



Workshop Report

River Sediments and Related Dredged Material in Europe

***River Sediments and Dredged Material
as Part of the System Catchment-Coastal
Sea: Policy and Regulatory Aspects***

Marine Safety Institute, Rotterdam, The Netherlands

17-19 April 2000

The Workshop was organised by the GKSS Research Centre and the Centre for Social and Economic Research on the Global Environment as part of the Rhine Research Project II (POR II) for the Rotterdam Municipal Port Management on the current and future contamination of dredged material and related emissions and immissions in the Rhine catchment area.

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Executive Summary

The workshop focused on policy issues surrounding the disposal of dredged material disposal. The disposal of dredged material is dealt with at the international, national and regional level. From the international perspective, the London Convention, OSPAR, HELCOM and ICPR gave presentations of the frameworks in which their organisations operate and deal with the issue of dredged material. The London Convention deals with issues of marine disposal at the global level, OSPAR with the North-East Atlantic, HELCOM with the Baltic Sea and the International Commission for the Protection of the Rhine (ICPR) with the Rhine catchment area. In addition national representatives from the Netherlands, Germany and the United Kingdom gave an overview of their national regulations. From the presentations it became clear that no uniform guidelines exist with regard to the disposal of dredged material in the various countries. Guidelines issued by international organisations are adapted/interpreted to/for local conditions. Furthermore the presentations and the discussions in the working groups showed that the catchment, the estuary and the marine environment are treated as single units, rather than as a continuum. However, a systems perspective to encompass the catchment-coastal zone continuum is required for cost-effective measures for the reduction of point and diffuse sources and for the identification of priority pollutants for both the fresh water and marine environment.

Two working groups dealt with either the short term (up to five years) developments in the dredged material regulations or longer term developments.

Both OSPAR and the EU have extended the lists of “chemicals of concern” from their present lists which include the heavy metals, PCB and PAH. Analysis for all these components was considered to be too onerous a task and therefore the conclusion was that in the future bioassays in combination with chemical assessment would become more and more important. Bioassays, covering different modes of action and hence 'new chemicals' as well to some extent, provide an additional economic (in the sense of costs of analysis) tool for hazard assessment. However, there is a need to link hazard assessment of sediments to risk assessment at the actual disposal site.

In the long term it is anticipated that, with continuing control of point and diffuse sources, both capital and maintenance dredging will converge in a sense that both can be treated as relocation of geological material. The continued integration of stakeholder opinion is needed; and a scenario approach might be helpful in this respect. Recommendations include:

1. More harmonisation and standardisation of international regulation (guidelines and frameworks) while maintaining the integrity of local systems and approaches. An approach which adopts the marine system as the reference point for all other catchment based numbers and ranges might provide a step towards mitigating the issue of uncoordinated regulation, and also will serve to highlight the need for consistency of approach adopted towards each contaminant.
2. Increased stakeholder participation in the process of environmental regulation setting and monitoring, in particular to exploit local scale solutions and consensus-building practices.

3. The adoption of a scenario approach to allow the assessment of biological, physical, chemical and economic factors, and the balancing of these gains and losses against political, economic and social welfare decision criteria.

1 Introduction

The GKSS Research Centre carries out, on behalf of the Rotterdam Municipal Port Management, and in collaboration with the Institute for Environmental Studies (IVM, Amsterdam), the Institute of Freshwater and Fisheries Ecology (IGB, Berlin) and the Technical University of Hamburg-Harburg (TU-HH, Hamburg) an integrated science-policy study (Rhine Research Project II, POR II) on the management of dredged material. Primary aims are to investigate and predict the future quality of sediments originating from the Rhine catchment area and current and future policies on regulations with regard to dredged material.

As part of the project this policy-oriented workshop was organised by the GKSS Research Centre and the Centre for Social and Economic Research on the Global Environment (CSERGE). This workshop was preceded by a science-oriented workshop which focused on the scientific aspects of evaluating and implementing bioassays within decision-making frameworks for dredged material management. The results of this workshop were presented (see Appendix I) at this follow-up workshop which dealt explicitly with policy and regulatory aspects.

The policy-oriented workshop, reported on in this document, was attended by invited experts from Europe and incorporated a series of lectures during the first public day. During the following two non-public days two parallel working groups and a plenum session were devoted to discussions focussed on the major issues, as described in the background paper (Appendix II). The workshop agenda is outlined in Appendix III.

The discussion focused on regulatory aspects, both regional, national and international, of dredged material management. Working groups dealt with both short-term (up to five years) and more long-term issues.

3 Report of Working Group I

Elements of a Methodology for Long-term Integrated Management of River, Estuary and Harbour Sediments

Chair: R. K. Turner, Rapporteur: N. Beaumont

Luc Absil, Peter Barham, Hans-Peter Baumert, Martijn Beekman, Marc Braun, René Coenen, Charlotte Hagner, Hartmut Kremer, Brigitte Lauwaert, Axel Netzband, Martin O'Connor, Ronan Uhel, Tiedo Vellinga, Rona Vink

Introduction

The management of sediments within river, estuary and harbour systems poses distinctive difficulties in both scientific and socio-economic terms. Given the generic policy objective of sustainable development, regulatory authorities will have to ensure that an acceptable balance between efficiency in resource usage and equity in resource allocation is achieved, with due deference to the precautionary principle. To achieve this balance a transdisciplinary approach is essential to link natural science with social science, and policy analysis and discourse theory (encompassing all relevant stakeholder interests).

The river, estuary, and marine ecosystems, are fundamentally dynamic and inter-related systems. To encompass the catchment-coastal zone continuum a systems perspective must be adopted. The dynamic nature of the system demands a long-term perspective; the impact of previous contamination must be considered, and the potential for future contamination must be predicted and controlled. It is anticipated that ports will continue to develop for be maintained for the foreseeable future, and the issue of dredging and sediment relocation and disposal will remain problematic during this period, hence a long-term approach is essential.

A pragmatic approach to a future strategy would be one in which all the relevant parties engage in an long-term iterative search process which should deliver a sustainable management system for sediments and related economic activities such as dredging and other port activities. The objectives of such a strategy would be to maximise the beneficial use of sediments where environmentally appropriate, together with waste minimisation at source (sediments as a "natural resource" philosophy); and to minimise the disposal impact of contaminated sediments via cleaning and separation techniques and "controlled" disposal operations and containment sites.

What are the Management Issues for River and Harbour Sediments?

Sustainable development should ensure secure economic wealth creation, and also the conservation of ecosystems. These two long run goals are intrinsically linked as ecosystems provide essential material flows, services and support for economic activity; for example, natural resources, amenities, waste reception, and environmental life support functions. To maintain the integrity of the ecosystem, from an economic and environmental perspective, the management strategy must be designed to maximise ecosystem function diversity, and therefore functional value diversity. Such a strategy is compatible with the need to adopt a spatial scale extensive enough to encompass the catchment-coastal zone continuum and the

range of pressures and socio-economic driving forces involved in the environmental change process.

Sediments can provide a wide variety of benefits, both in situ and when returned more or less naturally into the river system, as well as following extraction and relocation. They can be an essential component of physical support structures, for example flood defences, beach recharge, and local ecosystems such as mudflats. They also provide sinks, given a strict set of conditions, for the adsorption and storage of contaminants. This latter role is beneficial if the contaminants are “permanently” deposited and effectively removed from the system. If, however, they are deposited in an unstable state, and/or in too close proximity to human and other habitats they may become a source of pollution, and a cause of environmental and quality of human life degradation.

Following extraction sediments have a number of beneficial uses, which include:

- **Engineered uses** – land creation and improvement, beach nourishment, offshore berms, capping material and fill
- **Agricultural and product uses** – aquaculture, construction material, liners
- **Environmental enhancement** – restoration and establishment of wetlands, upland habitats, nesting islands, and fisheries

Where practicable these uses all contribute to the maintenance of functional diversity (and therefore the values provided by the functions) in ecosystems.

Definition of the Sediments

It is important to use consistent terminology, hence in this paper the term sediments is used to include all dredged material. In a management context sediments can be considered as:

- Relatively uncontaminated existing stock and flow replenishment
- Existing contaminated stock (often with a long history of accumulation) and flow replenishment.
- Potential future or new contaminated flows and stocks

Management policy options differ according to which sediment category is relevant. The division of sediments into these categories is highly dependent upon the perception (both expert and stakeholders) of contamination, and precise methods of classification are required. There can be complex temporal and spatial inter-dependencies within a catchment. Management of the system involves balancing economic opportunity with sustaining environmental services. Choices must be made which allow the environment to be effectively utilised to its full potential, whilst ensuring equity and efficiency through time and space.

A Framework for the Integrated Management of Sediments

The general goal is to define ways in which to organise the scientific and socio-economic data in order to emphasise the significance of changes to river-estuary-sediment functioning for existing or potential future socio-economic and environmental gains and losses. One way to scope and audit these management contexts is through the use of scenarios, see diagram.

In this context appropriate analysis and decision support techniques include methods such as cost benefit analysis (CBA) and risk-benefit analysis, buttressed by deliberative stakeholder consultation (using a variety of inclusionary processes, supported by institutional and documentary analyses, etc.) and management option scenarios. The management options characterised via the scenarios must then be evaluated for social acceptability and economic costs and benefits. This may entail a variety of analytical and deliberative techniques, which are aimed at ensuring solutions which are 'legitimated' through stakeholder consultation as well as being economically cost effective. The legitimation process serves to increase "trust" and "accountability" in the decisions making process.

In order to develop scenarios which explore feasible futures it is important to include information that goes beyond inventories of contaminants, and encompasses dynamic management dimensions. The decision support system provided in the diagram provides a framework for developing these future scenarios. This scenarios methodology operates on the basis of a series of questions. For example if contaminants are present upstream, and there is no option to treat or contain these sediments in situ these sediments, the problem will be transferred downstream by natural processes. The 'no' answer can result from a lack of technology, motivation or unacceptable costs. Once the sediments have been transferred downstream if there still remains no option to treat the contaminated sediments, or sustainably relocate them within the system, and there is no viable cleaning option, the end result is the 'do nothing' situation. The 'do nothing' option does not signify ignoring the issue. This option still requires regulatory effort, (e.g. monitoring), but does not involve the removal of the sediments from their intermediate or final sinks. It also gives some weight to the argument that natural systems recovery processes do exist and that "irreversible" change is not always inevitable.

Case Studies

The scenario approach was tested by investigating several case studies:

- ***HCB contamination of the Upper Rhine***

During the period 1960-1970 Pentachlorophenol was produced, and HCB's were produced as a side product. All production had stopped by the 1970's but by then the older sediments of the Upper Rhine had become severely contaminated. These contaminated sediments have since been moved downstream by high water flow and dredging. The majority of these sediments are periodically remobilised and are concentrating in various locks such as Gamsheim and Iffezheim Locks, which are the last sediment traps before the Rhine enters the Netherlands.

As an interim measure the HCB contaminated dredged material was allowed to accumulate in sites within the Rhine river stocked on land, but these containment areas, including Iffezheim, are now full. One option is to let the contaminated sediments continue moving down stream to the Netherlands, and eventually Rotterdam. This will solve the problem on a local scale, but merely serve to shift the HCB contamination to another location, thus shifting the environmental and political problem. The International Commission for the Protection of the Rhine (ICPR) does not have any regulatory power to influence this decision, but has operated successfully with a via voluntary agreements approach between countries.

- **TBT**

The contamination of sediments with TBT (an antifouling agent) has been reduced since its use on vessels <25m has been forbidden. Dockyards still have very high TBT sediment concentrations however due to the continued use of TBT on larger vessels. Contaminated TBT sediments are disposed of in containment sites, as there are no suitable treatment or de-contamination techniques available. TBT contamination cannot currently be easily eliminated at the source because of the financial implications, although a number of alternatives have now been developed. The proposal by the International Maritime Organisation to ban the use of TBT on all vessels from 2003, and for its removal from vessel hulls by 2008, will in time ameliorate the situation.

- **Fire Retardants**

Fire retardants are a new contaminant. They are increasingly used in many aspects of daily life, and enter the water and sediments as a diffuse source. Little is known about these contaminants and although they are present on the OSPAR contaminant list, they have not been included in the European Waste Directive. These contaminants are therefore not controlled, and a 'Do Nothing' response results when the Scenario approach is applied.

The application of the scenario approach to these case studies has demonstrated its usefulness. The scenario approach should be applied as a support process to aid decision making, highlight areas of concern, and improve the transparency of the decision making process. The application of this approach to these case studies has emphasised the fundamental lack of an appropriate institutional framework covering the catchment coastal-zone continuum, and the absence of harmonisation and standardisation within the regulation regimes.

Harmonisation and Standardisation of Regulation

The application of the scenario approach to the previous case studies highlights the lack of harmonisation of regulation, and the resulting effects. The issue of sediment contamination is generally included in Waste Directives, although it can be argued that sediment regulation should form a part of the Water Directives. The regulation of the contaminated sediments tends to fall between these 'two stools', and as a result it is not well integrated into any regulation.

Freshwater environments are treated differently to marine waters. It is scientifically sound to have different guidelines for contaminants in fresh and saline waters as the impact of contaminants varies in these different environments. To ensure a systems approach is adopted however, the regulation of the saline and fresh water environments should be linked together. Greater harmonisation and co-ordination is an urgent requirement at the international level in order to produce effective and efficient guidelines and frameworks. An effective dialogue between scientists and regulators is also essential, to derive a harmonised set of environmental standards which can be applied to the entire system. Environmental agencies and managers must also interact with other stakeholders to develop guidelines which encompass the entire catchment, whilst incorporating local scale issues.

Contaminants are treated differently by different regulators. For example, OSPAR has a list of approximately 400 contaminants, whereas the European Waste Directive lists in the region of 30. It is likely, however, that OSPAR will continue to refine its candidate substances list and may also end up with around thirty priority substances. Different countries interpret these lists in different ways depending on a variety of issues, including local economic and environmental pressures. This can inhibit the adoption of a systems approach as contaminants are prioritised differently in different areas. The presence of these two lists also has benefits as the OSPAR list is more precautionary, listing contaminants such as the Fire Retardants, and provides guidance, and recommendations, for future contaminants to be listed on the European Waste Directive. The documentation of contaminants that could potentially cause environmental damage is a useful step towards encouraging precaution in regulation.

Regulation still tends to be reactive to environmental issues, and precautionary measures remain in the minority. In the U.K. the Environmental Agency has drawn up a list of endocrine disrupters which will be regulated despite the fact that no detailed analysis has been undertaken. In the UK, this pro-active approach is considered an important step towards predictive and precautionary regulation. It considers actions are needed now to minimise discharges of certain substances such as: those already subject to statutory control for other reasons such as their toxicity and persistence, but/or which endocrine-disrupting effects have also been reported; and some alkylphenols and steroids not currently subject to statutory controls but according to recent evidence, may be harming wildlife. But the precautionary approach is not a simple panacea, its application may well entail substantial economic costs and depending on exact circumstances may not even result in environmental gain if alternative more ecologically efficient and effective options are not available.

The lack of standardisation and harmonisation of regulation is of significant concern, and the derivation of mechanisms to overcome this is considered an essential part of future catchment-coastal management. The specific components of the system should continue to be researched and managed on a local basis, but an over-arching management scheme must also be implemented to ensure the successful adoption of a systems approach. An approach which adopts the marine system and sink capacity as the reference point for all other catchment based numbers and ranges provides a step towards mitigating the issue of regulatory co-ordination.

The meaningful adoption and deployment of the Polluter Pays Principle (PPP) in this sediment management context seems to be a difficult challenge. Many of the pollution sources involved are diffuse in nature and cover wide temporal and spatial scales. One way in which an economic incentive instrument might be deployed in order to encourage separation and treatment of dredged material, and to inhibit future potential contaminants is via a landfill disposal tax/charge. The UK now has limited experience of the operation of such a charge and not all of it is positive. A charge is levied if sediments are placed in disposal sites rather than subjected to treatment. It remains an open question as to whether this type of instrument could be deployed more extensively in other countries.

The Integration of Stakeholder Opinion

The scenario approach provides an appropriate tool for improving the transparency of the situation, and highlighting potential problem areas, and therefore aiding the consultation and negotiation process. The role of stakeholders should be integral to this process. The incorporation of stakeholders requires time and money, but if the public's opinion is neglected science can lose the respect of the general public and suffer from trust and accountability deficits. This effect has been observed in the case of Genetically Modified Foods in the U.K. Public opinion was not fully integrated into the decision making process, and this coupled with poorly communicated information has resulted in significant distrust of science on this issue. To avoid this effect, and ensure science is successfully incorporated into stakeholder values and belief systems the derivation of environmental regulation must become a more inclusionary process.

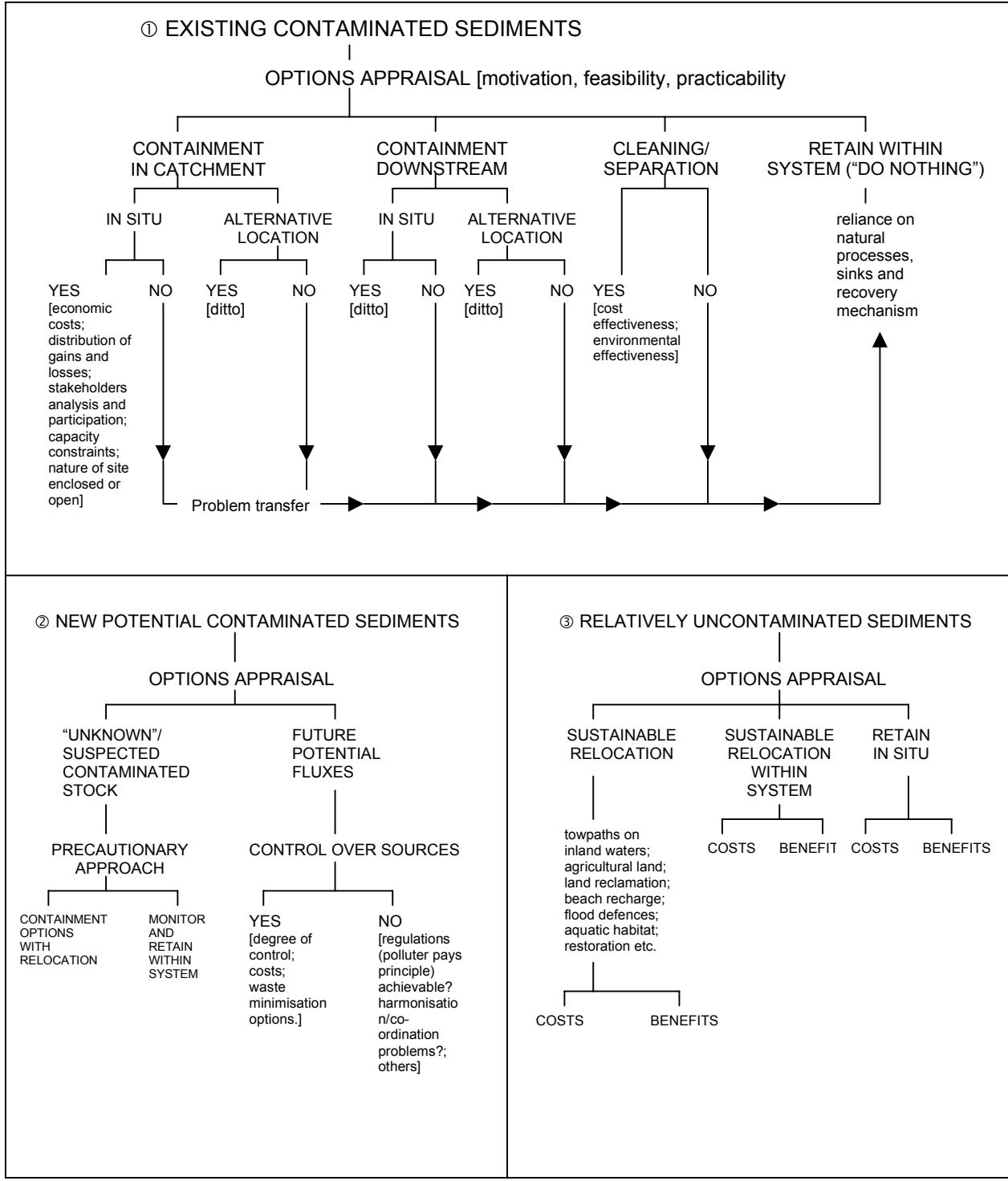
Stakeholder participation aids the development of equitable and acceptable regulation. Environmental regulation tends to involve balancing costs and benefits and the integration of stakeholder opinion into this process can result in the derivation of regulation which is perceived to be fair by a majority in society.

At the current time the inclusion of stakeholders in the regulation setting regime is considered to be insufficient. In some cases where the stakeholder opinion is included it does not have any significant effect on the decision process. Poor communication of information results in the inclusion of only those who are already closely involved in the process and/or have specific claims on the environment. It is also the case that stakeholder opinion is included in the process but not at the most appropriate level, for example the ICPR and OSPAR incorporate stakeholder opinion but it has little impact upon the higher order decision-making levels. It is recommended that organisations broaden their remit to involve the participation of stakeholders in a more effective manner.

Recommendations

- More harmonisation and standardisation of international regulation, (guidelines and frameworks) while maintaining the integrity of local systems and approaches An approach which adopts the marine system as the reference point for all other catchment based numbers and ranges provides a step towards mitigating the issue of uncoordinated regulation, and also serves to highlight the need for consistency of approach adopted towards each contaminant.
- Increased stakeholder participation in the process of environmental regulation setting and monitoring in order in particular to exploit local scale solutions and consensus-building practices
- The adoption of a scenario approach to allow the assessment of biological, physical, chemical and economic factors, and the balancing of these gains and losses against political, economic and social welfare criteria.

SEDIMENT MANAGEMENT SCENARIOS



4 Report of Working II

Dredged Material: Short-term issues and solutions

Chair: M. Scholten, Rapporteur: R. Peerboom

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C. Peters, F. Post, K. Pröpping, J. Stronkhorst

Introduction

All participants were invited to identify their “topic of concern” in relation to short-term issues of dredged material on the basis of a “dredged material management tree” (see Figure 1).

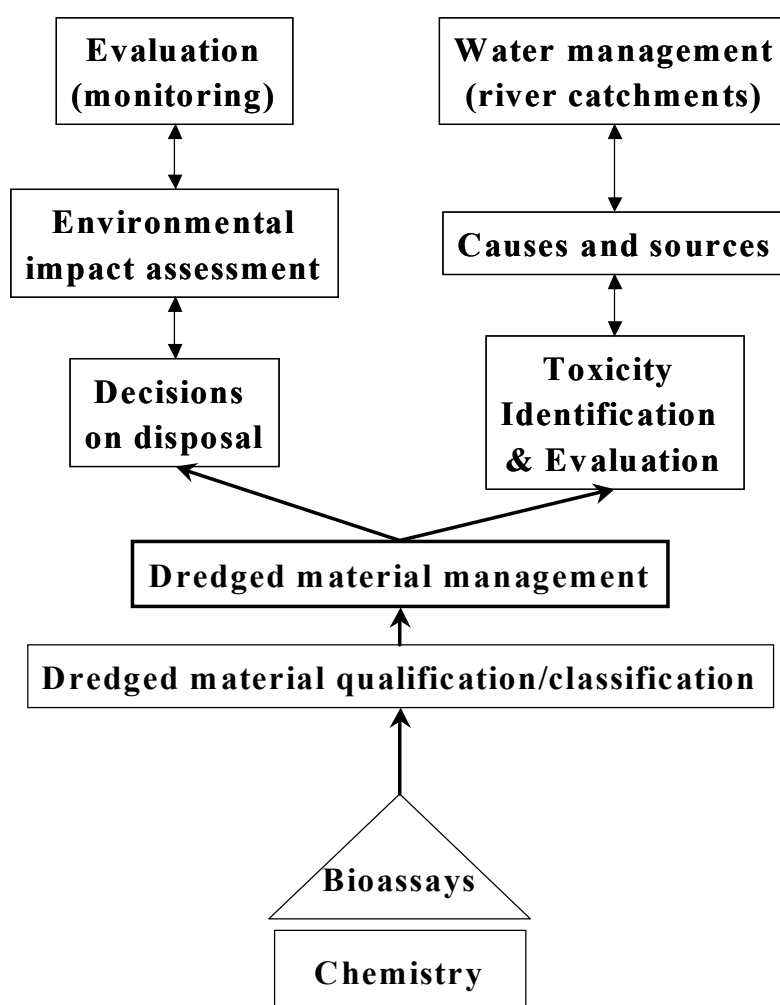


Figure 1: Dredged Material Management Scheme

From this inventory round six items for discussion emerged:

- Pragmatic approach dredged material management
- Disposal solutions
- Sources of pollution

- Added value bioassays
- Implementation level
- Goals 2005

In the following, a short description is given of the group discussion with respect to these topics.

Pragmatic approach for dredged material management

From the side of the Dutch North Sea directorate a need for a pragmatic approach to permit granting and disposal of dredged material was expressed, which should be more effective (division shore/sea) and more efficient (smaller time gap) than the present Dutch system. It was recognised that the approach should serve economy, ecology and the public (not necessarily in this order). Furthermore, clear objectives should be set with respect to the volumes (m³) and to the 'acceptable level of toxicity or pollution of concern' (at the disposal site) of the dredged material. Both objectives are linked, as lower toxicities allow larger volumes to be disposed and vice versa. Scientist would be involved to identify "the most toxic volume of the dredged material" as a basis for using the capacity of confined disposal sites in the most effective way. A risk-based, pragmatic approach, which is transparent to all stakeholders should be the result of all this. Monitoring, evaluation and subsequent adjustments would lead to continuous improvement (learning by doing), aiming at decreasing adverse effects and increasing the benefits gained by disposal. It was recognised that short-term effects are covered by above-mentioned approach, but some hesitations were expressed whether this also counts for long-term effects.

Disposal solutions

The method of choice depends of course on the specific properties of the material (type of material, type and level of contamination). Relevant criteria for disposal options are the risks involved, sustainability (environmentally sound solutions) and cost-effectiveness. For clean material, relocation in the system was identified as the preferred option, as this is most beneficial to the environment. Contaminated material can be beneficially used by land reclamation and active sediment management (sediment for dike construction). Confined sub-aquatic disposal with natural or artificial fixation is an alternative option. However, this might not be a long-term solution for material containing persistent pollutants. If one aims at total exclusion of risks, treatment and re-use are the options. The cocktail of pollutants found in contaminated material, however, make treatment a technically difficult and costly operation. Finally, land-fills and transport over land were not favoured as disposal options.

Sources of pollution

Dredged material contamination is related to activities in the catchment area, the harbour area and the marine area. The latter involves shipping-related pollution such as antifoulings, oil and chemical spills. From the catchment area various diffuse sources (pesticides) and domestic chemical residues originate. Finally, in the harbour area local pollution loads from shipping, docking and industrial activities are added to the sediment (future dredged material). Pathogenes might be an additional pollution of concern. Bioassays are useful for hazard indication, but also for source identification by the so-called Toxicity Identification and

Evaluation (TIE) approach, which is currently under development. Knowledge of local in-harbour sources and loads of pollution is important in getting a clear view on the other part of pollution. Furthermore, this type of inputs is under the control span of the harbour authorities, as opposed to the diffuse sources upstream in the catchment area. In this field many actors are involved and the issues are complex; agricultural practices, consumer behaviour, substance/product cycles, which should be tackled at a higher level. It was recognised that “the cleaning of the sources” cannot be triggered by the quality of dredged material alone. These things are beyond the focus of dredged material management and should not be addressed in this way. The strategy could be a transparent identification of the pollution of concern (by means of international priority chemicals lists) followed by a harmonised approach at a (inter)national level.

Added value bioassays

Chemical-based analyses are not always indicative for environmental risks of contaminated sediments. Materials with a high chemical load can be assessed by chemical considerations, but for moderately contaminated materials a toxicological consideration seems more appropriate. This is where bioassays fit in. As discussed extensively at the Science workshop in Geesthacht, the added value of bioassays is the fact that they address bioavailability, combination toxicity and not-analysed toxicants. The goal is not an extended analysis of dredged materials, but a better indication of hazard. In practise, a few, selected bioassays must provide a sound hazard indication. Important in this respect is a transparent judgement of bioassay results, which must prevent confusion in decision-making. Some aspects are not covered by bioassays and chemistry still has to be used. Weighing the results from bioassays and chemical analysis is a challenge.

Level of implementation

Is an international implementation of approaches for dredged material management preferred? The group distinguished three different aspects in this respect. For a general risk management approach, international (generic) guidelines were considered helpful. However, for the setting of quality criteria (actual action levels), international harmonisation would not do justice to the specific local (or catchment-related) situation. Finally, in the improvement of information exchange, international fora could again play a useful role. OSPAR was suggested as a suitable forum for networking, whereas transfer of knowledge could be established in the framework of the IMO/London Convention office.

Goals 2005

As the short-term issue group, working group II was asked to describe the goals for the year 2005, which turned out to be a summary of the above mentioned items. The aims can be divided in improved dredged material management and in pollution control. The first aim involves a pragmatic, transparent approach based upon risk management, at which bioassays are considered helpful diagnostic tools. Dredged material should be more beneficially relocated or used, considering it a valuable resource instead of waste. By evaluation of cases and monitoring, adjustments should lead to continuous improvement. Objectives with respect to the

sea form a point of concern in this respect. Additionally, in the year 2005 pollution control should be addressed on a catchment basis. In this complicated, international, multi-actor process, dredged material quality can serve as an indicator for success. Via the link of sediment quality, the European water framework directive could act as a reference in this respect.