

SDMS
88205129



Five-Year Review Report

First Five-Year Review Report
for
United Heckathorn Superfund Site
Town of Richmond
Contra Costa County, California

September 2001

PREPARED BY:

United States Environmental Protection Agency
Region IX
San Francisco, California

Approved by:

Date:

Keith Takata —

Keith Takata
Superfund Division Director
U.S. EPA, Region 9

9-28-01

United Heckathorn Superfund Site Five-Year Review Report September 2001

I. INTRODUCTION

1. Scope and Intent of this Five-Year Review

The U.S. Environmental Protection Agency, Region 9, (EPA) prepared this Five-Year Review report pursuant to the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Section 121(c), the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) Section 300.400(f)(4)(ii) and Office of Solid Waste and Emergency Response (OSWER) directives 93e55.7-02 and 9355.7-02a. The purpose of the five-year review is to determine whether the remedy at a site is protective of human health and the environment and is functioning as designed. The Five-Year Review report identifies any issues found during the review and recommends actions to address them.

EPA, Region 9, conducted the five-year review of the remedy implemented at the United Heckathorn Superfund Site in Richmond, California, from April 2001 through September 2001. The review was conducted for the entire site. This report documents the results of the review.

This is the first five-year review for the United Heckathorn Site. The triggering action for this statutory review is the remedial action start date of July 23, 1996. The five-year review is required due to the fact that hazardous substances, pollutants, or contaminants remain at the site above levels that allow for unlimited use and unrestricted exposure.

2. Summary of Review Results

The results of the Five-Year Review of the remedial action at the United Heckathorn site are: (1) the cap over the upland area is in good condition and is operating and functioning as designed; (2) although dredging removed over 107,000 cubic yards of contaminated sediments that contained 3 tons of DDT, post-remediation monitoring indicates contaminants of concern have been detected at the site, particularly Lauritzen Channel, and that remedial goals have not been maintained; (3) the original cleanup objectives are protective of human health and the environment; and (4) there are no new ARARs that would make the remedial action insufficient. Since cleanup goals have not been achieved in all surface waters, further study to determine the source and/or cause of current contamination is proposed.

II. SITE SUMMARY

1. Site Description and History

The United Heckathorn Superfund site is located in Richmond Harbor, an inlet of San Francisco Bay, in Contra Costa County, California. The site is in an industrial area dominated by active petroleum and shipping terminals. Currently, the Levin Richmond Terminal Corporation (LRTC) operates a marine shipping terminal at the location of the former United Heckathorn facility. The Levin Terminal is bounded by Cutting Boulevard on the north, South 4th Street on the east, the Santa Fe Channel on the south, and the Lauritzen Channel on the west. The Lauritzen Channel is hydraulically connected to the Santa Fe Channel by tidal flows, which in

MAIL CODE	SFD-8-1	SFD-7-3		SFD7	ORCS	SFD-1	
SURNAME	C. W. L. T.	S. A. D. A. W.	J. A. J. K.	T. K. L. E. N.		K.	
DATE	7/27/01	9/27/01	9/27/01	9/28/01	9/28/01	9/28/01	

U.S. EPA CONCURRENCES

OFFICIAL FILE COPY

**United Heckathorn Superfund Site
Five-Year Review Report
September 2001**

I. INTRODUCTION

1. Scope and Intent of this Five-Year Review

The U.S. Environmental Protection Agency, Region 9, (EPA) prepared this Five-Year Review report pursuant to the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Section 121(c), the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) Section 300.400(f)(4)(ii) and Office of Solid Waste and Emergency Response (OSWER) directives 93e55.7-02 and 9355.7-02a. The purpose of the five-year review is to determine whether the remedy at a site is protective of human health and the environment and is functioning as designed. The Five-Year Review report identifies any issues found during the review and recommends actions to address them.

EPA, Region 9, conducted the five-year review of the remedy implemented at the United Heckathorn Superfund Site in Richmond, California, from April 2001 through September 2001. The review was conducted for the entire site. This report documents the results of the review.

This is the first five-year review for the United Heckathorn Site. The triggering action for this statutory review is the remedial action start date of July 23, 1996. The five-year review is required due to the fact that hazardous substances, pollutants, or contaminants remain at the site above levels that allow for unlimited use and unrestricted exposure.

2. Summary of Review Results

The results of the Five-Year Review of the remedial action at the United Heckathorn site are: (1) the cap over the upland area is in good condition and is operating and functioning as designed; (2) although dredging removed over 107,000 cubic yards of contaminated sediments that contained 3 tons of DDT, post-remediation monitoring indicates contaminants of concern have been detected at the site, particularly Lauritzen Channel, and that remedial goals have not been maintained; (3) the original cleanup objectives are protective of human health and the environment; and (4) there are no new ARARs that would make the remedial action insufficient. Since cleanup goals have not been achieved in all surface waters, further study to determine the source and/or cause of current contamination is proposed.

II. SITE SUMMARY

1. Site Description and History

The United Heckathorn Superfund site is located in Richmond Harbor, an inlet of San Francisco Bay, in Contra Costa County, California. The site is in an industrial area dominated by active petroleum and shipping terminals. Currently, the Levin Richmond Terminal Corporation (LRTC) operates a marine shipping terminal at the location of the former United Heckathorn facility. The Levin Terminal is bounded by Cutting Boulevard on the north, South 4th Street on the east, the Santa Fe Channel on the south, and the Lauritzen Channel on the west. The Lauritzen Channel is hydraulically connected to the Santa Fe Channel by tidal flows, which in

turn is hydraulically connected to the Richmond Inner Harbor. The area of contamination at the site included the northern five acres of the Levin Terminal facility and approximately 15 acres of marine sediments in the harbor channels. The location of the site is depicted in Figure 1.

Several operators, including the R.J. Prentiss Company, Heckathorn and Company, United Heckathorn, United Chemetrics, and Chemwest Incorporated (collectively referred to as "United Heckathorn") used the United Heckathorn site from approximately 1947 to 1966 to formulate and package pesticides. No chemicals were manufactured on site. Heckathorn would receive technical grade pesticides from chemical manufacturers, grind them in air mills, mix them with other ingredients such as clays or solvents, and package them for final use in liquid or powder formulations. Although many pesticides were handled by United Heckathorn, dichlorodiphenyl trichloroethane (DDT) accounted for approximately 95 percent of Heckathorn's operations.

United Heckathorn went bankrupt and vacated the site in 1966. Between 1966 and 1970 the United Heckathorn facility buildings were demolished and cleared from the site. In the 1970s the site was used primarily for bulk storage. In 1981, the Levin Metals Corporation purchased the property and, as stated above, operates a bulk shipping facility at the site.

Regulatory agencies occasionally inspected the United Heckathorn facility during the time of its operation (1947 and 1966). During a site visit in 1960, the Bay Area Regional Water Quality Control Board (RWQCB) observed bulk storage of pesticides and solvents, leaking solvent pump lines, spills, and waste discharges. Subsequently, the California Department of Fish and Game (CDFG) discovered dead fish in the Lauritzen channel and, on a separate inspection, they observed a milky liquid emanating from the site into the channel.

In 1980, the United Heckathorn site was inspected and sampled by the California Department of Health Services (CDHS) as part of the Abandoned Site Project. Chlorinated pesticides and metals were detected in soil samples, and the area was designated a State Superfund site in March 1982. In March 1990, EPA placed the site on the National Priorities List (NPL) and in August of that year assumed lead agency status.

2. Remedial Investigations

In 1990 Levine-Fricke completed a remedial investigation (RI) of the site for LRTC. The investigation concluded that of all the environmental media at the site, upland area soils and embankment sediments contained the highest chlorinated pesticide concentrations, generally greater than 1 mg/kg near the former United Heckathorn facility, and exceeding 10,000 mg/kg in localized areas. Ground water concentrations of these chemicals were generally in the low $\mu\text{g}/\text{kg}$ range. Ambient air measurements at the site and downwind areas also detected very low airborne DDT concentrations, approximately 1 ng/m³.

A 1994 RI prepared by Batelle/Marine Science Laboratory for EPA focused on marine sediments. Marine sediment throughout the Richmond Inner Harbor consists of two geologic units: the younger bay mud and the underlying older bay mud (USACE 1979). The younger bay mud was deposited in estuarine and shallow marine environments as sea level rose following the last retreat of glacial ice, about 15,000 years ago. It is typically composed of very soft to soft clay, silt, and fine-grained sand with a high water content. The underlying older bay mud consists of relatively dry, firm to hard silts and clays with variable amounts of sand. The older bay mud appear to be unaffected by anthropogenic contamination because of its pre-industrial age, low water content, and consolidated character.

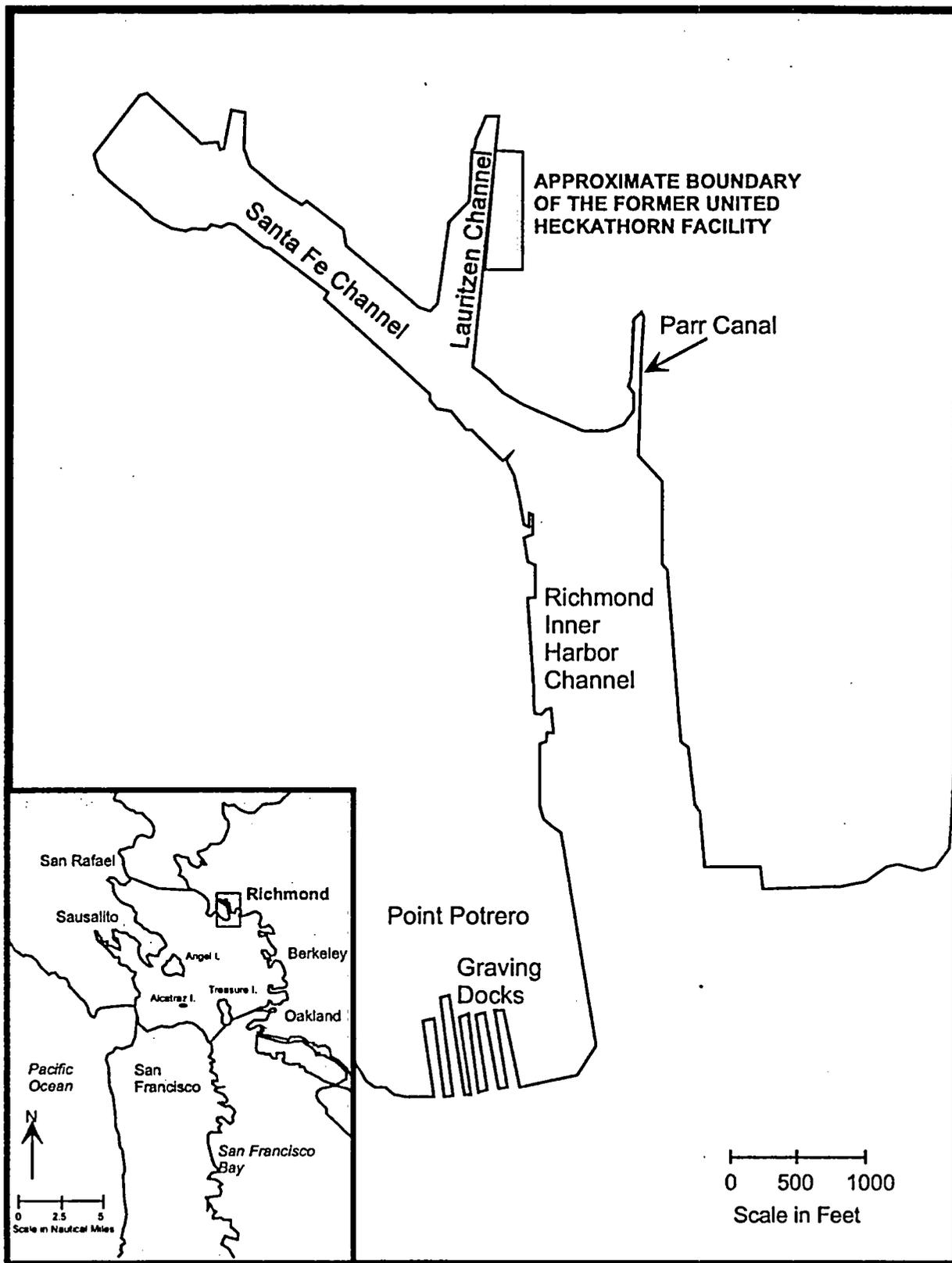


Figure 1. Location of the United Heckathorn Superfund Site, Richmond, California

Remedial investigations identified the Lauritzen Channel as the area of highest pesticide concentrations, followed by the Parr Canal. The human health risk from sediments at the site presented a 1×10^{-3} cancer risk through consumption of whole fish in which contaminants of concern (COCs) had bioaccumulated. Interviews conducted for the Human Health Risk Assessment (ICF Technology, Inc., 1994) confirmed that the area, particularly near Parr Canal, is used for recreational and subsistence fishing by local residents in spite of the CDHS multilingual "No Fishing" signs. For example, during fishing season (December to June or July), Laotian immigrants reported fishing biweekly on average and sometimes daily.

Remedial investigations identified DDT and dieldrin as the COCs. The highest total DDT concentration of 633,000 $\mu\text{g}/\text{kg}$ was measured in a sample from the center of Lauritzen Channel while concentrations of greater than 100,000 $\mu\text{g}/\text{kg}$ were detected in sediment from the northern and western portions of the channel. The highest total DDT concentration measured in Parr Canal was 4,080 $\mu\text{g}/\text{kg}$. The median total DDT concentration at the head of Lauritzen Channel was 47,000 $\mu\text{g}/\text{kg}$ and for Parr Canal, 840 $\mu\text{g}/\text{kg}$. Concentrations of dieldrin were lower (maximum concentration of 16,000 $\mu\text{g}/\text{kg}$), but exhibited the same spatial trend in relative concentration. The vertical extent of contamination appeared limited to the younger bay mud. Contact between the younger bay mud and the older bay mud was generally sharp, with the very soft clay of the younger bay mud overlying stiff to hard older bay mud. Below the younger bay mud/older bay mud contact, total DDT concentrations were generally less than 50 $\mu\text{g}/\text{kg}$.

3. Site Chronology

Table 1: Chronology of Site Events	
EVENT	DATE
Site used to formulate and package pesticides, particularly DDT	1947-1966
The RWQCB inspects and cites the facility for the release of DDT-laden wastewater into the Lauritzen Channel	1960
The CDFG identifies a discharge of wastewater overflow into the Lauritzen Channel and leakage from the pesticide settling tanks	1965
CDHS investigates site as part of its Abandoned Site Project	1980
Site listed by the CDHS as a State Superfund Site	Mar. 1982
The 1984-1985 California State Mussel Watch survey for the first time includes Richmond Harbor and finds levels of DDT and dieldrin "highest ever measured in mussels by the SMW program"	results published 1986
Interim Removal Actions occur on the upland portion of the site	1982-1993
Site listed on EPA National Priorities List	Mar. 1990
Pursuant to EPA Removal Order 90-22, approximately 1500 yards of soil and visible pesticide residue containing up to 100% DDT excavated by several PRPs.	Nov. 1990
DTSC issues advisory against consuming any bottom fish from the Inner Richmond Harbor	April 1994

Table 1: Chronology of Site Events	
Feasibility Study completed	July 1994
ROD selecting the remedy is signed	Oct. 1994
Remedial design/Remedial Action Workplan for sediment dredging submitted	May 1996
Consent Decree approved by US District Court	July 1996
Remediation action at Parr Canal and Lauritzen Channel begins	Aug. 1996
Remediation action at Parr Canal and Lauritzen Channel ends	Mar. 1997
Post-remediation monitoring begins	1997
Remedial design/Remedial Action Workplan for upland cap submitted	Apr. 1998
Construction of upland area cap begins	July 1998
Construction of upland area cap ends	July 1999
Post-Remediation Biomonitoring of Pesticides in Marine Waters Near the United Heckathorn Superfund Site, Year 1 Report	Sept. 1998, revised 7/00
Post-Remediation Biomonitoring, Year 2 Report	Oct. 1999, revised 7/00
Post-Remediation Biomonitoring, Year 3 Report	Oct. 2000
Post-Remediation Biomonitoring, Year 4 Report	June 2001

III. REMEDIAL ACTIONS

1. Removal Actions

During the 1980s, the owner of the site, Levin Metals Corporation, excavated contaminated soils on various occasions. In 1982, Levin removed soil, asphalt, and concrete from the site and stockpiled them on a lot adjacent to the Parr Canal. These materials were later taken to hazardous waste disposal facilities. In 1983, Levin excavated soils that contained high levels of pesticides during both routine maintenance and extension of on-site railroad lines. Levin also placed 6 to 8 inches of gravel over the surface throughout the site, including 6 inches of ballast rock over the Lauritzen Channel embankment and selected areas of high DDT concentrations. During excavation and train-scale construction in 1986, more pesticide-contaminated soils were found and approximately 50 cubic yards of soil were removed.

The United Heckathorn site was listed on the NPL in March 1990. In November of that year, under EPA Removal Order 90-22, approximately 1,450 cubic yards of soil and debris, containing up to 100 percent DDT, were excavated from the Lauritzen Channel embankment. This excavation led back to the foundation of the former Heckathorn Building 1, where a pesticide deposit approximately 3 feet thick was revealed beneath the foundation. An additional 1,800 cubic yards of pesticide residue and contaminated soil were excavated in April 1991. A final soil removal action was completed in May 1993.

These removal actions addressed the principal threats at the upland portion of the site. They did not address the contaminants remaining in sediments nor the low levels of contaminants remaining in soils. The remedy selected in the Record of Decision addressed these remaining hazards.

2. Selected Remedy

The October 26, 1994 Record of Decision presented the final selected remedy for the site. The remedy addressed two areas: (1) the upland area, and (2) marine sediments. The estimated cost for the selected remedy was \$7 million. The major components of the remedy included:

- Dredging of all soft bay mud from the Lauritzen Channel and Parr Canal in order to meet the remediation goal of average total DDT in sediment of 590 $\mu\text{g}/\text{kg}$.
- Offsite disposal of dredged material.
- Placement of clean material after dredging.
- Construction of a cap around the former Heckathorn facility to prevent erosion.
- A deed notice requiring O&M of the cap and limiting use of the property at the former Heckathorn facility location to non-residential uses.
- Marine monitoring to verify the effectiveness of the remedy.

Upland Area: Soil removal actions from 1983 - 1993 removed approximately 99 percent of the mass of pesticides from upland areas, but left an estimated 95,000 tons of onsite soils with pesticide concentrations of over 1 mg/kg. These concentrations are an acceptable risk for areas of commercial and industrial use; however, potential erosion of the contaminated upland soils posed a threat to the marine environment. Therefore, the selected remedy included a remediation goal of erosion prevention for upland soils. The remedy included capping the northern half of the Levin Terminal, about 4.5 acres, and placing a deed notice on the property to prevent conversion to other uses, such as residential, without further study and possibly further remediation.

Surface Waters: EPA marine chronic and human health water quality criteria were identified as ARARs (applicable or relevant and appropriate requirements) for surface water. Human health standards based on consumption of contaminated fish were used to establish remediation goals. Specific ARARs for surface water include EPA Ambient Water Quality Criteria (AWQC), promulgated under Section 304 of the Clean Water Act. Criteria for the protection of saltwater aquatic life are, for most pollutants, based upon toxic effects data for water-column organisms. However, for DDT and its metabolite, which bioaccumulate to high levels and may cause toxicity to organisms at higher trophic levels, it was determined that more restrictive criteria were necessary to protect fish-eating birds. Two federally listed endangered species, the California brown pelican and the least tern, and one state listed endangered species, the American peregrine falcon, have been observed feeding in and around the site. The prey of the brown pelican and the least tern is primarily fish, that of the peregrine falcon, birds. The California black rail, a state threatened species, also feeds in the area. The chronic marine aquatic life criterion for DDT is 1 ng/L (EPA 1980, EPA 440/5-980-038J).

The water quality criterion for the protection of human health from the consumption from the bioaccumulation of DDT in fish is 0.59 ng/L, based on achieving a 1×10^{-6} lifetime excess cancer risk level. The chronic marine aquatic life criterion for dieldrin of 1.9 ng/L is also residue

based, and was set at the level which would result in the achievement of the Food and Drug Administration's (FDA) action level in fish oil after bioaccumulation (EPA 1980, EPA 440/5-80-019). This criterion is protective of sensitive aquatic organisms. The water quality criterion for the protection of human health from the consumption from the bioaccumulation of dieldrin in fish is 0.14 ng/L, based on achieving a 1×10^{-6} lifetime excess cancer risk level. Table 2 shows remediation goals for surface waters and sediment.

Table 2: Final Remediation Levels				Cancer Risk Level
Medium	Chemical	Level	Basis	
Surface Water	DDT	0.59 ng/L	EPA AWQC	1×10^{-6}
	Dieldrin	0.14 ng/L		1×10^{-6}
Sediment	DDT	avg.: 590 $\mu\text{g}/\text{kg}$	Ecological Assessment	1×10^{-6}

Marine Sediments: No chemical-specific ARARs were identified as remediation goals for soils or sediments at the site. However, mean sediment levels were calculated to prevent violations of the surface waters ARARs, and to meet the National Academy of Sciences action level for DDT in fish to ensure protection of fish-eating birds, including endangered species. Site remediation goals for sediments were 590 $\mu\text{g}/\text{kg}$ for DDT.

The selected remedy for marine sediments called for dredging the younger bay mud of the Lauritzen Channel and Parr Canal down to the underlying older bay mud. The dredged material was to be transported by rail to a permitted land disposal facility. To promote the return of flora and fauna, a 6-inch layer of clean material was to be placed over the dredged areas. Finally, after dredging, dewatering and disposal, surface water and biota were to be monitored for at least five years or longer until it could be demonstrated that the remediation goals had been achieved.

3. Remedy Implementation

Upland Area: The selected remedy for the upland area of the site was capping. Construction of the upland cap began on July 1998 and was finished on July 1999. The property owner, pursuant to a Consent Decree with EPA, performed cap design and construction activities under EPA oversight. Installation of the cap consisted of three steps: (1) site grading to promote surface runoff to collection points; (2) installation of a drainage system to collect surface runoff, including best management practices for storm water pollution prevention; and (3) construction of a reinforced concrete cap in areas used for material stockpiling and of a geotextile fabric and gravel cap in low traffic areas. A fourth step was added when a 1,100-gallon underground storage tank was found in the central portion of the former United Heckathorn facility during grading activities. It was removed and all visibly affected soil (approximately 250 cubic yards) was excavated.

Reinforced concrete was used to cap the site in high-traffic and materials stockpiling areas. The cap is composed of concrete with steel wire reinforcement overlying a prepared and compacted subgrade. The thickness of the concrete ranges from 6 to 14 inches. The reinforcing

steel in the concrete consists of a double layer of 6-inch by 6-inch steel welded wire fabric over areas with asphalt pavement and a double layer of 4-inch by 4-inch steel welded wire fabric over portions of the site that were not previously paved. The welded wire fabric was supported above the rough grade and overlapped for splicing during successive days of concrete pouring. The surface was sloped uniformly to drain surface runoff. Over a portion of the cap, the surface slopes toward the center of the cap. Surface water in these areas is captured in shallow swales that direct the water to drop inlets. Over the rest of the cap, the surface slopes toward the outside edge of the cap. In these areas, a 7- to 12-inch high concrete curb was added at the edge of the concrete slab to ensure that surface runoff remains on the concrete slab and enters drop inlets around the perimeter of the cap. Along the northern margin of the Lauritzen Channel, a gravel and geotextile fabric cap was used. A geotextile fabric was placed on a prepared subgrade of soil and was covered with a minimum of 6 inches of imported clean gravel.

Finally, institutional controls limiting use of the property to non-residential uses were put in place. A deed notice puts obligations and restrictions on the owner. The notice requires longterm operations and maintenance of the cap and prevents conversion to residential uses. Operation and maintenance (O&M) activities for the cap are being performed by the property owner under a Consent Decree with EPA.

Marine Sediments: Remedial activities commenced at Parr Canal then continued to the Lauritzen Channel. Montrose Chemical Corporation of California, Inc. performed the remedial action for the marine sediments pursuant to a Consent Decree with EPA. Remedial activities at the Parr Canal began on August 7, 1996 and were completed on August 30, 1996. A silt curtain was erected across the mouth of the Parr Canal prior to excavation activities to inhibit sediments from migrating into the Santa Fe Channel. Younger bay mud from the Parr Canal was removed from the canal bottom and placed into trucks for shuttling to the Lauritzen Channel dewatering cell. Younger bay mud was removed from the Parr Canal by excavation from both shores. Excavators began on the south side of the canal and worked their way in tandem, north toward the head of the canal. A section of the canal, a small ridge, was not accessible from the shore. EPA subsequently sampled the area and found the contaminant concentrations to be below levels of concern. EPA decided to leave the area for ecosystem enhancement. Excavation continued until riprap or other non-removable barriers made further excavation impractical. As much younger bay mud was removed as practical. A total of 2,620 cubic yards of sediments was excavated from the Parr Canal. After completion of the excavation, an average of 18 inches of clean sand was placed on the bottom of the Parr Canal to provide a means of promoting growth and restoring the ecosystem.

Remedial activities commenced at the Lauritzen Channel on August 22, 1996 and were completed on March 31, 1997. During the remedial activities, a silt curtain was installed across the mouth of the Lauritzen Channel. The curtain was damaged and repaired on numerous occasions throughout the project. This was one of many difficulties encountered during excavation of the Lauritzen Channel. Although a marine derrick raised large debris (sunken barges, storage tank, caissons, cables, etc.) before dredging commenced, additional debris in the channel impeded dredging operations, severely damaging equipment and causing periodic suspensions of operations. Dredging was conducted from the outer to the inner part of the channel to minimize contamination of clean areas. To the maximum extent possible, the dredge utilized a patented Cable-Arm or similar bucket to provide a level cut and to minimize turbidity.

In areas where there were known obstructions or large objects, such as pilings or debris, a different bucket was used. The bucket placed sediments into a scow. When the scow was loaded, it was moved over to the dewatering cell side of the channel and the sediments were placed into the dewatering cell. Unloading the scow was to be by hydraulic pump; however, the amount of debris broke the pumps and unloading had to be done by crane and bucket.

Another difficulty resulting in further delays involved a change in disposal facilities. Initially, the sediment was disposed at the Butterfield Station in Mobile, Arizona, but after community protests and demonstrations in Richmond, CA and Arizona, the disposal site was changed to the ECDC disposal facility in Utah. This led to difficulties in tracking trains and in keeping available an adequate number of rail cars.

Approximately 105,000 cubic yards of contaminated sediment containing 3 tons of DDT were removed from Lauritzen Channel. In addition, 187 tons of salvaged metal were retrieved from the channel. After completion of sediment removal, clean sand was imported by barge and spread by hydraulic pumping through the bottom of the channel at an average thickness of 18 inches.

In April 1997, after remediation had concluded, post-cleanup surface sediment concentrations were measured. Before remediation, the median total DDT concentration at the head of Lauritzen Channel was 47,000 $\mu\text{g}/\text{kg}$ and the median total DDT concentration in Parr Canal was 840 $\mu\text{g}/\text{kg}$. After remediation, average DDT concentrations in Lauritzen Channel were 263 $\mu\text{g}/\text{kg}$ and in Parr Canal 200 $\mu\text{g}/\text{kg}$.

4. System Operations & Maintenance

Upland Area: LRTC is responsible under the Consent Decree for long-term management of the upland capping system at the former United Heckathorn facility. As per the Operations and Maintenance Plan, inspections, monitoring and maintenance of the cap and drainage system are documented in an Annual Report. LRTC is also responsible for maintaining the institutional controls at the site to prevent residential use of the property.

The upland area remedial action was approved as complete on September 30, 1999. One O&M report has been submitted since then in December 2000. In September 2000 the cap was inspected and found to be intact and in good condition, and the five stormwater interceptors were emptied and cleaned. The cap was inspected again in November 2000 and found to be uncompromised with occasional surface feather cracks. The cracks were insignificant and not indicative of stress fractures.

Marine Channels: Marine sediment dredging at the United Heckathorn site was completed in April 1997. Figures 2 and 3 illustrate pre- and post-remediation pesticide concentrations at the site.

The remedy called for post-remediation monitoring for at least five years to document the expected reduction in flux of contaminants from the site following EPA response actions. The measurement endpoints for the yearly post-remediation monitoring are surface waters and mussels from four stations in and near Lauritzen Channel. Mussels were chosen because contaminants accumulate in their fatty tissues, making the concentration amounts of the chemicals easier to determine. Surface water samples were also collected in order to determine particulate levels in the water. Dieldrin and DDT were analyzed in water samples and in tissue samples from transplanted (in years 1 and 2) and naturally occurring mussels (all years). The

Before

DDT Concentrations in Lauritzen Channel were two to three orders of magnitude higher than in Santa Fe or Richmond Harbor Channels

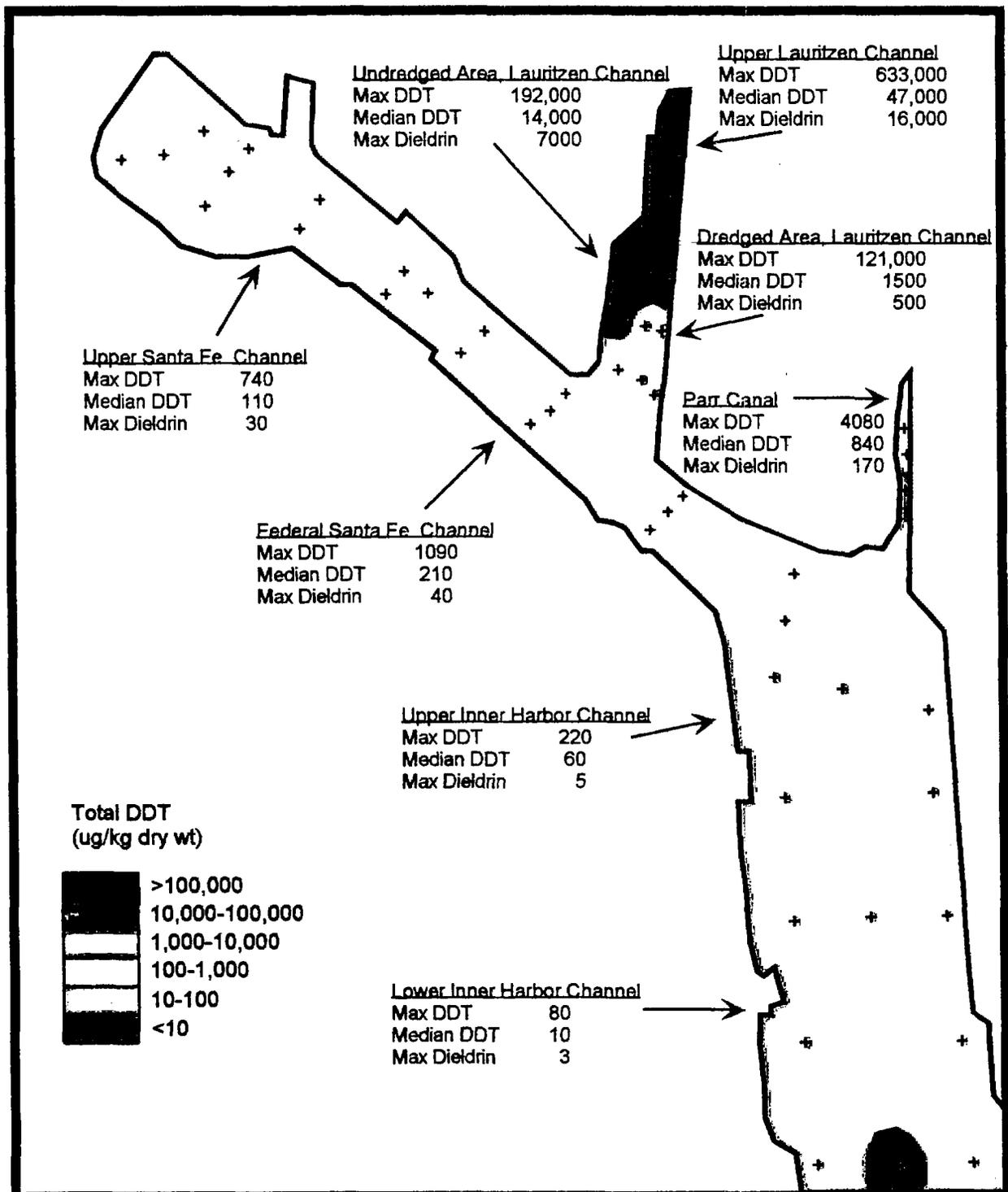


FIGURE 2: Magnitude and extent of contamination prior to cleanup.

After

All soft bay mud was removed from Lauritzen Channel, and DDT concentrations in remaining sediment were about the same as in Santa Fe Channel. The final average DDT in Lauritzen Channel was 263 ug/kg, below the cleanup level of 590 ug/kg. Final maximum DDT concentrations were below the benthic effects threshold concentration.

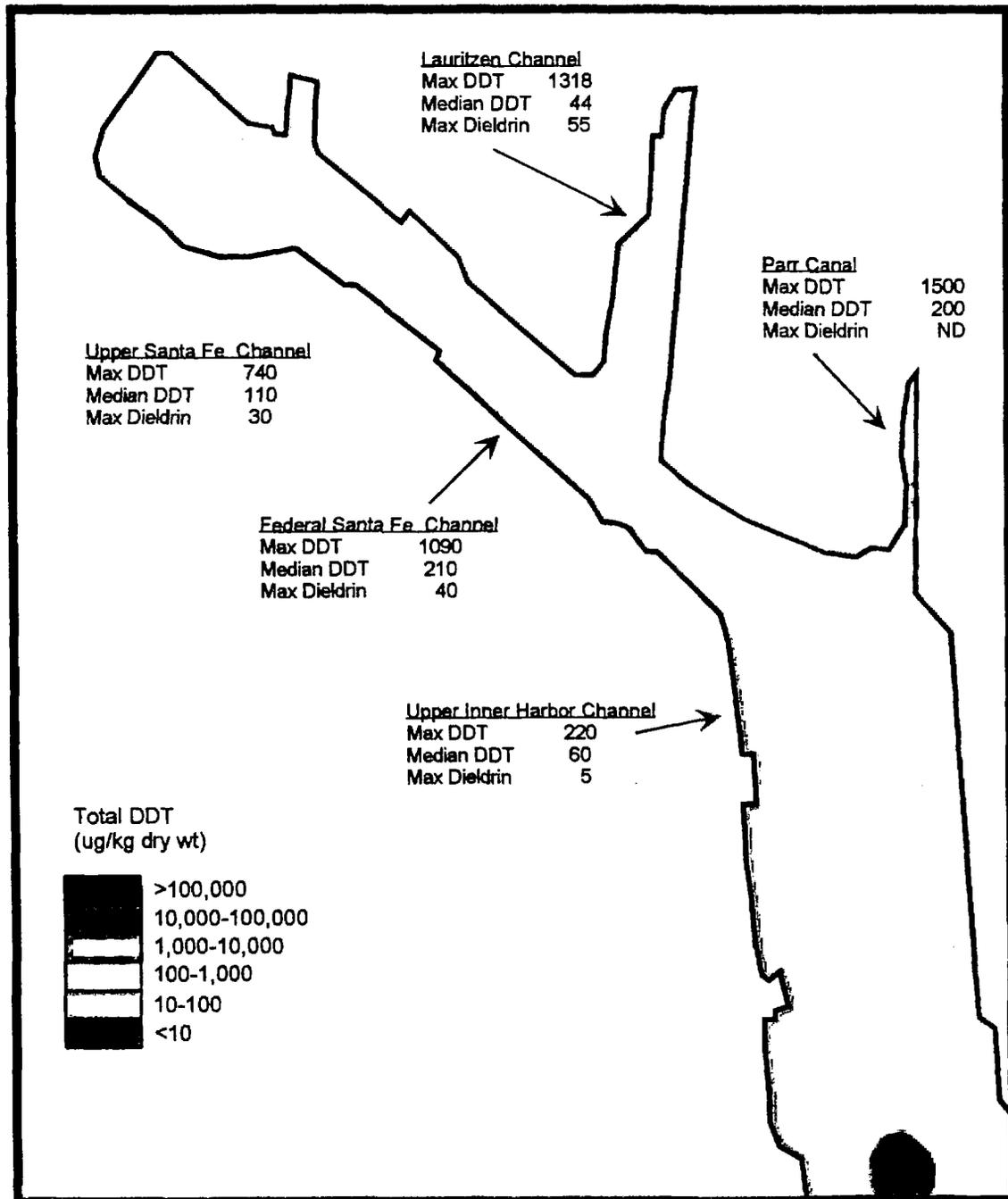


FIGURE 3: Magnitude and extent of contamination at the Heckathorn site after cleanup (April 1997).

methods of sampling the DDT and dieldrin concentrations were consistent with the Quality Assurance Project Plan (QAPP) and the RI/FS for the United Heckathorn site.

V. TECHNICAL ASSESSMENT

1. Remedy Function

The first round of post-remediation biomonitoring began in September 1997, with placement of mussels at four sampling locations: Richmond Inner Harbor Channel, Lauritzen Channel/Mouth, Lauritzen Channel/End, and Santa Fe Channel/End. Mussels and water samples were collected in January 1998. Year 1 biomonitoring showed that pesticide concentrations in the tissues of mussels exposed at the site were higher than those observed before remediation. Year 2 samples were collected in February 1999. Year 2 biomonitoring showed tissue levels that were much reduced from Year 1 but still exceeded preremediation levels of DDT at Lauritzen Channel, Santa Fe Channel, and Richmond Inner Harbor Channel. During both years the concentrations in mussels and water were higher at Lauritzen Channel stations than at the Richmond Inner Harbor Channel or Santa Fe Channel stations.

The increase in pesticide concentrations in mussel tissue was not known immediately because of a reporting error on the part of EPA's contract laboratory. For Years 1 and 2 the tissue pesticide data were reported as dry weight when the data were actually wet weight values. The lab converted what it thought was dry weight data to wet weight by "diluting" the concentrations. Mussel tissue is typically 85 to 90 percent moisture, so actual dry weight concentrations were 7 to 10 times higher than what were reported as dry weight concentrations in the Year 1 and 2 reports. Years 1 and 2 reports were reissued in July 2000.

Year 3 samples were collected in February 2000. Year 3 biomonitoring showed an increase in DDT and dieldrin concentrations from Year 2, albeit much reduced from Year 1, in mussel tissues. Concentrations of dieldrin and DDT in water samples were higher for the Lauritzen Channel in Year 3 than in Year 2, but lower in water samples taken from the Santa Fe Channel and the Richmond Inner Harbor Channel. Year 4 samples were collected in January 2001. Total DDT concentrations in mussel tissues measured in Year 4 were slightly higher than Year 3 values at all stations except Richmond Inner Harbor Channel. Dieldrin concentrations measured in Year 4 were lower than Year 3 values at all stations. Some Year 4 water samples were lower than Year 3 levels, but still above remediation goals except for the Richmond Inner Harbor Channel, where concentrations of DDT and dieldrin in water were below the method detection limit. As in previous years, the highest concentrations of total DDT and dieldrin were found at the end of the Lauritzen Channel. Table 3 summarizes surface water sampling data for all years; Table 4 presents mussel tissue data for all years.

There is heavy marine activity in the channels, primarily from dredging vessels and tankers unloading raw materials. As a result, the water is very turbid. This is reflected in the water samples that have been collected. Water samples are analyzed for total DDT, which would include all suspended particles. In an attempt to differentiate between DDT in the water column and DDT in sediments, the Year 4 analysis analyzed dissolved as well as total DDT in water samples. Total DDT measured at the head of Lauritzen Channel was much higher in the total fraction than in the dissolved fraction of water samples, e.g., 92.3 ng/L vs. 10.8 ng/L.

Monitoring of the United Heckathorn site has shown remediation goals for DDT and dieldrin have not been reached. The mean contaminant concentration in surface water ranges

Table 3: Comparison of Post-Remediation Concentration of total DDT and Dieldrin in Water Samples with Preremediation Levels and Remedial Goal Concentrations (Water Concentration in ng/L)							
Water Sample ID	Location	Remediation Goal	Pre-Remediation ^(a)	1998 (Yr 1) Post-remediation	1999 (Yr 2) Post-remediation	2000 (Yr 3) Post-remediation	2001 (Yr 4) Post-remediation
Total DDT							
303.1	Richmond Inner Harbor	0.59	1	0.65	14.4	2.56	ND ^(b)
303.2	Lauritzen/ Mouth	0.59	no sample	42.6	4.61	27.9	2.88
303.3	Lauritzen/ End	0.59	50	103	62.3	83.7 (w/o rep b) 1773 (all reps)	142
303.4	Santa Fe/ End	0.59	8.6	11	19.2	3.70	2.51
Dieldrin							
303.1	Richmond Inner Harbor	0.14	<1	0.65	0.62	1.57	ND
303.2	Lauritzen/ Mouth	0.14	no sample	8.18	0.48	8.96	0.46
303.3	Lauritzen/ End	0.14	18	18.1	12.5	83 (w/o rep b) 625 (all reps)	8.49
303.4	Santa Fe/ End	0.14	1.8	2.47	0.37	2.11	0.46

(a) Preremediation water concentration is the average of samples collected in October 1991 and February 1992 for the Ecological Risk Assessment (Lee et al. 1994)

(b) ND None detected

Table 4: Comparison of Post-Remediation total DDT, Dieldrin, PCBs in Tissues with Preremediation Concentrations (µg/kg wet weight)							
Station Number	Station Name	State Mussel Watch ^(a) Transplant	Eco Risk Assessment ^(b) Resident	1998 (Yr 1) Post-remediation Resident	1999 (Yr 2) Post-remediation Resident	2000 (Yr 3) Post-remediation Resident	2001 (Yr 4) Post-remediation Resident
Total DDT							
303.1	Richmond Inner Harbor	47	40	127	30	52	25
303.2	Lauritzen/Mouth	629 ^(d)	--	1,222	176	310	340
303.3	Lauritzen/End	5,074 ^(d) 1,369	2,900	4,504	606	522	1,136
303.4	Santa Fe/End	369 ^(c)	350	256	76	75	150
Dieldrin							
303.1	Richmond Inner Harbor	7.7 ^(c)	4.0	5.43	1.9	5.4	0.7
303.2	Lauritzen/Mouth	87.0 ^(d)	--	40.3	6.5	27.7	6.3
303.3	Lauritzen/End	602 ^(d) 100 ^(c)	97.0	184	28.4	42.7	32.1
303.4	Santa Fe/End	32.5 ^(c)	19.0	8.18	2.8	6.4	3.3
Total PCBs							
303.1	Richmond Inner Harbor	176 ^(c)	not measured	not measured	51	150	53
303.2	Lauritzen/Mouth	120 ^(d)	not measured	not measured	75	187	92
303.3	Lauritzen/End	196 ^(d) 137 ^(c)	not measured	not measured	124	169	158
303.4	Santa Fe/End	138 ^(c)	not measured	not measured	67	123	99

(a) Most recent data available from State Mussel Watch program, transplanted California mussels (Rasmussen 1995).

(b) Average concentration in resident mussel tissue from samples collected in October 1991 and February 1992 (Lee et al., 1994)

(c) State Mussel Watch program sample from March 1991 (Rasmussen 1995).

(d) State Mussel Watch program sample from January 1988 (Rasmussen 1995).

considerably from year to year, e.g., total DDT from the end of Lauritzen Channel went from 50 ng/L at pre-remediation to 103 ng/L in 1998, 62.3 ng/L in 1999, 83.7 ng/L in 2000 and to 142 ng/L in 2001. The remediation goals of 0.59 ng/L DDT and 0.14 ng/L dieldrin have only been achieved once, in 2001, at the Richmond Inner Harbor Channel. See Table 3 for a comparison of post-remediation concentration in water samples. The great variability in contaminant concentrations in surface water samples and the activity in the channels that continually creates highly turbid water conditions, throw into question the usefulness of surface water measurements to determine the progress of the remedy. Mussel tissue analysis appears to be a better measure.

The concentration of DDT in mussel tissue did jump from pre-remediation to Year 1 post-remediation levels, but since has trended downward (see Table 4). These results suggest that DDT and dieldrin are still present and bioavailable in Lauritzen Channel.

2. ARARs Review

EPA reviewed the ARARs presented in the ROD and finds them still valid. EPA believes that the exposure assumptions and toxicity data used to generate cleanup levels remain valid. As noted above, achieving the remedial action objective for DDT in the water column is complicated by the variability associated with measuring this parameter. Although mussel tissue analysis provides better data regarding bioaccumulation of contaminants, there is no remediation goal associated with mussel tissue concentrations that could be substituted for the surface water remediation goals.

3. New Information

A publication authored by independent academic researchers from the University of California and by personnel from the State of California Department of Fish and Game (Anderson *et al.*, 2000) has been published in a peer-reviewed scientific journal. This study used techniques of ecological risk assessment similar to those described in the Remedial Investigation for this site (White, *et al.*, 1994). The work by Anderson *et al.* (2000) supports the view that the sediments in the Lauritzen Channel still present considerable ecological risk to marine receptors.

4. Site Inspection

Inspection of the site was conducted on September 26, 2001 by the RPM and an EPA environmental engineer. The purpose of the inspection was to assess the protectiveness of the remedy, including the integrity of the upland area cap and the condition of the dredged channels. EPA representatives toured the site with the LTRC operations superintendent and the former project manager. The Levin Terminal is surrounded by other industrial facilities. The property is fenced and access is limited. No significant issues were identified regarding the cap and drainage structures. Some hairline cracks are visible on the cap surface but the integrity of the cap is not compromised. The stormwater interceptors are inspected and cleaned routinely. LTRC has instituted stormwater pollution prevention measures, such as absorbent materials and filters around and within each interceptor and storm drain. EPA and LTRC personnel walked the length of Lauritzen Channel and Parr Canal. At the time of the visit there was no ship traffic and the water was relatively calm. Lauritzen Channel has numerous outfall pipes, including interceptor outfalls and City of Richmond outfalls. Part of the channel has metal sheeting along the bank that prevents erosion and other areas have riprap. Not all of Lauritzen Channel's bank

was visible from shore. Riprap lines the banks of Parr Canal. At the time of the visit, a flock of grebes were swimming in the canal. The area adjacent to Parr Canal had been paved with a curb on the rim of the paved area to prevent stormwater runoff. A “No Fishing” sign could be seen in the Inner Richmond Harbor from the Parr Canal.

VII. ISSUES

- Post-remediation monitoring of the site indicates that levels of DDT and dieldrin measured in the water and sediment do not meet cleanup goals. While the concentrations do not pose an immediate risk to human health and the environment, through bioaccumulation up the food chain, the contaminants pose a potential risk to fish-eating birds, mammals and fishermen in the Inner Richmond Harbor area.
- Laboratory reporting errors occurred in Years 1 and 2 of the post-remediation biomonitoring, grossly underestimating contaminant concentrations in mussel tissue. Conflicting data generated from another source led to the discovery of this error. Measures to tighten QA/QC are warranted to assure such errors do not occur again.

Recommendations and Follow-up Actions: Post-remediation monitoring indicates that Lauritzen Channel still harbors unacceptable levels of COCs. The following table presents recommendations that address the issues identified above.

Recommendation	Date
Consider revisions to post-remediation monitoring plan and QAPP: <ul style="list-style-type: none"> ▶ increase sampling frequency to biannual; ▶ analyze dissolved as well as total DDT in water samples; ▶ prepare a comprehensive report covering all post-remedial monitoring. 	Nov. 2001
Review lab’s QA/QC procedures and Quality Problem Report; provide recommendations for preventive measures.	Nov. 2001
Prepare a source identification study. Potential sources of DDT in Lauritzen Channel include: <ul style="list-style-type: none"> ▶ incomplete dredging of channel during cleanup; ▶ discharge from storm drain; ▶ discharge from an abandoned outfall hidden by debris or rip-rap; ▶ sloughing from areas inaccessible to dredging. 	Nov. 2001
Prioritize potential sources of recontamination for further study and prepare work plans for further investigation	Dec. 2001
Combine outfall water sampling with next biomonitoring sampling event	Feb. 2002

Recommendation	Date
Further field investigations to determine potential sources of recontamination	May 2002 - Apr. 2003
Evaluation of data to determine next steps	May 2003 - Sept. 2003

VIII. PROTECTIVENESS STATEMENTS

The remedy implemented at the upland area of the United Heckathorn Superfund site is protective of human health and the environment. Yearly monitoring will assure that the remedy continues to be protective.

The remedy implemented at the remainder of the site, i.e., in harbor channels, has not met remediation goals presented in the ROD and therefore is not protective of human health and the environment. As presented in Table 5, sediment sampling shows levels of contamination above ARARs. The Remedial Investigation (White *et al.* 1994) determined protective levels for sediments, the water column, and fish tissues for both human and avian consumers. Relationships between sediment DDT concentrations and concentrations in other media were determined by EPA in the Ecological Assessment (Lee *et al.* 1994). The water quality criterion for the protection of human health from consumption from the bioaccumulation of DDT in fish is 0.59 ng/L, based on achieving a 1×10^{-6} lifetime excess cancer risk level; this translates to a total DDT sediment concentration of 590 $\mu\text{g}/\text{kg}$. Current sediment contaminant concentrations exceed this level. Further investigation to identify source(s) and/or cause(s) of DDT contamination, followed by evaluation of additional remedial actions to address such sources/causes, is warranted.

Table 5: Total DDT in Sediment	Lauritzen Channel	Parr Canal
Final Remediation Goal	590 $\mu\text{g}/\text{kg}$	590 $\mu\text{g}/\text{kg}$
Pre-remediation median tDDT levels	47,000 $\mu\text{g}/\text{kg}$	840 $\mu\text{g}/\text{kg}$
Confirmation sampling after dredging	263 $\mu\text{g}/\text{kg}$	200 $\mu\text{g}/\text{kg}$
Post-remediation sampling (1998)	2,700 $\mu\text{g}/\text{kg}$ to 130,000 $\mu\text{g}/\text{kg}$	no sample
Post-remediation sampling (1999)	100 $\mu\text{g}/\text{kg}$ to 180,840 $\mu\text{g}/\text{kg}$	825 $\mu\text{g}/\text{kg}$ to 1,172 $\mu\text{g}/\text{kg}$

IX. NEXT REVIEW

The next five-year review for the United Heckathorn Superfund Site will be conducted in 2006, five years from the date of this review.

Reference:

- Anderson, B.S., J.W. Hunt, B.M. Phillips, M. Stoelting, J. Becker, R. Fairey, H.M. Puckett, M. Stephenson, R.S. Tjeerdema, and M. Martin. 2000. Ecotoxicologic Change at a Remediated Superfund Site in San Francisco, California, USA. *Environmental Toxicology and Chemistry* 19(4):879-887.
- White, P.J., N.P. Kohn, W.W. Gardiner, and J.Q. Word. 1994. The Remedial Investigation of Marine Sediment at the United Heckathorn Superfund Site. Pacific Northwest Laboratory. PNL-9383. February.
- Lee, H., A. Lincoff, B.L. Boese, F.A. Cole, S.P. Ferraro. 1994. Ecological Risk Assessment of the Marine Sediments at the United Heckathorn Superfund Site. U.S. EPA, ERL-Narragansett Pacific Ecosystems Branch. May.
- ICF Technology, Inc. 1994. Final Human Health Risk Assessment for the United Heckathorn Superfund Site Richmond , California. Prepared for U.S. EPA Region 9. May.