**Annex A**

## Management Framework for the Assessment of Dredged Sediments and the Determination of Disposal Options

This Annex sets out the details of the 3-tier screening procedure to determine the most appropriate marine disposal arrangement for dredged sediments.

2. The proposed 3-tier screening procedure comprises the following and is diagrammatically presented in Fig. 1 :

* Tier I screening of existing information.

* Tier II chemical screening of the concentration of 8 specified metallic elements, Arsenic, PAHs, PCBs and TBT.

* Tier III biological screening of the biological responses of marine organisms to contaminated sediment.

### Tier I Screening of Existing Information

3. Tier I screening comprises the examination of existing information on the characteristics of the sediment. The information may fall into the following categories :

* Sediment classification records of recent dredging works in close proximity to the project site;

* Location of any possible source of polluted discharge and records of the content of discharge; and

* Distance between the sources of polluted discharge and the likelihood of contamination at the project site.

4. If the available information explicitly indicates that the sediment to be dredged is not contaminated, the material can be classified as Uncontaminated Material. This material is acceptable for open sea disposal, and no more testing is necessary. Otherwise, the material must be subjected to Tier II Chemical Screening.

### Tier II Chemical Screening

5. Tier II screening comprises the chemical analysis of the sediment for a suite of contaminants including 8 specified metallic elements, Arsenic, PAHs, PCBs and TBT. Sediments will be categorised based on their contaminant level with reference to the Chemical Exceedance Levels set out in Table 1.

Table 1 - Sediment Quality Criteria for the Classification of Sediment

| **Contaminants** | **Lower Chemical Exceedance Level (LCEL)** | **Upper Chemical Exceedance Level (UCEL)** |
|---|---|---|
| **Metals** ***(mg/kg dry wt.)*** | | |
| Cadmium (Cd) | 1.5 | 4 |
| Chromium (Cr) | 80 | 160 |
| Copper (Cu) | 65 | 110 |
| Mercury (Hg) | 0.5 | 1 |
| Nickel (Ni) | 40 | 40 |
| Lead (Pb) | 75 | 110 |
| Silver (Ag) | 1 | 2 |
| Zinc (Zn) | 200 | 270 |
| **Metalloid** ***(mg/kg dry wt.)*** | | |
| Arsenic (As) | 8 | 42 |
| **Organic-PAHs** ***(µg/kg dry wt.)*** | | |
| Low Molecular Weight PAHs | 550 | 3160 |
| High Molecular Weight PAHs | 1700 | 9600 |
| Total PAHs | 4000 | 44800 |
| **Organic-non-PAHs** ***(µg/kg dry wt.)*** | | |
| Total PCBs | 23 | 190 |
| **Organometallics** ***(µg TBT/L in interstitial water)*** | | |
| TBT | 0.15 | 0.15 |

There are 3 categories of sediments :

Category L Sediment with all contaminant levels not exceeding the Lower Chemical Exceedance Level.

Category M Sediment with any one or more contaminant levels exceeding the Lower Chemical Exceedance Level and none exceeding the Upper Chemical Exceedance Level.

Category H Sediment with any one or more contaminant levels exceeding the Upper Exceedance Level.

6. Category L sediment is considered acceptable for open sea disposal, and no more testing is necessary.

7. Category M and H sediments must be subjected to Tier III Biological Screening before deciding on the marine disposal arrangement.

**Tier III Biological Screening**

8. Tier III biological screening comprises the biological response tests (including survival rate, growth rate, and development deformity) of sediment for 3 specified marine organisms (amphipod, bivalve and polychaete). This screening is applicable to all Categories M and H sediments, and is designed to check whether the sediments show any adverse biological response and toxic effects. The criteria for passing these tests are set out in Table 2.

Table 2 Biological Screening - Toxicity Test and Pass Criteria

| Toxicity Test | Parameters Measured | Pass Criteria |
|---|---|---|
| 10-d amphipod | Survival Rate | Not less than 90% of the reference sediment and statistically significant |
| 20-d juvenile polychaete | Survival Rate (in dry weight) | - ditto - |
| 48-hr larval development (Bivalve or Echinoderm) | Survival Rate & Normality Rate | - ditto - |

9. In general, all biological tests shall be conducted on composite samples prepared by mixing not more than 5 samples of the same category. For Category H sediment, biological testing must be conducted on a composite sample by mixing contaminated sediment with reference sediment.

10. On the basis of the chemical and biological test results, the most appropriate disposal arrangement will be made according to Table 3.

Table 3 : Determination of Sediment Disposal Arrangement

| Mud Category | Disposal Option |
|---|---|
| Category M sediment passing biological test | Open sea disposal [dedicated sites] |
| Category M sediment failing biological test | Confined marine disposal |
| Category H sediment passing biological test | Confined marine disposal |
| Category H sediment failing biological test | Special disposal arrangement |