CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SAN DIEGO REGION

MINIMUM CRITERIA FOR CONTAMINATED SEDIMENT ASSESSMENT FOR SOUTHWEST MARINE, NASSCO, AND CONTINENTAL MARITIME

(Sediment Assessment Criteria)

AUGUST 3, 1995

The Regional Board designates cleanup levels for contaminated bay sediment sites in accordance with the enclosed State Water Resources Control Board Resolution 92-49, POLICIES AND PROCEDURES FOR INVESTIGATION AND CLEANUP AND ABATEMENT OF DISCHARGES UNDER WATER CODE SECTION 13304. In order to determine if cleanup and abatement of the effects of bay sediment contaminants is necessary, an investigation of the nature, extent, biological, and water quality effects of the bay sediment contaminants is required. The investigation shall be comprised of the following minimum components:

1. Site Assessment;
2. Cleanup Levels;
3. Cleanup Alternatives; and
4. Cleanup Costs

1 SITE ASSESSMENT

1.1. The shipyards shall analyze the geographic horizontal and vertical extent of the bay sediment contaminants. The list of contaminants shall include copper, lead, zinc, mercury, tributyltin, PCBs, PAHs, TPH, and any other constituent associated with shipbuilding and repair activities believed to be present in bay sediment in excess of background concentrations. Historical data should be also analyzed to determine contaminants in excess of background concentrations.

The surficial distribution of contaminants concentrations shall be portrayed using Thiessen polygons or other equivalent methodology. Thiessen polygons are created by constructing straight lines from each station to every nearby station that can be reached without crossing any other straight line and then constructing the perpendicular bisector of each radius. Each Thiessen polygon will represent the single station located within the polygon, and all points within a given Thiessen polygon are closer to that station than to any adjacent station.

1.2. The shipyards shall determine the sources of pollution which caused the contaminated sediment to exist. Both shipyard

and non-shipyard sources shall be evaluated for existing or historic activities that may have contributed contaminants to San Diego Bay.

1.3. The shipyards shall determine the contaminant concentrations in the pore water of the sediments. Water-sediment equilibrium partition coefficients shall be developed to estimate the sediment quality objective that would not cause an exceedance of the water quality objectives for San Diego Bay list in item 2.4 below.

2 CLEANUP LEVEL

The shipyards shall determine the following for each contaminant:

2.1. The cleanup level defined by background levels at Reference station one (REF-01) for each contaminant.

The NPDES permit monitoring program requires sediment monitoring at three remote references stations. The average values of the remote reference station designated reference station one (REF-01) will be used for the purposes of evaluating one level of background concentrations.

2.2. The cleanup level defined by background levels at Reference station three (REF-03) for each contaminant.

The NPDES permit monitoring program requires sediment monitoring at three remote references stations. The average values of the remote reference station designated reference station three (REF-03) will be used for the purposes of evaluating one level of background concentrations.

2.3. The cleanup level(s) defined by Lowest Apparent Effect Threshold (LAET) for each contaminant at each shipyard.

The LAET is the lowest concentration of a suite of Apparent Effect Thresholds (AETs). The suite will consist of at least four test-specific measures of toxicity and benthic community structures (amphipod mortality, polychaete growth depression, depression in total benthic infauna abundance, and depression in amphipod abundance). An AET is the contaminant concentration within the sediments of a shipyard, above which, adverse effects are always found within a particular toxicity or abundance test. Thus a separate AET will be generated for each of four or more test-specific measures of biological responses (toxicity or

abundance). The cleanup level(s) shall be to the lowest of the four or more AETs which are developed for each contaminant (i.e., Lowest AET). The AETs and Lowest AETs shall be shipyard-specific, developed only from the chemical and biological tests which are performed with sediment of a single shipyard.

2.4. The cleanup level(s) defined by sediment quality levels determined using both Water-Sediment Equilibrium Partition Coefficients and the water quality objectives listed below:

Contaminant	Unit	Concentration
Copper	ìg/l	2.9
Lead	ìg/l	2
Mercury	ng/l	25
Zinc	ìg/l	20
Tributyltin	ng/l	1.4
PAHs	ng/l	8.8
PCBs	ng/l	0.019

Based on the results of the site assessment, the list of contaminants in this table may be modified.

2.5. The cleanup level(s) defined by a level that is as close to background as is technically and economically feasible within the constraints of Resolution 92-49.

2.6. The cleanup level(s) defined by the Effects Range Median (ERM) for each contaminant, as listed in the article by Edward R. Long, titled "*Incidence of Adverse Biological Effects Within Ranges of Chemical Concentrations in Marine and Estuarine Sediments*", Environmental Management Vol.19, No. 1, pp. 81-97, and reproduced, in part, below:

Contaminant	ERM Concentration (ppm, dry wt)
Copper	270
Lead	218
Mercury	0.71

Zinc	410
Total PAH	44.792
Total PCB	0.180

Based on the results of the site assessment, the list of contaminants in this table may be modified.

3 CLEANUP ALTERNATIVES

The following cleanup and abatement methods, or combinations thereof, should be considered for each alternative cleanup level to the extent that the methods are applicable to the contaminated sediment. A cost and feasibility analysis should be provided for each applicable cleanup and abatement method. The USEPA Report Selecting Remediation Techniques for Contaminated Sediment (EPA-823-B-93-001) provides a more detailed explanation of these cleanup alternatives.

3.1. Treatment
3.2. Dredging
3.3. Disposal or Reuse
3.4. Subaqueous Capping
3.5. No Action

The criteria to be considered for each alternative cleanup and abatement method are described below:

3.1. Treatment

Site treatment involves the physical or contaminant alteration of the sediment. The treatment must reduce or eliminate the toxicity, mobility, or volume of contaminated material such that compliance with State Board Resolution 92-49 is achieved. Treatment may be either in-situ or ex-situ. In-situ and ex-situ treatment requires uniform treatment and documentation of effectiveness. Ex-situ treatment generally requires a dedicated treatment area.

Types of treatment may include:

a) biological,
b) dechlorination,
c) soil washing,
d) solvent extraction,
e) solidification,
f) incineration,

g) thermal desorption, and
h) contaminant fixation

Appropriate treatment methods depend upon the contaminant characteristics, as well as physical characteristics of the sediments (e.g. clay content, organic carbon content, salinity, and water content). Some treatment options produce by-products which require further handling. Although the above technologies are currently being employed for soils, their effectiveness for use in marine sediments should be thoroughly evaluated. Bench tests and pilot projects should be performed to document the efficacy of the treatment method if the effectiveness of the treatment method is not well documented.

3.2. Dredging

There is no single dredge technology that is the universal solution for cleanup of contaminated sediment. Typical dredging methods include mechanical or hydraulic dredging. The following factors should be considered in the selection of the dredging process:

a) Physical characteristics of the contaminated sediment to be dredged

b) Quantity of contaminated sediment to be dredged

c) Depth of water overlying the contaminated sediment

d) Placement site of the material once it is removed and distance to this authorized contaminated sediment disposal area

e) Concentration of contaminants in the sediment to be dredged

f) Mobility of contaminants in the sediment and containment capability of the methods employed

g) Method of disposal for the dredged material

h) Types of dredging equipment available

i) Currents and waves

j) Access to the site

The dredging process can disturb bottom sediments leading to the release of contaminants into the water column by resuspension of contaminated sediment particles, dispersal of interstitial water in the sediment pores and desorption of contaminants from the contaminated sediment. It is critical that the dredging process be designed to limit sediment resuspension. This will reduce the potential for release of contaminants to the water column during the dredging process and reduce the possibility that the contaminants will spread to previously uncontaminated sediment areas. To reduce the transport of contaminated sediment to other areas, silt curtains constructed of geotextile fabrics may be utilized.

3.3. Disposal or Reuse

Potential alternatives for the disposal or reuse of dredged material from San Diego Bay include:

(1) Beach replenishment;
(2) Habitat restoration/ enhancement;
(3) Ocean disposal;
(4) Incineration;
(5) Upland disposal without treatment;
(6) Upland disposal with treatment;
(7) Confined aquatic disposal; and
(8) Reuse sites such as capping.

Most of these items are further discussed in the attached section titled *Disposal of Dredged Material*, of the San Diego Basin Plan, Chapter Four.

Removal often involves consolidation using a diked structure which retains the dredged material. Considerations include:

a) construction of the dike or containment structure to assure that contaminants do not migrate,

b) the period of time for consolidation of the sediments,

c) staging or holding structures or settling ponds

d) de-watering issues, including treatment and discharge of wastewater,

e) transportation of dredged material, i.e., pipeline, barge, rail, truck,

f) regulatory constraints.

3.4. Subaqueous Capping

Subaqueous capping refers to the placement of a clean material over the contaminated sediment. Capping may be the preferred alternative where the costs and environmental effects of moving or treating the contaminated sediments are too great. The cover material must minimize or prevent the migration of contaminants from the sediment to the water column. Subaqueous capping may require long-term monitoring to measure changes in cap thickness, erosion around cap boundaries, and possible leakage of contaminants through the cap.

The following criteria must be satisfied to allow implementation of a subaqueous cap:

a) Point source discharges to the cap area must be terminated.

b) The cap must provide adequate coverage of contaminated sediments. The capping materials must be suitable for easy and accurate placement.

c) The cap design must inhibit burrowing organisms from penetrating the cap and re-exposing contaminated sediments (bioturbation).

d) The contaminated sediments must have the ability to support the cap, i.e. the cap will not cause settlement or loading.

e) During seismic events, the bottom topography must not allow sloping or slumping of the capped sediments. The seismic design of the cap should be conducted as required by California Code of Regulations Title 23, Division 3, Chapter 15 (Chapter 15). Section 2547 of Chapter 15 requires Class I and II waste management units to be designed to withstand the Maximum Credible Earthquake and Class III waste management units to be designed to withstand the Maximum Probable Earthquake.

f) Hydrologic conditions must not disturb the site, and natural or human activities must not compromise the integrity of the cap. The cap area must be protected against erosion or disruption by currents, waves, propeller wash, or ship hulls.

g) The potential of shipping channels, channel maintenance dredging, or other present and future harbor development projects to disrupt the integrity of the cap must be considered.

h) The capped area must be noted on appropriate maps, charts, and deeds to document the exact location of the site.

i) Section 2511 (d) of the California Code of Regulations Title 23, Division 3, Chapter 15 regulations (Chapter 15) provides that remedial actions intended to contain waste at the point of release, such as a subaqueous cap, must conform to applicable provisions of the Chapter 15 regulations to the extent feasible. Recognition is made that many of the Chapter 15 regulations pertaining to liners, subsurface barriers, geologic criteria, ground water monitoring, precipitation and drainage controls etc. are obviously not applicable to a subaqueous cap. However, there are some Chapter 15 regulations which are applicable.

3.5. No action

The "no action" alternative involves reliance upon natural processes for managing contaminated sediment. Examples of the natural processes include:

Burial of the contaminated sediment by natural sedimentation
Dispersal of contaminants by natural processes
Natural detoxification of contaminated sediments

The no action alternative may include posting of warning signs, restricting access to the site, and monitoring of water, sediments, or organisms.

If a no-action alternative is considered, the shipyards shall provide compelling evidence that no remediation technologies should be applied and only the no-action alternative is feasible at the site, a cleanup cost comparison of all other remediation technologies versus the no-action alternative, and a detailed proposed monitoring program. The monitoring program should be designed to measure changes in discharge rates from the site and to show whether rates of contaminant release and the area of influence of the contaminants are accelerating. The

duration of the monitoring and all organizations which will implement the monitoring shall be identified.

The Regional Board will require the shipyards to demonstrate some or all of the following items before consideration of the no-action alternative:

a) All contaminant discharges have been halted;

b) The costs and environmental effects of moving and treating contaminated sediment are too great;

c) Hydrologic conditions will not disturb the site;

d) The contaminated sediment will not be re-mobilized by human or natural activities, such as by shipping activity or bioturbation;

e) The contaminated sediments at the site will not spread;

f) Burial or dilution processes are rapid;

g) Uncontaminated sediments will integrate with contaminated sediments through a combination of dispersion, mixing, burial, and/or biological degradation;

h) Notices to abandon the site including a list of all contaminants known or suspected, concentrations of contaminants, estimate of the total amount of contaminants, potential hazards to human health, toxicity and bioaccumulation potential in sport or commercial fish and shellfish will be issued to appropriate federal, state, and local agencies and to the public including the US Army Corps of Engineers, US Coast Guard, local harbor authorities, county health officer, California Coastal Commission, State Lands Commission, State and federal fish and wildlife agencies, local environmental groups, and local water user groups; and

i) The exact location and depth of the site with a list of contaminants and their quantities will be noted on appropriate deeds, maps, and navigational charts such as those prepared by the US Army Corps of Engineers, US Coast Guard, National Oceanographic and Atmospheric Administration, Coastal Commission, State Lands Commission, and harbor authorities.

4. CLEANUP COSTS

The shipyards shall obtain at least two direct quotes from reliable companies for each cleanup alternative listed above. Obtaining direct quotes assures that all aspects of the project are included in the final estimate. These will also help refine the remedial design and the selection of the technology, for instance, selecting the appropriate type of dredging method, designing the appropriate type of containment structure, determining the method for transport of dredged sediments, or selecting the type of pretreatment or effluent treatment methods. Include the following, where applicable for each cleanup level and alternative:

Assumptions,
Capital costs,
Operation and Maintenance Costs,
Unit costs with subtotals, and
Sources of cost estimates.