"

Modeling Description: Refer to "Modeling Summary"

Company Performing Modeling: U.S. Army Engineer Research and Development Center, Coastal and Hydraulics Laboratory, Waterways Experiment Station, Vicksburg, MS

Modeling Status: Completed. Refinements in progress.

Modeling Summary: As described in Reference E-151:

“The mathematical model Multiple Dump FATE (MDFATE) was used to predict the rate of cap material buildup for specific sediment characteristics, various water depths over the shelf, and various placement approaches. The USACE Short-Term FATE (STFATE) and SURGE models were used to predict cap material dispersion during placement and evaluate the velocities of bottom impact on spreading behavior, respectively. These predictions were initially based on a broad range of assumed properties for the cap material. Once specific cap material sources were selected, refined predictions using the specific site conditions and cap material properties were made using the MDFATE, STFATE, and CORMIX models. Results of the refined predictions were used to adjust the operational approach and monitoring efforts for the pilot.”

As described in Reference E-152:

“STFATE simulates the process of placement of a single load of dredged material from a hopper dredge or barge. Field evaluations by Bokuniewicz, et al. (1978) and laboratory tests by Johnson, et al. (1993) have shown that the placement of dredged material generally follows a three-step process: (a) convective descent during which the material falls under the influence of gravity, (b) dynamic collapse, occurring when the descending cloud or jet either impacts the bottom or arrives at a level of neutral buoyancy, in which case the descent is retarded and horizontal spreading dominates, and (c) passive transport-dispersion, commencing when the material transport and spreading are determined more by ambient currents and turbulence than by the dynamics of the disposal operation.”

“The STFATE model was used to predict the fate of the plume that remained in the water column, the impact velocity of the descending jet, and the bottom surge velocity. In addition, because of concern that the plume might adversely impact the inshore kelp beds, an STFATE simulation was conducted to predict the path and total suspended sediment (TSS) concentrations in the water column from a single placement of cap material. This TSS information was used to make a qualitative estimate of potential impact to the kelp beds. There was also concern over cap material placement impacts on the Whites Point sewage outfalls. However, the MDFATE simulations prediction of cap thickness showed essentially no accumulation at the outfall locations, so no STFATE simulations to predict water column plume tracks and concentrations in the direction of the outfalls were made.”

“MDFATE simulates the mound developed by multiple placements of dredged material from a hopper dredge or barge. MDFATE was developed under the Corps’ Dredging Research Program (Hales 1995). The MDFATE model was formerly known as Open Water Disposal Area Management Simulation (ODAMS) program (Moritz and Randall 1995). MDFATE is a site management tool that bridges the gap between the STFATE model (Johnson and Fong 1993), which simulates the placement of a single load of

Project Name: **PALOS VERDES SHELF****ProjectID:** 09-01**Last Updated:** 07/16/01

dredged material, and the Long Term FATE of dredged material (LTFATE) model (Scheffner, et al. 1995) which predicts the long term stability (days to years) of dredged material mounds.”

“In MDFATE, the suspended solids and conservative tracer portions of STFATE are removed so the modified STFATE sub-model within MDFATE only models the convective descent, dynamic collapse, and passive diffusion processes. The LTFATE model combines hydrodynamics (waves, currents, and tides) and sediment transport algorithms to predict the stability of dredged material mounds composed of grain sizes ranging from small gravel/coarse sand down to coarse silts. MDFATE uses modified versions of STFATE and LTFATE to simulate multiple disposal events at one site to predict mound building and can be used to determine if navigation hazards are created, to examine site capacity and mound stability, to design capping operations, and to conduct long-term site planning.”

The Summary from Reference E-152 says:

“Numerical model simulations of various cap placement factors have been conducted using the ERDC-developed models, Short Term FATE of dredged material (STFATE) (Johnson and Fong 1993), and Multiple Dump FATE of dredged material (MDFATE) in support of the Palos Verdes Shelf Pilot Cap project. FATE modeling, used in a predictive mode, provided guidance for developing the Operations and Monitoring Plan and support during the capping operation. Simulations were also conducted in a hindcast mode using measured data for operational support and model evaluation. Results from MDFATE simulations for single and multiple conventional placement show reasonably good qualitative comparison for cap thickness and size. However, simulations and comparisons are still being conducted, in particular for the full pilot cap. In general, STFATE surge speed results, with the model coefficients specified, compare quite well with the observed data. However, to more accurately compute the spatial distribution of the bottom surge resulting from the disposal of dredged material in open water, a more rigorous three-dimensional computational model is required.”

FISH ADVISORIES

Project Name **PALOS VERDES SHELF**

ProjectID: 09-01

Advisory: Point Vicente, Palos Verdes-Northwest

AdvisoryID: 267

Extent: Coastal Waters

Pollutant: DDT

Species: croaker-white

Population: NCGP

Population Definition: No Consumption-General Population: Advise against consumption by the general population.

Advisory Type: Coastal

Advisory Number: 22

Status (Active or Rescinded): Active

Date Rescinded:

Contact Name: Robert Brodberg

Contact Number: 916-323-4763

Advisory: Point Vicente, Palos Verdes-Northwest

AdvisoryID: 268

Extent: Coastal Waters

Pollutant: PCBs (total)

Species: croaker-white

Population: NCGP

Population Definition: No Consumption-General Population: Advise against consumption by the general population.

Advisory Type: Coastal

Advisory Number: 22

Status (Active or Rescinded): Active

Date Rescinded:

Contact Name: Robert Brodberg

Contact Number: 916-323-4763
