CSTF AQUATIC SUBCOMMITTEE MEETING

CEMENT STABILIZATION OF CONTAMINATED DREDGED MATERIAL

BENCH SCALE STUDY

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HEARTWELL PARK
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BENCH STUDY OVERVIEW

- Assess Application of Cement Based Stabilization (CBS) Technology to Regional Dredged Material
- Consider Range of Sediment Types and Levels of Contamination
- Analyze Ability to (1) Bind Contaminants and (2) Improve Physical Properties through Extensive Chemical and Physical Testing Program
- Determine Effectiveness of More Economical Reagents than Cement Alone
WHAT IS CEMENT BASED STABILIZATION TECHNOLOGY?

- Treatment of radioactive wastes from weapons and fuel programs
- Treatment of industrial wastes including oil and chemical wastes
- Addition of reagents causes solidification (physical) and stabilization (chemical)
- Solidification increases strength and decreases permeability
- Stabilization changes chemical structure rendering the hazardous components less soluble and less toxic
- Successful treatment of over 4 million cubic yards of contaminated dredged material
PACIFIC OCEAN

DREDGE MATERIAL SOURCE

Figure E-1

CEMENT-BASED STABILIZATION OF DREDGED MATERIAL

LOCATION MAP

LEGEND:

- DREDGE MATERIAL SOURCE

DISTANCE IN FEET

4000 0 4000 8000

CALIFORNIA

PORTS OF LONG BEACH AND LOS ANGELES

MARINA DEL REY

Prepared by: Maritime & Naval Engineers

3.6 mike

Bottom corner: King Building
REGионаl Dredged Sediment Characteristics

- Marina del Rey - coarse sandy material with shells & debris - strong sulfide odor
- LA River Estuary - sand (less coarse than MdR) - strong odor
- POLB Channel Two - clay with shells - strong odor
- POLA - Consolidated Slip - oily clay material - strong sulfide & organic odor
## SELECTED REAGENTS

<table>
<thead>
<tr>
<th>REAGENT</th>
<th>$/Ton Range for So.CA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type II Portland Cement</td>
<td>$67 to $82</td>
</tr>
<tr>
<td>Type F Fly Ash</td>
<td>$32 to $36</td>
</tr>
<tr>
<td>Fluidized Bed Ash</td>
<td>$17 to $20</td>
</tr>
</tbody>
</table>
## REAGENT TEST COMBINATIONS

<table>
<thead>
<tr>
<th>SITE</th>
<th>REAGENT</th>
<th>REAGENT MIXTURE (Percent by Weight)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALL (Base Case)</td>
<td>Type II Cement</td>
<td>8 6 4 6 4 2 6 4 2 Raw</td>
</tr>
<tr>
<td></td>
<td>Type F Ash</td>
<td>4 6 8</td>
</tr>
<tr>
<td></td>
<td>FB Ash</td>
<td>6 8 10 2 4 6</td>
</tr>
</tbody>
</table>

- Additional tests included 2% cement w/ and w/o 2% Type F Fly Ash
BENCH SCALE TEST PROGRAM

- Upper limit to prevent loss of contaminants and improve strength
- Lower limit to show some improvement in binding and strength
- Median to be approximate mid-point
- 3 reagents at 3 percentages results in 9 combinations per site
- Full suite of testing for LARE; median for other sites
- Reduced suite for all other combinations
POLA Raw Mixed No Seawater
MDR-029
TRASH REMOVED
148 g.
8/14/01
LARE 8% 1HR
PHYSICAL TESTING PROGRAM

- Grain Size
- Atterberg Limits
- Compaction
- Consolidation
- Permeability
- Unconfined Compressive Strength
- Direct and Vane Shear
CHEMICAL TESTING PROGRAM

- Bulk Chemistry
- Conventionals
- Waste Extraction Test (WET)
- Synthetic Precipitation Leaching Procedure (SPLP)
- Pore Water Salinity
KEY PHYSICAL TEST RESULTS - MDR & LARE

- Already possess good engineering qualities (93% & 89% sand, respectively)
- Produced “set times” of 5-10 hours
- Improved unconfined compression & shear strength
- Minimum impact on compaction, compressibility and permeability
KEY PHYSICAL TEST RESULTS - POLB

- 16% sand
- Set time reduced to less than 1 day
- Improved shear strength
- Increase permeability - improved drainage
- No improvement to compressibility
- Mixes with best combination of engineering properties: 
  - 4% cement / 8% FB
  - 4% cement / 6% TF / 4% FB
KEY PHYSICAL TEST RESULTS - POLA

- 10% sand
- Set time reduced to less than 12 hours for higher cement contents
- Improved shear strength
- Increase permeability - improved drainage
- Reduced compressibility
- Mix with best combination of engineering properties:
  - 4% cement / 8% FB
KEY RESULTS - CHEMICAL ANALYSIS

• All raw sediments exceeded ER-M values in at least 1 category; POLA had 23

• No raw sediments exceeded TTLC values

• No raw or stabilized extracts exceeded STLC values

• Results indicate none of the samples (raw or treated) would be considered hazardous waste under California Title 22 criteria

• Blends with 4% or more cement bound contaminants better
CONCLUSIONS & RECOMMENDATIONS

- CBS improved ability to manage material in timely manner
- High fines and low density may limit applicability of POLB, POLA sediments
- Cost projected at $45/cy dredging through treatment; $7 for reagent purchase
- Recommendations:
  - more aggressive pH?
  - test material with more contaminants of concern (eg DDT)
  - market study for potential end users