

## GENERAL SITE INFORMATION, CHARACTERISTICS, AND STATUS

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<b>Project Name</b>	<b><u>UNITED HECKATHORN</u></b>	<b>ProjectID:</b> 09-02
<b>Last Updated:</b>	02/05/04	
<b>City:</b>	Richmond	
<b>County:</b>	Contra Costa	
<b>State:</b>	CA	
<b>Country:</b>	USA	
<b>Bodies of Water:</b>	Lauritzen Channel and Parr Canal in Richmond Harbor; San Francisco Bay	
<b>US EPA Region:</b>	IX	
<b>Status (Active, Complete, or Monitoring Only):</b>	Active	
<b>Date On NPL:</b>	1990	
<b>ROD/ESD Date:</b>	1994; 1996 (ESD)	
<b>Operable Unit:</b>	N/A	
<b>Areas of Concern (length or acres):</b>	The Lauritzen Channel about 1,600 feet long by 200 feet wide. The Parr Canal about 1,000 feet long by about 70 feet wide.	
<b>Other Characteristics of Water Body:</b>	Both are dead-ended channels branching from the larger Santa Fe Channel which flows into Richmond Inner Harbor. The Richmond Inner Harbor is on San Francisco Bay. The Lauritzen Channel varies in depth from 10 feet at the northern end to 40 feet at its mouth.	
<b>Contaminants of Concern:</b>	DDT; dieldrin	
<b>Source of Contamination:</b>	The United Heckathorn site is adjacent to the Lauritzen Channel. Over the years, the 13.5 acre site has had a variety of owners, tenants, and users. Uses have included pesticide processing, production of napalm, and metal recycling. The last tenant to formulate pesticides at this site was Chemwest, Inc., successor to United Heckathorn, Inc. (1957-1965).	
<b>Contaminated Area Physical Characteristics:</b>	<p>Length and breadth of both the channel and canal were targeted, to sediment depths of one to five feet (the "soft younger bay mud").</p> <p>Pesticide concentrations were highest in the Lauritzen Channel, and decreased with increasing distance from the former United Heckathorn Site, suggesting that Heckathorn was the source of contamination. The highest total DDT concentration of 633 ppm was measured in a sample from 1-foot to 3 feet below the mudline in the center of the channel. Pesticide concentrations of greater than 100 ppm were detected in sediment from the northern and western portions of the channel. The median total DDT concentration was approximately 47 ppm at the head of the Lauritzen Channel, which had not been dredged in a number of years. The median concentration of total DDT decreased to about 14 ppm in the western, undredged portion of the channel, and to 1 ppm in the dredged portion of the channel near the Levin terminal. Dieldrin concentrations were lower (maximum concentration of 16 ppm).</p> <p>Pesticide concentrations in Parr Canal sediment were lower than those measured in the Lauritzen Channel but greater than those measured in Santa Fe or Richmond Inner Harbor Channels. The maximum and median total DDT concentrations measured in Parr Canal sediment were 4 ppm and 0.8 ppm, respectively. The maximum dieldrin concentration was 0.2 ppm. The Parr Canal is significantly narrower than it was in the 1940s, due to filling, which occurred sometime between 1958 and 1968. Some of the materials used to fill the canal were dredged from the Lauritzen Channel harbor, possibly causing the elevated levels of pesticides in Parr Canal sediments.</p> <p>As described in Reference B-34, "mussels from the Lauritzen Channel contain by far the highest</p>	

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levels of DDT and dieldrin ever reported in the State Mussel Watch Program. Fish contain approximately 10 ppm DDT in the Lauritzen, 1 ppm in the Santa Fe, and 0.1 ppm in the Richmond Inner Harbor Channel. Fish in the Lauritzen exceed Food and Drug Action Levels for DDT and dieldrin."

***Type of Regulatory Action:*** Superfund. Final. Four consent decrees between EPA and PRPs approved in July 1996.

***Overall Status Summary:*** The project had been delayed by EPA negotiations with PRPs: four Consent Decrees were signed in July 1996; contaminants of concern were pesticides, primarily DDT and dieldrin; dredging targeted the pesticide-contaminated soft sediment down to underlying hard deposits in two dead-end waterways; mechanical dredging in the Lauritzen Channel started in September 1996 and finished in April 1997; removal using long-stick excavators started in the Parr Canal in August 1996 and finished in April 1997; 108,000 cy were removed, solidified, and disposed offsite, by rail to landfills in Arizona and Utah; a Cable Arm clamshell was used for soft sediment, a conventional clamshell for the harder material beneath. Dredged areas were backfilled with six to 18 inches of sand (15,700 cy).

Two years of post-remediation monitoring showed that elevated concentrations of DDT (2.7 - 130 ppm) and dieldrin (0.05 - 3.3 ppm) remained in the top 10 inches of sediments, and water concentrations of DDT and dieldrin were still about 100 times greater than the remedial goal; conversely, biomonitoring showed substantial and continuing reductions of DDT and dieldrin in resident and transplanted mussels.

Two additional studies (References E-164 and M-357) raised questions regarding the ecological success of the dredging project citing a) a lack of sufficient pre- and post-dredging data for benthic and fish populations, b) confounding effects from sediment disturbance from shipping and dredging activities as well as from sub-tidal deposits that were not dredgeable due to in-water obstructions such as pilings and wharves, and c) dramatic measured 3- to 70-fold increases in DDT body burdens in ten fish and invertebrates monitored.

EPA completed a Five-Year Review in September 2001. The Five-Year Review concluded that the dredging remedy has not kept the Lauritzen Channel from being recontaminated with unacceptable levels of pesticides, as evidenced by water column pesticide concentrations exceeding cleanup goals. As a result, EPA will take additional remedial actions at the site.

The first step (Phase I), to collect additional water and sediment samples, was performed in February and March 2002. EPA looked for outfalls that may discharge into Lauritzen Channel and sampled embankments and sediment in the channel. Many of these samples were above cleanup goals, including one sediment sample that exhibited 23,190 ppm DDT. Additionally, during the 2002 sampling, a buried outfall only visible during low tide was found that discharged water with high levels of DDT. The second step (Phase II), additional water and sediment sampling, took place in May 2003.

As described in Reference A-1144 (February 2004):

"The reinvestigation confirmed that the site has not met cleanup goals. USEPA has entered into an agreement with the U.S. Army Corps of Engineers to prepare a Focused Feasibility Study (FFS) to assess a range of alternative actions that could be taken at the site to remediate the remaining contamination. The range of alternatives will include a no action alternative . . ."

"In preparing the FFS, it became clear that additional information on the nature of the sediments at the site would be necessary before an assessment of alternatives could be prepared. Therefore, the FFS has been put on hold while the Army Corps and USEPA gather more

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information on the types of sediments found in Lauritzen Channel. This work will delay the FFS by a year. However, sediment information will help determine which alternatives are truly feasible and what technologies simply are not viable."

***Remedial Action Planned:***                      ☒

***Risk Assessment:***                      ☒

***Remedial Action Implemented:***                      ☒

***Status of Dredging***                      ☐

***PRPs:***                      ☒

***Contacts:***                      ☒

***References:***                      ☒

***Modeling:***                      ☐

***Fishing Advisory:***                      ☒

***Key Conditions:***                      capping, commercial landfill, specialty dredge, post monitoring, fish spawning limitations, rail transport for disposal, solidification / stabilization

## REMEDIAL ACTION PLANNED

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<b>Target Sediment Cleanup Standards (TSCS):</b>	590 ppb DDT	
<b>How TSCS Established:</b>	<p>As reported in the ROD, although DDT and dieldrin co-occurred, the DDT concentration was generally 10 to 100 times higher, and DDT was detected in sediment samples over a wider area. Therefore, sediment remediation goals, which were expected to attain protective levels for both contaminants, were established based only on DDT concentration. The sediment remediation goals met a 10<sup>-6</sup> human health cancer risk level. Further, it was expected that the EPA marine chronic water quality criteria of 1 ppt DDT would be achieved if the average channel sediment concentration was reduced below 1 ppm DDT, and the human health surface water criteria of 0.6 ppt DDT would likely be achieved if the average sediment concentration was reduced below 590 ppb DDT.</p> <p>The National Academy of Sciences (NAS) action level for the concentration of DDT in fish to protect fish-eating birds was not an ARAR but was identified as a TBC to assist in determining the protectiveness of remediation. The NAS action level was likely to be achieved if the average channel DDT sediment concentration is reduced below 420 ppb. Since the average concentrations of DDT in the adjacent Santa Fe and Inner Harbor Channels are below this level, cleanup of sediments in the Lauritzen Channel and Parr Canal was expected to result in achievement of the NAS action level.</p>	
<b>Target Bank and Floodplain Cleanup Levels (if applicable):</b>	N/A	
<b>Other Target:</b>	None	
<b>Environmental Sample Data References:</b>	<ul style="list-style-type: none"><li>• <b>Sediment:</b> References A-239 (RI) and A-240 (Eco Risk Assessment)</li><li>• <b>Water:</b> References A-239 and A-240</li><li>• <b>Fish:</b> References A-239 and A-240</li></ul>	
<b>Estimated Target Volume:</b>	65,000 cy	
<b>Planned Disposal Method:</b>	Rail transport to offsite landfill	
<b>Estimated Calendar Time to Implement Remedy:</b>	2 months	
<b>Estimated Time to Implement Remedy:</b>	2 months	
<b>Estimated Cost to Implement Remedy:</b>	\$7 million (1994 ROD); \$9 million (Reference B-163, EPA Public Notice)	
<b>Stated Remedial Action Objectives (and Source):</b>	<p>Only as already stated under "How TSCS Established." Further, as stated in Reference B-162:</p> <p>"Based on the information currently available, EPA believes that the preferred alternative utilizes permanent solutions to the maximum extent practicable and provides the best balance among the other alternatives with respect to the evaluation criteria. As discussed in the FS, treatment of contaminated sediments was determined to be not-practicable, and the preferred alternative satisfies the NCPs expectation for use of engineering controls (containment in a permitted</p>	

## REMEDIAL ACTION PLANNED

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	disposal facility) for large volumes of wastes containing relatively low contaminant concentrations. The State of California Department of Toxic Substances Control and the Regional Water Quality Control Board agree with EPA's Preferred Alternative."	
<b>Measures of Success to be Used:</b>	Below ("Planned Monitoring and Restoration")	
<b>Planned Monitoring and Restoration:</b>	Monitoring of surface water and biota will occur for at least five years or until it is demonstrated that the remediation goals have been achieved, and could continue for a longer period of time. (Source: ROD, Oct. 1994).	
<b>Agency Position on Sediment Removal (and Source):</b>	Source: ROD, October 1994: "The environmental media requiring remediation are soft marine sediments (young bay muds) in the Lauritzen Channel and Parr Canal. Contamination is confined to softer younger bay mud, and has not migrated into the underlying older bay mud. The volume of contaminated sediment in the Lauritzen Channel and Parr Canal is approximately 65,000 cy. Remediation of this sediment is expected to result in achievement of the remedial action goals. In addition, erosion of upland soils containing DDT at concentrations exceeding the final remediation level for sediments must be prevented. No action will be taken in other areas in Richmond Harbor, such as the Santa Fe Channel and Inner Harbor Channel, because sediment levels are below the remediation levels established."  Source: ROD, Oct. 1994: "The Levin Richmond Terminal is a rail facility with lines running the length of the shoreline of the Lauritzen Channel. Since dredging can produce very large volumes of sediment very quickly, the limiting factor in removing sediment from the Site would be the time required to load it for transport. Watertight rail cars would be used to prevent releases during transportation. A rail car can carry 100 tons, and a single train can transport approximately 8000 tons. It is estimated that the entire project could be accomplished in about two months."	

## ***RISK ASSESSMENT***

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***RA Type:*** Human Health and Ecological

***RA Status:*** Complete

***RA Objectives:*** Evaluate the threat to human health and the environment posed by contamination from the United Heckathorn site, and provide sufficient information to develop site remediation goals which would be protective.

***Company*** ICF Technology (human health)

***Performing RA:*** US EPA (ecological)

***RA Reference Report:*** Reference A-240 (ecological)

***RA Summary and*** Source: ROD, Oct. 1994 re Human Health Risk Assessment:

***Conclusions:*** "Risks to fishermen and their families who consume fish caught in the inner Richmond Harbor were evaluated using information from two sources: fish tissue data generated as part of EPA's ecological assessment of the Site, and community interviews with individuals who fish or are familiar with fishing practices in Richmond Harbor. The community interviews confirmed that fishing occurs regularly in Richmond Harbor, particularly at a Site in the Inner Harbor Channel near the Parr Canal that has unrestricted access. Although it could not be determined from the limited interviews performed whether fishing at subsistence rates occurs in the harbor, it is clear that the fishermen are from poor, minority communities, and that the fish are caught for consumption. Fishing in the Lauritzen Channel is restricted because it is surrounded by fenced industrial facilities, and fishing from boats is discouraged by warning signs in English, Spanish, Vietnamese and Laotian, posted under a 1986 order of the CDHS. Baseline risk assessments, however, assume that institutional controls, such as fences and posting, will be ineffective or not maintained."

"The results of the risk calculations indicate that the risks from long-term consumption of either whole fish or fillets of fish caught in the Lauritzen Channel are unacceptable. Using the exposure scenario which is the basis of EPA's water quality criteria for fish consumption, the lifetime excess cancer risk associated with Site COCs is above 10<sup>-3</sup> for consumption of whole fish, and above 10<sup>-4</sup> for fillets. In the Santa Fe and Richmond Inner Harbor Channels, lifetime excess cancer risks are within the acceptable range using the same exposure scenario. If consumption were to occur at subsistence rates, the associated risks would be approximately 10 fold higher. The proposed remedy is expected to achieve protective levels for contaminants of concern under either exposure scenario."

Source: Ecological Risk Assessment (Reference A-240):

"Overall, the results indicate that the gross contaminant levels in the Lauritzen Channel threaten a variety of ecological receptors at various trophic levels, including benthic and water column organisms and fish-eating birds. Effects are likely to be much less severe in the Santa Fe Channel, although the contaminant levels in the fish are still significantly higher than the levels which may threaten sensitive fish-eating birds. In the Richmond Inner Harbor Channel, the DDT residues in whole fish (115 ppb wet) fall between the levels which are the basis of the EPA/state chronic marine water quality criteria intended to protect marine birds (150 ppb) and the National Academy of Sciences recommendation (50 ppb) for protecting marine birds."

"It appears, then, that the most sensitive ecological receptors to sediment organochlorines in Richmond Harbor are fish-eating marine birds. The only contaminated medium for which regulatory criteria were identified is surface water. Non-regulatory or surrogate criteria were also identified for fish and shellfish tissues, benthic communities and sediments. It was found that surface water concentrations were consistent during different tidal cycles and seasons in each of the three channels sampled, allowing the prediction of the sediment concentration required to achieve a protective water concentration. In addition,

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the concentrations measured in the water column and the concentrations measured in whole fish were found to agree remarkably well with the concentrations predicted by the EPA marine chronic Water Quality Criteria and State Water Quality Objectives. This demonstrates that DDT present in surface waters is bioavailable and that it accumulates as predicted by the applicable criteria."

"The analysis of surface water pesticide concentrations in the three channels indicates that the concentrations in the Santa Fe and Richmond Inner Harbor Channels are likely elevated by approximately an order-of-magnitude over the concentrations which would result from the respective local sediment concentrations, due to the flux of contaminated water from the Lauritzen Channel. This can confound the calculation of potential remediation goals in the Santa Fe and Richmond Inner Harbor Channels, making them overly conservative, but it also indicates that remediation of the Lauritzen would have beneficial effects throughout the Inner Harbor."

"The final goal of the ecological assessment was to provide sufficient information to develop site remediation goals for contaminated sediments which would be protective of human health and the environment. It was determined that the minimum ecological effects concentration for benthic amphipods was 100 g DDT/g organic carbon, which is equivalent to 1900 ppb (dry wt.) at 1.0% organic carbon. Sediment concentrations exceeding this value might cause local chronic adverse impacts to benthic organisms. EPA has reviewed data for other amphipods. Cleaning-up sediment to this DDT concentration would reduce dieldrin concentrations below its proposed sediment quality criterion of 17 g/g organic carbon."

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<b>Physical Target:</b>	Lauritzen Channel, about 1,600 feet by 200 feet, and Parr Canal, about 1,000 feet by 70 feet, in Richmond Harbor near San Francisco Bay.	
<b>Goals:</b>	Removal to a DDT target level of 590 ppb, to meet human health risk of 10-6 and surface water criteria.	
<b>Primary Contractor:</b>	Chemical Waste Management	
<b>Other Contractors:</b>	Dutra Dredging; Manson Construction and Engineering; Levine-Fricke (RI); ICG Technology (risk assessment); Battelle (oversight)	
<b>Generic Remediation Method:</b>	Mechanical dredging; wet excavation	
<b>Equipment:</b>	12 cy Cable Arm clamshell bucket; 7 cy conventional clamshell bucket; 5 cy clamshell for re-handling 5,000 cy receiving scows with grizzlies; tugboats to move the scows; derrick and clamshell bucket for unloading scows. For Parr Canal, a land-based long-reach excavator (70-foot reach). Backfilling by pneumatically pumping clean, dredged sand from a barge through a diffuser pipe.	
<b>Material Handling:</b>	<p>To the maximum extent possible, the dredge utilized a patented Cable Arm or similar "environmental" 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. Sediments were moved by the bucket and placed into the scow. When the scow was loaded, it was moved to the dewatering cell side of the Channel and the sediments were placed into the dewatering cell. Water in the scow was pumped to the dewatering area where the liquids were treated and managed. All dredging was conducted on a grid-by grid pattern, working from the outer to the inner part of the Channel, which kept the contaminated areas in front of the dredge crew, minimizing contamination of clean areas.</p> <p>The dredge operator attempted to maximize the amount of sediments in each bucket so as to minimize water. Dredging was conducted such that as each bucket was raised, free water was allowed to drain back into the Lauritzen Channel. All work was performed inside of a silt curtain, and acceptable turbidity levels ("not defined") were achieved prior to removal or repositioning of the silt curtain.</p> <p>Due to both the size and volume of debris encountered, a metal grid known as a grizzly was placed across the scow. The grizzly was only partially effective because (1) the volume of debris filled the surface area quickly and (2) the debris was so extensive that the grizzly would rapidly become blocked with material. Each dredging shift reportedly spent 30% of its time positioning the grizzly and transferring debris from its surface.</p> <p>The dredge operator loaded each scow to at least 90% of capacity before radioing the tugboat to pull the full scow to the LRT dock and return with an empty scow. The filled scows were shuttled by the tugboat to the dock for unloading. Dutra, the original dredging contractor, utilized their derrick for unloading operations following dredging. The scow was positioned beside the dock to allow the derrick to unload across scaffolding, erected for spill protection across the dock.</p> <p>Long reach excavators (approximately 70-foot reach) were used to remove sediments from the Parr Canal. As sediments were removed, a layer of visqueen was placed underneath where the bucket was anticipated to swing. Spillage which occurred on the canal slopes was captured on visqueen. The material was loaded into watertight dump trucks for shuttling to the Lauritzen Channel dewatering cell.</p>	



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	<p>After completion of sediment removal, 9,100 cy of clean sand was imported by barge, and a minimum 6-inch layer placed throughout the dredged areas of the Channel. The general method used to place the sand was to pneumatically pump the sand from the barge through a pipe equipped with a diffuser such that it would result in a relatively even layer of sand on the bottom of the Channel. In the Parr Canal, 18-inches of sand was placed in the same manner (6,500 cy). The EPA-approved source of clean material was sand materials dredged from Presidio Shoals, another part of San Francisco Bay.</p> <p>Each load of sediment in the dewatering area was raked before stabilizing reagents were added. Reagents, stored in silos and a tank, were sodium silicate and cement additives. Average rate of application was 0.037 tons of cement and 0.026 tons of sodium silicate per in-situ cy of sediment. An asphalt grinder was used to mix the sediment and reagents.</p> <p>As the sediments were dried, they were moved toward the rail car loading area at one end of the paved dewatering cell. At the loading area, front end loaders loaded the sediments into rail cars staged on the adjacent loading track. As they were loaded, rail cars were pushed along the track by a switch engine</p>	
<b>Volume Removed:</b>	108,000 cy (105,300 cy from the Lauritzen Channel and 2,700 cy from Parr Canal).	
<b>Calendar Time:</b>	Lauritzen Channel: Sep. 13, 1996 to Apr. 16, 1997. Parr Canal: Aug. 7-30, 1996 and Apr. 10-16, 1997.	
<b>Time To Implement:</b>	8 months (typically 24 hours per day, six days per week)	
<b>Total Cost:</b>	Not available. Bid cost for original target of 65,000 cy was reportedly \$7.3-7.5 million (\$112-\$115 per cy). An estimated minimum cost for the project is \$12.1-\$12.4 million based on 108,000 cy removed and assuming the same unit cost. Actual combined transport and disposal cost to the ECDC landfill was about \$48 per ton.	
<b>Dredging Cost:</b>	Not available.	
<b>Disposal of Sediment:</b>	Rail transport to two commercial landfills. A total of 1444 gondola rail cars of 70-107 ton capacity were dispatched. A total of 58,049 tons of stabilized material was disposed at the Butterfield Station solid waste landfill (AZ) and 69,148 tons were disposed at the ECDC landfill at East Carbon, Utah.	
<b>Volume of Water:</b>	2.8 million gallons	
<b>Method of Water Treatment:</b>	A 300 ft. by 96 ft. paved dewatering cell was constructed onsite. A water collection subcell, 300 ft. by 30 ft., received water drained from stockpiled sediment as well as water pumped from scows. Onsite treatment system (no details).	
<b>Water Discharge Limit:</b>	Not available.	
<b>Air Monitoring During Remediation:</b>	Not available.	
<b>Water Monitoring During Remediation:</b>	Not available.	
<b>Outcome:</b>	Project completed. 108,000 cy were removed and commercially landfilled vs. a predicted 65,000 cy. Verification was done primarily to a depth target. A 50-foot grid system was established to track the dredging. Numerous core samples were taken to verify removal of "young bay mud" and penetration into "old bay mud" (the depth target). If at least 3 of 5 cores showed "old bay mud," the dredge moved on. In selected grids, after reaching the depth target had been verified, EPA took samples from the top six inches of the verification cores and analyzed for DDT and dieldrin, for	

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information. Seventeen such samples were collected from the Lauritzen Channel cores which showed (1) average DDT concentration of 263 ppb, (2) median DDT of 44 ppb, and (3) max. DDT of 1.3 ppm (cleanup goal was 590 ppb). Maximum dieldrin was 55 ppb. Three such samples were collected from the Parr Canal cores which showed (1) average DDT of 200 ppb, (2) median DDT of 200 ppb, (3) max. DDT of 1.5 ppm, and (4) non-detectable dieldrin.

The use of locally dredged clean sediment was considered by the EPA to be part of the restoration effort in the dredged areas. According to Reference A-255; "The source of the clean material was sand materials dredged from Presidio Shoals, another part of San Francisco Bay, which source was approved by the EPA. It is hoped that the use of sand imported from another part of the Bay will be helpful to promoting natural growth in the Lauritzen Channel."

A post-remedial biomonitoring program focusing on mussels is underway, being performed by Battelle. The program is similar to the State's "mussel watch" program. Mussels have been transplanted from the outer coast to four locations within Richmond Harbor. September 1997 to January 1998 was defined as post-dredging year one. Five years of monitoring are planned. Year 2 post-remedial monitoring results are reported in Reference A-437.

According to Reference A-437, "The first round of post-remedial biomonitoring was conducted 6 months after remediation. Year 1 biomonitoring showed that pesticide concentrations in the tissues of mussels exposed at the site were lower than those observed before remediation, although the tissue concentrations were still elevated in Lauritzen Channel relative to the nearby Santa Fe and Richmond Harbor Channels. These results suggested that DDT was still present and bioavailable in Lauritzen Channel, especially near its head, relative to other waterways."

"In October 1998, the institute of Marine Sciences at the University of California, Santa Cruz reported finding 20 ppm total DDT (dry weight) in a Lauritzen Channel sediment sample. Based on this observation, EPA collected four additional sediment samples in early November 1998," as part of Year 2 monitoring. The sediment samples were 10-inch cores from mid-channel, at four separate locations along the length of the Lauritzen Channel. The samples exhibited DDT concentrations of 2.7, 10.3, 13.9, and 130 ppm. Only the 13.9 ppm sample exhibited a preponderance of sand (67%). (9100 cy of sand had been deposited in the Lauritzen Channel after remedial dredging, equivalent to an average depth of one foot.) The same samples exhibited dieldrin concentrations ranging from 0.05 ppm to 3.3 ppm. As summarized in Reference A-437, "sediment collected for this study had total DDT levels between the median and maximum levels measured before remediation activities (i.e., dredging and capping)" and "sediment samples collected for this study had dieldrin concentrations comparable to maximum levels measured in 1993."

Relative to 1999 water samples, Reference A-437 states: "Water concentrations of dieldrin and total DDT were well above remediation goals in all water samples and at all sampling stations. The most elevated contaminant concentrations were found in Lauritzen Channel/End water, where total DDT and dieldrin levels were 106 and 89 times greater, respectively, than remedial goals." Remedial goals in water were 0.59 ppt for total DDT and 0.14 ppt for dieldrin. Based on Table 3.3 in Reference A-437, DDT concentration in water in the Lauritzen Channel ranged from 43 - 103 ppt in 1998 and 5 - 62 ppt in 1999. The 103 ppt and 62 ppt measurements are from a location in the source end of the channel which had measured 50 ppt DDT in 1991-92.

Biomonitoring consisted of collection and analysis of both transplanted and resident mussels from four stations, two in the Lauritzen Channel and one each in the Santa Fe Channel (which feeds the Lauritzen Channel) and the Richmond Inner Harbor Channel. Post-monitoring biomonitoring results seem more favorable than the sediment and water column sampling results. According to Reference A-437, "the first round of post-remedial biomonitoring was conducted 6 months after remediation."

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Year 1 biomonitoring showed that pesticide concentrations in the tissues of mussels exposed at the site were lower than those observed before remediation, although the tissue concentrations were still elevated in Lauritzen Channel relative to the nearby Santa Fe and Richmond Harbor Channels. These results suggested that DDT was still present and bioavailable in Lauritzen Channel, especially near its head, relative to other waterways." For Year 2, Reference A-437 concluded that "tissue burdens from Year 2 of post-remediation biomonitoring were dramatically reduced from pre-remediation levels at all stations and also are significantly lower than Year 1 post-remediation levels." Specifically, lipid-normalized "DDT levels in resident mussels from Year 1 biomonitoring were 59% to 82% lower than average concentrations measured in 1991/1992 for the Ecological Risk Assessment. Further reduction in bioavailability of total DDT was demonstrated by Year 2 biomonitoring for which resident mussels had total DDT levels between 88% and 97% lower than in 1991/1992. Lipid-normalized dieldrin levels in resident mussels showed similar trends in reduced bioavailability, with reductions of 78% to 88% for Year 1 and 92% to 98% for Year 2 biomonitoring relative to 1991/1992 levels. Biomonitoring with transplanted mussels revealed the same pattern, with a similar degree of reduced bioavailability at all sites . . ."

"Lipid-normalized tissue levels of total DDT in transplanted mussels were reduced by an average of 86% (range of 82% to 89%) in Year 1 post-remediation samples and 96% (range of 93% to 98%) in Year 2 samples in comparison to the most recent published values from the State Mussel Watch Program (1995). The mean values for percentage reduction of dieldrin in transplanted mussels were the same as those for total DDT, 86% in Year 1 and 96% in Year 2 post-remediation samples."

"Either transplanted or resident mussels appear to be acceptable for biomonitoring at the study site, but continued monitoring with both species could increase understanding of differences found between the species. Inter-species differences in total body burdens could have arisen from a variety of factors, including differences in feeding, growth rate during exposure, lipid content of tissues, duration of exposure, and height in the water column"

Comparisons were confounded, to some extent, by the absence of resident mussel samples from the State Mussel Watch Program.

The results of an assessment of the Lauritzen Channel marine environment immediately before and approximately one year after the dredging of sediments were published in Reference M-357 . . . "The study included chemical analysis of sediments, tissue concentrations of transplanted mussels, toxicity testing of sediment samples, and characterization of benthic community structure. Results indicated that sediment toxicity to bivalve larvae (*Mytilus galloprovincialis*) decreased in post-remediation samples, but that toxicity to the amphipod *Echaustorius estuarius* increased significantly. Assessment of benthos at this site suggested a transitional benthic community structure. In addition, post-remediation sediments remained contaminated by a variety of organic chemical compounds, including DDT, dieldrin, chlordane, polycyclic aromatic hydrocarbons, and polychlorinated biphenyls. Tissue concentrations of DDT and dieldrin in mussels (*M. galloprovincialis*) were lower than those in pre-remediation samples, indicating that although sediment concentrations of organochlorine pesticides remained high, concentrations of these chemicals in the water column were reduced after dredging."

Reference M-357 further concluded that . . . "interpretation of the benthic community data was confounded because of sediment disturbance from shipping and dredging activities both at this site and in the adjacent area. Because the remediation activities were designed largely to minimize exposure of DDT and dieldrin to higher-trophic-level organisms, post-remediation monitoring at this site emphasized water column concentrations of these chemicals and their bio-accumulation in mussel tissues because of ecologic and human health concerns. These measures demonstrated

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that dredging reduced concentrations of DDT and dieldrin to Lauritzen Channel water and in the surrounding system. . . . Concentrations of chlorinated pesticides have declined in mussels; however, insufficient data exist to determine whether the residual sediment contamination in Lauritzen Channel is affecting the larger system. Further analyses of these chemicals in the tissues of local fish populations, particularly in species that prey extensively on benthic fauna, would help to answer this question. The degree of contamination and toxicity at this site after extensive remediation of contaminated sediments is problematic, and it suggests that future remediation projects that rely on similar methodologies should incorporate greater consideration of possible sources for post-remediation contamination to better achieve the project goals.”

Another study, documented in Reference E-164, concluded that . . . “DDT concentrations in surficial sediments 4 months after the completion of dredging were indistinguishable from pre-dredging levels. The source of this contaminated material is believed to be subtidal deposits that were not dredgeable due to pilings, wharves, and similar obstructions. Dredging activities led to a dramatic increase in DDT body burdens of all ten fish and invertebrates monitored, presumably due to exposure and resuspension of previously buried sediments. Body burdens in the monitored species increased 3 to 70-fold after dredging. Approximately 1.5 years after dredging, approximately 80% of the species had DDT body burdens at or above pre-dredging concentrations. These high concentrations were due to continued exposure to the contaminated sediments remaining in Lauritzen Canal (sic), rather than slow elimination of the dredging-induced pulse in DDT body burdens. Despite the abrupt spatial gradients in contamination, the relatively small amount of contaminated material to be removed, and other factors which gave the impression of a relatively straightforward approach to remediation, success was not unequivocal.”

The Reference E-164 presentation was published in October 2002 and reported the findings as follows:

Results of a sampling study to evaluate the success of the dredging project were reported in 2002 (Reference A-1040). The study evaluated success based largely on body burdens of DDT and its metabolites in resident biota, with some data on sediment and water contaminant levels and sediment toxicity testing. As reported in the report Abstract: “Sediment disturbance during dredging introduced a pulse of DDT metabolites in the Lauritzen Canal ecosystem, and body burdens of fish and invertebrates increased two to 76-fold, depending on the species. Approximately 1.5 years after remediation (July 1998), 11 of 14 indicators showed contamination comparable with or worse than the contamination that existed prior to dredging. Monitoring of mussels up to four years post-dredging suggests some modest improvement, although the DDT metabolite body burden of canal mussels remained far above the norm for San Francisco Bay. The elevated DDT metabolite body burdens in biota that persisted for years after remediation reflect recent exposure and are not merely a result of slow metabolic elimination of the DDT metabolite pulse associated with dredging. Sediment DDT metabolite concentrations were low immediately after dredging, but within months the canal bottom became covered with a veneer of fine sediment as contaminated as that that had been removed. The source of this material has not been conclusively established, but we suspect it came from slumping and erosion from the flanks of the canal beneath docks and around pilings where dredging was not done. In retrospect, either capping in place or more thorough dredging may have been more successful in reducing pesticide exposure of the biota, although there were difficulties associated with both alternatives.”

EPA completed the Five-Year Review in September 2001. The Review concluded that the dredging remedy has not kept the Lauritzen Channel from being recontaminated with unacceptable levels of pesticides, as evidenced by water column pesticide concentrations exceeding cleanup goals. As a result, EPA will take additional remedial actions at the site. The first step, to collect additional water

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and sediment samples, was performed in February and March 2002, and further investigation is continuing.

**Site-Specific Difficulties:** Extensive debris; silt curtain damage; logistical delays with rail cars; disposal site load refusals, and public controversy regarding disposal.

More specifically (as described in Reference A-255):

(1) Prior to dredging, a marine derrick raised two sunken barges, a used storage tank, caissons, cables and other previously located and identified large debris from the water. Once raised, the objects were rinsed of sediments and placed on shore for appropriate recycling or disposal.

(2) The young bay mud contained extensive amounts of metal debris, rail road spikes, metal cable, rope and miscellaneous rubble. The debris "field" extended throughout the channel. The debris damaged tires, halted pumping operations, caused periodic suspensions of processing operations, and caused severe damage to equipment. A broken piece of concrete, covered by the sediment, tore a hole in the transfer case of one loader. Subsequent pieces of material tore mixing teeth and damaged the tracks (bent or broken) on the mixing equipment. Overall cycles were impacted sixty percent due to dealing with debris.

(3) A tug boat destroyed the original silt curtain before dredging operations commenced. The tug boat backed into the Lauritzen Channel and spun the silt curtain into its twin propellers. A new curtain was constructed and installed prior to initiating dredging. The dredging operation was delayed approximately one week due to the incident.

An additional 14 days of delays were experienced during the project due to silt curtain management issues. These issues included propeller damage from tug boats moving vessels in the Santa Fe Channel, and also during two days of extreme tides. Removal operations adjacent to the curtain were performed last and on an outgoing tide to prevent tearing the curtain with the dredge bucket. The cumulative delays from the silt curtain maintenance in the Lauritzen Channel was 23 days over the entire project.

(4) As each scow was unloaded, the debris had to be separated from the sediment prior to processing in the dewatering area. Metal, tires, cable, wire rope and chains were segregated and cleaned. Each segregation process required two hours to pull debris from the sediment prior to mixing. Separation of recyclable debris and loading of large non-recyclable items required an additional two hours per shift on average. The most significant impact was the difference in processing rates between unloading a scow by bucket vs. hydraulically pumping the sediment to the dewatering area. Unloading times from pumping required only two hours per scow vs. eight hours per scow utilizing a bucket and crane. The pumping operation could not be used often due to the volume of debris.

(5) Rail operations proved difficult. The Levin Terminal support for rail service reflected obstructions in scheduling, consistency and reliability. Scheduling was a low priority, frequently with the least experienced crew and only after all commodity activities had received priority. Consistency or routines could not be established due to frequent changes in personnel, conflicting objectives and intermittent railroad communication. Outdated or poorly maintained equipment and trackage further hampered consistent operations, reflected in numerous derailments at the LRT facility. Locomotives broke down in addition to the tracks' bending, splitting, and buckling at various points in the route in and around the facility.

Changing disposal sites in early December was expected to improve rail service, but the opposite

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occurred. Loads traveling from Richmond to ECDC had two transit options, one direct on Union Pacific and one joint-hauled using BNSF to UP at Stockton. The difficulties expanded exponentially in tracking trains and cars, with service cycles, per train set, extending from ten days to 14 days and up to 21 days on the "new" route. Weekly conference calls, daily computer tracking, and continuous telephone contacts did little to improve or correct a circumstance which the railroads were unwilling or unable to stabilize. After debris management, use of rail for transport caused the most significant overall project impacts and problems.

(6) The disposal site originally intended for use, the WMI Midway Landfill near Pueblo, Colorado, was not used. The Midway site declined to accept project material on August 27, 1996 ("reason unknown"), after 43 railcars of sediments from the Parr Canal had already been loaded. The first trainload was dispatched to the alternate site, the WMI Butterfield Station Facility at Mobile, Arizona on August 29, a RCRA Sub-title D facility. In spite of the site's suitability and prior approval by EPA, public controversy broke out. Greenpeace and local residents protested the shipments of Heckathorn sediments and attracted substantial media attention. EPA conducted public outreach activities during September, and shipments to Butterfield continued. The public controversy resumed. During November, EPA asked the Contractor to stop shipping to Arizona, and begin using the only feasible alternate site, the East Carbon Development Corp. (ECDC) facility in Utah.

(7) NOAA recommended that the dredging of the Lauritzen Channel and Parr Canal not be conducted during the period from December 1 to March 1 in order to protect the herring spawning season in San Francisco Bay. In the Response to Comments portion of the EPA Record of Decision, EPA agreed to abide by NOAA's request. However, in an ESD, EPA subsequently authorized and allowed dredging and related activities in the Lauritzen Channel and Parr Canal to be conducted on and after December 1. This decision was based on the following considerations. "First and foremost, NOAA, having been apprised of the situation, including the status and progress of dredging in the Lauritzen Channel, supports continuing the dredging and related activities in order to complete the marine remedial actions as soon as possible. Second, the areas being dredged are physically isolated from the rest of Richmond Harbor and San Francisco Bay by means of a silt curtain and daily turbidity testing is conducted to confirm that the silt curtain is functioning properly. EPA believes these safeguards will continue to prevent the release of dredged sediments into the larger ecosystem of Richmond Harbor during dredging activities. Third, if weather conditions or testing results suggest dredging activities could or would result in a release of sediment outside the dredging area, EPA has full authority to order the dredging activities to cease until favorable conditions return or are restored. And fourth, given that a substantial portion of the Lauritzen has been dredged already, significant and costly response actions may have been required to stabilize sediment conditions in the Lauritzen Channel if further dredging had been postponed until March 1."

### Monitoring Data

#### References:

- **Sediment** Reference A - 437
- **Water:** Reference A - 437
- **Fish:** Reference A - 437



***POTENTIALLY RESPONSIBLE PARTIES***

---

***Project Name*** **UNITED HECKATHORN**

***ProjectID:*** 09-02

***PRP Name:*** PRP INFORMATION NOT RELEASED

***PRPID:***

***Street Address:***

***City:***

***State:***

---

## **KEY CONTACTS**

---

***Project Name*** **UNITED HECKATHORN**

***ProjectID:*** 09-02

***Last Name:*** KEY CONTACT INFORMATION NOT RELEASED

***Contact ID:***

***First Name:***

***Title:***

***Company:***

***Address:***

***City:***

***State:***

***Postal Code:***

***Work Phone # :***

***Other Phone #:***

***Fax # :***

***Email Address:***

---



## REFERENCES

---

**Project Name** **UNITED HECKATHORN**

**ProjectID:** 09-02

**Reference Type:** A

**ReferenceID:** 73

**Title:** ***Superfund Record of Decision: United Heckathorn Site, Richmond, CA***

**Location:** AEM

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

**Prepared by/Author:** US EPA Region IX

**Preparer/Author  
Address:**

**Prepared For:** General Public

**Date Published:** October 26, 1994

**Key Words and  
Phrases:**

---

**Reference Type:** A

**ReferenceID:** 157

**Title:** ***NPL Site Narrative at Listing: United Heckathorn Co.***

**Location:** AEM

**Category:** Site Update

**Prepared by/Author:** US EPA HQ

**Preparer/Author  
Address:** Office of Emergency and Remedial Response

**Prepared For:** General Public

**Date Published:** March 14, 1990

**Key Words and  
Phrases:**

---

**Reference Type:** A

**ReferenceID:** 239

**Title:** ***Remedial Investigation United Heckathorn Site Richmond, California***

**Location:** AEM

**Category:** RI/FS

**Prepared by/Author:** Levine-Fricke

**Preparer/Author  
Address:** 1900 Powell Street  
Emeryville, CA 94608

**Prepared For:** Cooper, White & Cooper

**Date Published:** May 17, 1990

**Key Words and  
Phrases:**

---

## REFERENCES

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**Project Name** UNITED HECKATHORN

**ProjectID:** 09-02

**Reference Type:** A

**ReferenceID:** 240

**Title:** *Ecological Risk Assessment of the Marine Sediments at The United Heckathorn Superfund Site*

**Location:** AEM

**Category:** Risk Assessment

**Prepared by/Author:** (1) Henry Lee II, (2) Andrew Lincoff, (3) Bruce L. Boese, (4) Faith A. Cole, (5) Steven P. Ferraro, (6) Janet O. Lamberson, (7) Robert J. Ozretich, (8) Robert C. Randall, (9) Karl R. Rukavina, (10) Donald W. Schults, (11) Kathy A. Sercu, (12) David T. Specht, (13) Richard C. Swartz, (14) David R. Young

**Preparer/Author Address:** (1, 3 thru 14) US EPA ERL-Newport  
Pacific Ecosystems Branch,  
Newport, OR 97365  
and  
(2) US EPA Region IX  
San Francisco, CA 94105

**Prepared For:** General Public

**Date Published:** May 20, 1994

**Key Words and Phrases:**

---

**Reference Type:** A

**ReferenceID:** 255

**Title:** *Completion Report for Marine Remedial Action on the United Heckathorn Superfund Site Richmond, California*

**Location:** AEM

**Category:** Contaminated Sediments: Remediation Final Report

**Prepared by/Author:** Chemical Waste Management, Inc.

**Preparer/Author Address:**

**Prepared For:** EPA Region IX

**Date Published:** October 1997

**Key Words and Phrases:**

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**Project Name** UNITED HECKATHORN

**ProjectID:** 09-02

**Reference Type:** A

**ReferenceID:** 368

**Title:** *Explanation of Significant Difference: for the Record of Decision*

**Location:** AEM

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

**Prepared by/Author:** US EPA Region IX

**Preparer/Author Address:** San Francisco, CA 94105

**Prepared For:** General Public

**Date Published:** November 29, 1996

**Key Words and Phrases:**

---

**Reference Type:** A

**ReferenceID:** 437

**Title:** *Draft Report: Post-Remediation Biomonitoring of Pesticides and Other Contaminants in Marine Waters and Sediment near the United Heckathorn Superfund Site, Richmond, California.*

**Location:** AEM

**Category:** Monitoring, Post

**Prepared by/Author:** L.D. Antrim and N.P. Kohn

**Preparer/Author Address:** Battelle Marine Sciences Laboratory  
Sequim, Washington

**Prepared For:** US EPA Region IX

**Date Published:** July 1999

**Key Words and Phrases:**

---

**Reference Type:** A

**ReferenceID:** 812

**Title:** *Year 4 Post-Remediation Biomonitoring Of Pesticides And Other Contaminants In Marine Waters Near The United Heckathorn Superfund Site, Richmond, California*

**Location:** AEM

**Category:** Monitoring, Post

**Prepared by/Author:** N.P. Kohn and R.K. Kropp

**Preparer/Author Address:** Battelle Marine Sciences Laboratory  
Sequim, WA

**Prepared For:** US EPA Region IX and US Dept. of Energy

**Date Published:** December 2001

**Key Words and Phrases:**

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## **REFERENCES**

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**Project Name** **UNITED HECKATHORN**

**ProjectID:** 09-02

**Reference Type:** A

**ReferenceID:** 841

**Title:** ***Fact Sheet: Review of United Heckathorn Superfund Site Finds  
Additional Cleanup Necessary***

**Location:** AEM

**Category:** Site Update

**Prepared by/Author:** US EPA Region IX

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

**Prepared For:** General Public

**Date Published:** June 2002

**Key Words and  
Phrases:**

---

**Reference Type:** A

**ReferenceID:** 965

**Title:** ***Fact Sheet: United Heckathorn Co.***

**Location:** AEM

**Category:** Site Update

**Prepared by/Author:** US EPA Region IX

**Preparer/Author  
Address:**

**Prepared For:** General Public

**Date Published:** July 14, 2003

**Key Words and  
Phrases:**

---

**Reference Type:** A

**ReferenceID:** 1144

**Title:** ***Reinvestigation of Waterways Completed***

**Location:** AEM

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

**Prepared by/Author:** US EPA Region IX

**Preparer/Author  
Address:**

**Prepared For:** General Public

**Date Published:** February 2004

**Key Words and  
Phrases:**

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**Project Name** **UNITED HECKATHORN**

**ProjectID:** 09-02

**Reference Type:** B

**ReferenceID:** 34

**Title:** ***EPA Seeks Public Comments on the Proposed Plan for Final Cleanup***

**Location:** AEM

**Category:** Site Update

**Prepared by/Author:** US EPA Region IX

**Preparer/Author Address:** 75 Hawthorne Street (H-1-1)  
San Francisco, CA 94105

**Prepared For:** General Public

**Date Published:** July 1994

**Key Words and Phrases:**

---

**Reference Type:** B

**ReferenceID:** 157

**Title:** ***EPA Begins Cleanup in Richmond***

**Location:** AEM

**Category:** Site Update

**Prepared by/Author:** US EPA Region IX

**Preparer/Author Address:** 75 Hawthorne Street (H-1-1)  
San Francisco, CA 94105

**Prepared For:** General Public

**Date Published:** April 1991

**Key Words and Phrases:**

---

**Reference Type:** B

**ReferenceID:** 158

**Title:** ***Update on Activities at the United Heckathorn Site***

**Location:** AEM

**Category:** Site Update

**Prepared by/Author:** US EPA Region IX

**Preparer/Author Address:** 75 Hawthorne Street (H-1-1)  
San Francisco, CA 94105

**Prepared For:** General Public

**Date Published:** March 1992

**Key Words and Phrases:**

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## REFERENCES

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**Project Name** **UNITED HECKATHORN**

**ProjectID:** 09-02

**Reference Type:** B

**ReferenceID:** 159

**Title:** ***Removal of Pesticides-Affected Soils Continues at the United Heckathorn Site***

**Location:** AEM

**Category:** Site Update

**Prepared by/Author:** US EPA Region IX

**Preparer/Author Address:** 75 Hawthorne Street (H-1-1)  
San Francisco, CA 94105

**Prepared For:** General Public

**Date Published:** April 1992

**Key Words and Phrases:**

---

**Reference Type:** B

**ReferenceID:** 160

**Title:** ***Removal of Pesticide Contaminated Soil Begins in Richmond***

**Location:** AEM

**Category:** Site Update

**Prepared by/Author:** US EPA Region IX

**Preparer/Author Address:** 75 Hawthorne Street (H-1-1)  
San Francisco, CA 94105

**Prepared For:** General Public

**Date Published:** March 1993

**Key Words and Phrases:**

---

**Reference Type:** B

**ReferenceID:** 161

**Title:** ***Additional Investigation and Removal of Pesticide Contaminated Soil at Richmond Site***

**Location:** AEM

**Category:** Site Update

**Prepared by/Author:** US EPA Region IX

**Preparer/Author Address:** 75 Hawthorne Street (H-1-1)  
San Francisco, CA 94105

**Prepared For:** General Public

**Date Published:** April 1993

**Key Words and Phrases:**

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## REFERENCES

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**Project Name** **UNITED HECKATHORN**

**ProjectID:** 09-02

**Reference Type:** B  
**Title:** ***EPA Announces Final Phase of Cleanup***  
**Location:** AEM  
**Category:** Site Update  
**Prepared by/Author:** US EPA Region IX  
**Preparer/Author Address:** 75 Hawthorne Street (H-1-1)  
San Francisco, CA 94105  
**Prepared For:** General Public  
**Date Published:** July 1996  
**Key Words and Phrases:**

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**ReferenceID:** 163

**Reference Type:** B  
**Title:** ***US EPA Acts to Speed Cleanup of DDT-Contaminated Sediment***  
**Location:** AEM  
**Category:** Site Update  
**Prepared by/Author:** US EPA Region IX  
**Preparer/Author Address:** 75 Hawthorne Street (H-1-1)  
San Francisco, CA 94105  
**Prepared For:** General Public  
**Date Published:** December 16, 1996  
**Key Words and Phrases:**

---

**ReferenceID:** 164

**Reference Type:** B  
**Title:** ***United Heckathorn Company: Site Description***  
**Location:** AEM  
**Category:** Site Update  
**Prepared by/Author:** US EPA Region IX  
**Preparer/Author Address:** 75 Hawthorne Street (H-1-1)  
San Francisco, CA 94105  
**Prepared For:** General Public  
**Date Published:** August 7, 1996  
**Key Words and Phrases:**

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**ReferenceID:** 165

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**Project Name** UNITED HECKATHORN

**ProjectID:** 09-02

**Reference Type:** C

**ReferenceID:** 86

**Title:** *Shipping, Superfund combo dredging eyed.*

**Location:** AEM

**Category:** Site Update

**Prepared by/Author:**

**Preparer/Author**

**Address:**

**Prepared For:** Superfund Week

**Date Published:** August 27, 1993

**Key Words and  
Phrases:**

---

**Reference Type:** C

**ReferenceID:** 141

**Title:** *United Heckathorn sediment dredge nears*

**Location:** AEM

**Category:** Site Update

**Prepared by/Author:**

**Preparer/Author**

**Address:**

**Prepared For:** Superfund Week

**Date Published:** August 16, 1996

**Key Words and  
Phrases:**

---

**Reference Type:** C

**ReferenceID:** 142

**Title:** *Heckathorn design due in spring*

**Location:** AEM

**Category:** Site Update

**Prepared by/Author:**

**Preparer/Author**

**Address:**

**Prepared For:** Superfund Week

**Date Published:** December 15, 1995

**Key Words and  
Phrases:**

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## REFERENCES

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**Project Name** **UNITED HECKATHORN**

**ProjectID:** 09-02

**Reference Type:** C

**ReferenceID:** 143

**Title:** *United Heckathorn dredging talks start*

**Location:** AEM

**Category:** Site Update

**Prepared by/Author:**

**Preparer/Author**

**Address:**

**Prepared For:** Superfund Week

**Date Published:** October 13, 1995

**Key Words and  
Phrases:**

---

**Reference Type:** C

**ReferenceID:** 144

**Title:** *United Heckathorn dredging plan released*

**Location:** AEM

**Category:** Site Update

**Prepared by/Author:**

**Preparer/Author**

**Address:**

**Prepared For:** Superfund Week

**Date Published:** August 5, 1994

**Key Words and  
Phrases:**

---

**Reference Type:** C

**ReferenceID:** 236

**Title:** *EPA, Corps part ways on Heckathorn*

**Location:** AEM

**Category:** Site Update

**Prepared by/Author:**

**Preparer/Author**

**Address:**

**Prepared For:** Superfund Week

**Date Published:** December 24, 1993

**Key Words and  
Phrases:**

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## REFERENCES

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**Project Name** UNITED HECKATHORN

**ProjectID:** 09-02

**Reference Type:** C

**ReferenceID:** 916

**Title:** *Remedy Fails to Protect Public at United Heckathorn*

**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:** E

**ReferenceID:** 164

**Title:** *Abstract: Evaluation of Dredging as Remediation at a DDT-Contaminated Site in San Francisco Bay*

**Location:** AEM

**Category:** Dredging: Remedial (Contaminated Sediments)

**Prepared by/Author:** (1) Donald Weston, (2) Walter Jarman, (3) Gilbert Cabana

**Preparer/Author  
Address:** (1) University of California  
Berkeley, CA

(2) University of Utah

Salt Lake City Utah

(3) University of Quebec

Quebec, Canada

**Prepared For:** SETAC 22nd Annual Meeting

**Date Published:** November 2001

**Key Words and  
Phrases:** Subsequently published as Reference E-208

---

## REFERENCES

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**Project Name** UNITED HECKATHORN

**ProjectID:** 09-02

**Reference Type:** E

**ReferenceID:** 208

**Title:** *An Evaluation of the Success of Dredging as Remediation at a DDT-Contaminated Site in San Francisco Bay, California, USA*

**Location:** AEM

**Category:** Monitoring, Post

**Prepared by/Author:** (1) Donald P. Weston, (2) Walter M. Jarman, (3) Gilbert Cabana, (4) Corinne E. Bacon, (5) Lisa A. Jacobson

**Preparer/Author Address:** (1) University of California  
Department of Integrative Biology  
3060 Valley Life Sciences  
Berkeley, CA 94720-3104  
(2), (4), (5) Energy & Geoscience Institute  
Civil and Environmental Engineering  
University of Utah  
423 Wakara Way, Suite 300  
Salt Lake City, UT 84103  
(3) Department de Chimie-Biologie  
University of Quebec at Trois-Rivieres  
Trois-Rivieres, Quebec G9A 5H7

**Prepared For:** Environmental Toxicology and Chemistry, Vol. 21, No. 10, pp 2216-2224

**Date Published:** 2002

**Key Words and Phrases:**

---

**Reference Type:** L

**ReferenceID:** 29

**Title:** *Memo re: United Heckathorn Status*

**Location:** AEM

**Category:** Site Update

**Prepared by/Author:** AEM, Inc.

**Preparer/Author Address:** Malvern, PA 19355

**Prepared For:** Internal file

**Date Published:** September 30, 1997

**Key Words and Phrases:**

---

## REFERENCES

---

**Project Name** **UNITED HECKATHORN**

**ProjectID:** 09-02

**Reference Type:** L

**ReferenceID:** 146

**Title:** ***Maximum Baseline Cancer Risks for Contaminated Sediment Sites***

**Location:** AEM

**Category:** Risk Assessment

**Prepared by/Author:** AEM, Inc.

**Preparer/Author  
Address:**

**Prepared For:** Distribution

**Date Published:** October 22, 2001

**Key Words and  
Phrases:**

---

**Reference Type:** M

**ReferenceID:** 356

**Title:** ***Persistence of DDT residues and dieldrin off a pesticide  
processing plant in San Francisco Bay, California***

**Location:** AEM

**Category:** Contaminated Sediments: Characteristics/Bioavailability

**Prepared by/Author:** (1) David Young, (2) Robert Ozretich, (3) Henry Lee II, (4) Scott Echols, (5)  
John Frazier

**Preparer/Author  
Address:** (1, 2, 3) US EPA, Western Ecology Division  
Newport, OR 97365  
(4, 5) CH2M Hill  
Corvallis, OR 97330

**Prepared For:** US EPA Region X

**Date Published:** 2000 circa

**Key Words and  
Phrases:**

---

## REFERENCES

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**Project Name** UNITED HECKATHORN

**ProjectID:** 09-02

**Reference Type:** M

**ReferenceID:** 357

**Title:** *Ecotoxicologic Change at Remediated Superfund Site in San Francisco, California, USA*

**Location:** AEM

**Category:** Contaminated Sediments: Characteristics/Bioavailability

**Prepared by/Author:** (1) Brian S. Anderson, (2) John W. Hunt, (3) Bryn M. Phillips, (4) Matt Stoelting, (5) Jonathon Becker, (6) Russell Fairey, (7) Max Puckett, (8) Mark Stephenson, (9) Ronald S. Tjeerdema, (10) Michael Martin

**Preparer/Author** (1, 2, 3, 9) Department of Environmental Toxicology

**Address:** University of California  
Davis, CA 95616

(4, 5) Institute of Marine Sciences

University of California

Santa Cruz, CA 95064

(6) San Jose State University Foundation

Moss Landing Marine Laboratories

P.O. Box 747

Moss Landing, CA 95039

(7) California Department of Fish and Game

Marine Pollution Studies Laboratory

34500 Coast Route 1

Monterey, CA 93940

(8, 10) California Department of Fish and Game

20 Lower Ragsdale Drive, Suite 100

Monterey, CA 93940-5729

**Prepared For:** Environmental Toxicology and Chemistry, Vol. 19, No. 4, pp 879-887

**Date Published:** 2000

**Key Words and  
Phrases:**

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**Reference Type:** R

**ReferenceID:** 28

**Title:** *Letter to PRP re: Case Histories: Contaminated Sediment Sites  
(with response from Latham & Watkins)*

**Location:** AEM

**Category:** Site Update

**Prepared by/Author:** AEM, Inc.

**Preparer/Author** Malvern, PA 19355

**Address:**

**Prepared For:** Latham & Watkins, submitted to

**Date Published:** May 14, 1999

**Key Words and  
Phrases:**

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## **REFERENCES**

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**Project Name** **UNITED HECKATHORN**

**ProjectID:** 09-02

**Reference Type:** S

**ReferenceID:** 7

**Title:** ***U.S. v. United Heckathorn (Richmond, CA)***

**Location:** AEM

**Category:** Legal

**Prepared by/Author:** US EPA Region IX

**Preparer/Author**

**Address:**

**Prepared For:** FY 1996 Enforcement and Compliance Assurance Accomplishments Report

**Date Published:** May 1997

**Key Words and Phrases:** consent decrees for cost recovery

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## ***FISH ADVISORIES***

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***Project Name*** **UNITED HECKATHORN**

***ProjectID:*** 09-02

***Advisory:*** Richmond Harbor Channel Area ***AdvisoryID:*** 269  
***Extent:*** Richmond Harbor Channel; Santa Fe Channel; Lauritzen Canal (San Francisco Bay)  
***Pollutant:*** DDT  
***Species:*** bullhead  
***Population:*** NCGP  
***Population Definition:*** No Consumption-General Population: Advise against consumption by the general population.

***Advisory Type:*** Estuary ***Advisory Number:*** 3351  
***Status (Active or Rescinded):*** Active ***Date Rescinded:***  
***Contact Name:*** Robert Brodberg ***Contact Number:*** 916-323-4763

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***Advisory:*** Richmond Harbor Channel Area ***AdvisoryID:*** 270  
***Extent:*** Richmond Harbor Channel; Santa Fe Channel; Lauritzen Canal (San Francisco Bay)  
***Pollutant:*** DDT  
***Species:*** croaker  
***Population:*** NCGP  
***Population Definition:*** No Consumption-General Population: Advise against consumption by the general population.

***Advisory Type:*** Estuary ***Advisory Number:*** 3351  
***Status (Active or Rescinded):*** Active ***Date Rescinded:***  
***Contact Name:*** Robert Brodberg ***Contact Number:*** 916-323-4763

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***Advisory:*** Richmond Harbor Channel Area ***AdvisoryID:*** 274  
***Extent:*** Richmond Harbor Channel; Santa Fe Channel; Lauritzen Canal (San Francisco Bay)  
***Pollutant:*** DDT  
***Species:*** croaker-white  
***Population:*** NCGP  
***Population Definition:*** No Consumption-General Population: Advise against consumption by the general population.

***Advisory Type:*** Estuary ***Advisory Number:*** 3351  
***Status (Active or Rescinded):*** Active ***Date Rescinded:***  
***Contact Name:*** Robert Brodberg ***Contact Number:*** 916-323-4763

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## ***FISH ADVISORIES***

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***Project Name*** **UNITED HECKATHORN**

***ProjectID:*** 09-02

***Advisory:*** Richmond Harbor Channel Area ***AdvisoryID:*** 271  
***Extent:*** Richmond Harbor Channel; Santa Fe Channel; Lauritzen Canal (San Francisco Bay)  
***Pollutant:*** DDT  
***Species:*** gobies  
***Population:*** NCGP  
***Population Definition:*** No Consumption-General Population: Advise against consumption by the general population.

***Advisory Type:*** Estuary ***Advisory Number:*** 3351  
***Status (Active or Rescinded):*** Active ***Date Rescinded:***  
***Contact Name:*** Robert Brodberg ***Contact Number:*** 916-323-4763

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***Advisory:*** Richmond Harbor Channel Area ***AdvisoryID:*** 272  
***Extent:*** Richmond Harbor Channel; Santa Fe Channel; Lauritzen Canal (San Francisco Bay)  
***Pollutant:*** DDT  
***Species:*** shellfish  
***Population:*** NCGP  
***Population Definition:*** No Consumption-General Population: Advise against consumption by the general population.

***Advisory Type:*** Estuary ***Advisory Number:*** 3351  
***Status (Active or Rescinded):*** Active ***Date Rescinded:***  
***Contact Name:*** Robert Brodberg ***Contact Number:*** 916-323-4763

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***Advisory:*** Richmond Harbor Channel Area ***AdvisoryID:*** 273  
***Extent:*** Richmond Harbor Channel; Santa Fe Channel; Lauritzen Canal (San Francisco Bay)  
***Pollutant:*** DDT  
***Species:*** surfperch  
***Population:*** NCGP  
***Population Definition:*** No Consumption-General Population: Advise against consumption by the general population.

***Advisory Type:*** Estuary ***Advisory Number:*** 3351  
***Status (Active or Rescinded):*** Active ***Date Rescinded:***  
***Contact Name:*** Robert Brodberg ***Contact Number:*** 916-323-4763

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## ***FISH ADVISORIES***

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***Project Name*** **UNITED HECKATHORN**

***ProjectID:*** 09-02

***Advisory:*** Richmond Harbor Channel Area ***AdvisoryID:*** 275  
***Extent:*** Richmond Harbor Channel; Santa Fe Channel; Lauritzen Canal (San Francisco Bay)  
***Pollutant:*** dieldrin  
***Species:*** bullhead  
***Population:*** NCGP  
***Population Definition:*** No Consumption-General Population: Advise against consumption by the general population.

***Advisory Type:*** Estuary ***Advisory Number:*** 3351  
***Status (Active or Rescinded):*** Active ***Date Rescinded:***  
***Contact Name:*** Robert Brodberg ***Contact Number:*** 916-323-4763

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***Advisory:*** Richmond Harbor Channel Area ***AdvisoryID:*** 276  
***Extent:*** Richmond Harbor Channel; Santa Fe Channel; Lauritzen Canal (San Francisco Bay)  
***Pollutant:*** dieldrin  
***Species:*** croaker  
***Population:*** NCGP  
***Population Definition:*** No Consumption-General Population: Advise against consumption by the general population.

***Advisory Type:*** Estuary ***Advisory Number:*** 3351  
***Status (Active or Rescinded):*** Active ***Date Rescinded:***  
***Contact Name:*** Robert Brodberg ***Contact Number:*** 916-323-4763

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***Advisory:*** Richmond Harbor Channel Area ***AdvisoryID:*** 280  
***Extent:*** Richmond Harbor Channel; Santa Fe Channel; Lauritzen Canal (San Francisco Bay)  
***Pollutant:*** dieldrin  
***Species:*** croaker-white  
***Population:*** NCGP  
***Population Definition:*** No Consumption-General Population: Advise against consumption by the general population.

***Advisory Type:*** Estuary ***Advisory Number:*** 3351  
***Status (Active or Rescinded):*** Active ***Date Rescinded:***  
***Contact Name:*** Robert Brodberg ***Contact Number:*** 916-323-4763

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## ***FISH ADVISORIES***

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***Project Name*** **UNITED HECKATHORN**

***ProjectID:*** 09-02

***Advisory:*** Richmond Harbor Channel Area ***AdvisoryID:*** 277  
***Extent:*** Richmond Harbor Channel; Santa Fe Channel; Lauritzen Canal (San Francisco Bay)  
***Pollutant:*** dieldrin  
***Species:*** gobies  
***Population:*** NCGP  
***Population Definition:*** No Consumption-General Population: Advise against consumption by the general population.

***Advisory Type:*** Estuary ***Advisory Number:*** 3351  
***Status (Active or Rescinded):*** Active ***Date Rescinded:***  
***Contact Name:*** Robert Brodberg ***Contact Number:*** 916-323-4763

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***Advisory:*** Richmond Harbor Channel Area ***AdvisoryID:*** 278  
***Extent:*** Richmond Harbor Channel; Santa Fe Channel; Lauritzen Canal (San Francisco Bay)  
***Pollutant:*** dieldrin  
***Species:*** shellfish  
***Population:*** NCGP  
***Population Definition:*** No Consumption-General Population: Advise against consumption by the general population.

***Advisory Type:*** Estuary ***Advisory Number:*** 3351  
***Status (Active or Rescinded):*** Active ***Date Rescinded:***  
***Contact Name:*** Robert Brodberg ***Contact Number:*** 916-323-4763

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***Advisory:*** Richmond Harbor Channel Area ***AdvisoryID:*** 279  
***Extent:*** Richmond Harbor Channel; Santa Fe Channel; Lauritzen Canal (San Francisco Bay)  
***Pollutant:*** dieldrin  
***Species:*** surfperch  
***Population:*** NCGP  
***Population Definition:*** No Consumption-General Population: Advise against consumption by the general population.

***Advisory Type:*** Estuary ***Advisory Number:*** 3351  
***Status (Active or Rescinded):*** Active ***Date Rescinded:***  
***Contact Name:*** Robert Brodberg ***Contact Number:*** 916-323-4763

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