2014 INTERNATIONAL OIL SPILL CONFERENCE

Developing Location-based Oil Spill Waste Management Plans

Dr Stuart Metcalf
SLR Consulting Ltd
Aspect House
Aspect Business Park
Bennerley Road
Nottingham
NG6 8WR
UK

Downloaded from http://meridian.allenpress.com/iosc/article-pdf/2014/1/1633/1748676/2169-3358-2014_1_1633.pdf by guest on 16 April 2024

ABSTRACT 300110:

The management of waste arising from offshore and in particular on-shore oil spill response activities can often incur more cost and resources than the responses themselves. Careful pre-planning can deliver more efficient and effective implementation, minimising both impact and cost and providing the opportunity for improved stakeholder engagement and media interaction.

Current practice necessarily focuses much effort and resource on two goals:

- the development of comprehensive plans to prevent oil releases from offshore oil exploration and production facilities
- detailed planning of effective responses if they do arise.

In many cases, detailed planning for the management of wastes appears to have been left largely until after a release has occurred. This is understandable when a vessel is the source of the spill as none of the critical variables can be defined in advance. However, when releases originate from offshore oilfield infrastructure it is possible to define many of these variables with reasonable accuracy and to use them as the basis for detailed and focused pre-incident planning, yet oil spill planners still seem to have been reluctant to address this issue. This is possibly due to the inherent complexity, cost and lack of perceived benefit of pre-incident waste management planning – it is hoped this paper will stimulate rethinking of this approach.

A significant number of the factors which influence the preparation of an effective waste management plan derive from the impacted location, (forecast using trajectory modelling). This information (shoreline substrate, clean up techniques, logistics, resources etc.) can be used to develop models that estimate waste arising from individual sections of shoreline - these can then be consolidated with data from other shoreline sections to determine waste stream types and quantities on a local and regional basis. Options for reuse/recycling/treatment and disposal and the resources required can also be assessed, allowing the development of strategies for delivery of the selected options. Assessments can also be made of the need/benefit for providing stockpiles of materials and/or equipment.

Considering key issues before an incident arises enables these to be reviewed more comprehensively in a non-crisis situation. The development of models facilitates review of alternative scenarios and quick adjustment to the plans if an actual release occurs and more

accurate details become available. The approach proposed can be applied to any geographical location. The paper outlines this process, examples of the results and the benefits of its adoption.

INTRODUCTION:

The need to develop contingency planning to respond to the results of a marine oil spill has been reinforced by many governments and oil companies in the wake of the Deepwater Horizon incident in 2010. A very large body of literature exists describing the theory and practice of management of oil spills in the marine environment and techniques for managing and removing/cleaning results of the deposition of oil which has migrated to land on receptor shorelines. Considerable effort is also expended by all operators in pre-incident planning to consider and address all the issues which may arise in a response.

It seems, however, that most oil spill contingency plans include very limited information on the management of waste, in spite of its significance. A number of papers and other industry publications include references to mechanisms and technologies which might be applied to treat the waste arising once the oil deposited has been removed from the beach, but there appears to be little work undertaken to date which provides guidance on the process of developing an Oil Spill Waste Management Plan. Such plans must of necessity work within the context of the relevant local legal, regulatory, and political frameworks, and take into account the availability of adequate processing capacity and capability, logistics, infrastructure, human, physical and financial resources as well as a wide range of other considerations such as political, cultural and social. Whilst it is clear that no two plans will be identical, guidance can be given on the approach, structure and methodology to be adopted in developing effective plans.

It is considered essential that an effective and implementable plan is in place at the earliest opportunity and that subsequently the plan(s) can and should be refined and optimised in all aspects, including legal, corporate, environmental and best practice compliance and cost.

The approach presented herein offers a structured and consistent basis which operators can use and enhance to create a standardised methodology for oil spill waste management planning.

The essential features of the approach can be summarised as:

- Extensive pre-incident information collection and planning;
- The development of an “adequate” plan as early in the planning process as practical;
- Developing plans around information specific to defined, potentially impacted sections of the shoreline (Locations);
- The creation of datasheets which summarise all the relevant information specific to each location and can be used by response teams and management
- The use of models which predict the quantities of waste generated, which can be extended to include resources and costs, and enable rapid updating and revision of strategies and plans in the event of an incident;

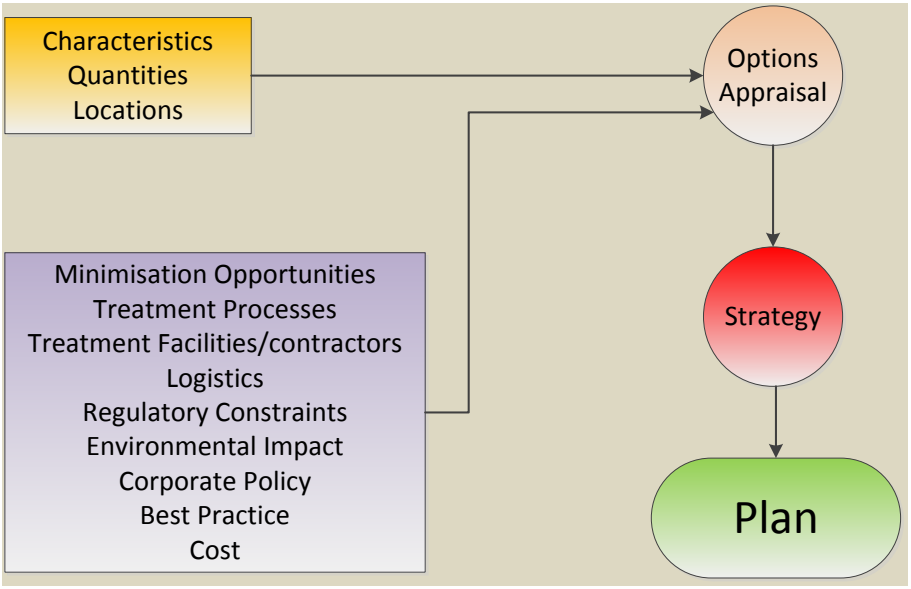
Downloaded from http://meridian.allenpress.com/iosc/article-pdf/2014/1/1633/1748676/2169-3358-2014_1_1633.pdf by guest on 16 April 2024

OIL SPILL WASTE MANAGEMENT PLANNING:

The Waste Management Planning Process

Planning for the management of any waste streams will generally follow the sequence of events shown in Figure 1 below:

Figure 1 – Waste Management Planning Process



This flow chart identifies the critical information which it is necessary to assemble before an effective plan can be developed – for example, what are the waste characteristics, how much will there be and where will it be? Once these are established, more generic data (as indicated in the purple box above) can be used with this information to enable an options appraisal to be undertaken and a strategy developed.

Oil Spill Waste Management Planning

The management of waste generated from oil spill response activities is in many ways unique, as little control can be exercised over the "feedstock" and the location of the waste. However, the principles outlined above are still applicable and adopting a structured and formalised process will enable plans to be developed appropriate to a wide range of different applications.

The Benefits of Pre-Incident Planning

Planning for the management of oil spill waste is an extremely complicated process, with many factors to consider. However, as with all other aspects of oil spill response planning, pre-incident waste management planning offers considerable benefits including:

- Enabling time to be taken to consider all of the options and scenarios and optimise the solution(s) taking into account all relevant factors and allowing involvement of all interested parties (including contractors) in unpressurised, non-emergency conditions;
- The preparation of effective documentation to summarise the actions required

Downloaded from http://meridian.allenpress.com/iosc/article-pdf/2014/1/1633/1748676/2169-3358-2014_1_1633.pdf by guest on 16 April 2024

- The opportunity to undertake training and exercises and engage with stakeholders - this in turn allows immediate and effective implementation of strategy;
- Lower overall cost
- Better public perception;
- Ease of communication

An indirect benefit of this approach is that involvement of staff in the preparation of the plan raises the profile of this critical aspect of contingency planning and can be used to highlight potential issues and help internal understanding of the problems.

In-incident Updating

Pre-incident oil spill waste management planning is of necessity based on forecasts and estimates which will inevitably not be exactly replicated in an incident. It is therefore essential that a feature of any spill waste management planning process is the incorporation of mechanisms for revising and updating key elements of the plan when actual circumstances are known. That the plan will change, at least in detail, does not render the time and effort expended in detailed pre-incident planning wasted, rather that the process enables those elements which are liable to change to be identified and assessments made of how they should be varied in different circumstances. It is this critical aspect of spill planning which leads to the consideration of waste modelling discussed later.

Waste Plan Content

The purpose of pre-incident planning is to enable those involved in a response to understand:

- **What** is to be done
- **Who** is going to do it (and **when**)

Response and Action Plans

The primary output of the planning exercise is therefore regarded as a "Waste Management Response and Action Plan" (RAP), or more accurately a series of RAPs, developed by the Operator, Responder and the various Contractors who will be engaged to undertake the wide range of activities required to implement that plan.

The Response and Action Plan is the document which defines how the waste management elements of a spill response are delivered. It is the document which is taken off the shelf and referred to when an incident arises.

The exact content and format of such plans is entirely variable and can be tailored to suit requirements. It is also possible that for large areas or regions where facilities and resources may be concentrated into small areas, a series of regional plans may be developed which are different from each other.

In all cases, however, an effective plan needs to provide, as a minimum:

- Clear definition of the infrastructure or geographical scope to which it applies

Downloaded from http://meridian.allenpress.com/iosc/article-pdf/2014/1/1633/1748676/2169-3358-2014_1_1633.pdf by guest on 16 April 2024

- Basis of plan (i.e. release rates etc)
- Forecast impacted shoreline locations and data relating to the locations
- Summary of waste streams and clarity on strategy – i.e. what to do with each waste stream?
- Possible locations for intermediate storage sites
- Identification of key parties (e.g. oil spill responder, waste contractor, statutory bodies)
- Immediate availability of critical information such as background data/contacts/sources of information
- How to go about obtaining the information which it was not possible to establish during pre planning
- Legislative/regulatory framework and how to comply
- Who does what and when?
  - Roles and Responsibilities and organisational charts
  - Key interfaces between parties
  - Communications and Information flow
  - Identification of third parties and pre-contract agreements (where relevant)
  - Understanding of third parties' plans (egg spill responder, waste contractor etc)
  - Flow Charts of process
  - Detailed Action Plans (including those of responders and contractors)

These plans should be as concise as possible to enable users to focus on the actions rather than contain information which may be useful but not relevant at the time. Information concerning the various shoreline locations where oil is likely to impact is invaluable to responders and planners alike and should be a fundamental element of a plan.

Supporting Plans

In order for the Response and Action Plan to be effective, it must be based on the best available data, which is then used to consider all the options and to reach a conclusion as to the optimum, taking all pertinent factors into account.

Collection and collation of the input data required to allow compilation of a spill waste management plan can be undertaken as a single-stage or multi-stage process. In the single-stage process, strategies and plans are developed based on detailed assessment of the potentially impacted locations.

However, it may be more effective to adopt a multi-stage process, which seeks to create an overall strategy based on initially cruder estimates of the total quantities of waste likely to be produced. This recognises the reality that it is probable that one or two streams will constitute the largest proportion of the waste generated. Defining the means by which these

Downloaded from http://meridian.allenpress.com/iosc/article-pdf/2014/1/1633/1748676/2169-3358-2014_1_1633.pdf by guest on 16 April 2024

will be managed can enable key strategic investment and procurement decisions to be made and implemented whilst the process of developing details of the plan including the remainder of the waste streams is in hand. This is consistent with the objective outlined above of first creating an adequate plan and then developing and optimising it. The methodology centres on initially determining whether there are any waste management facilities which already exist which could be used to process the principal oil spill waste arisings, and if not, what equipment and/or infrastructure would need to be procured (either on hire or purchased) in order to provide the necessary treatment capability and capacity.

Generation of the more detailed input data is undertaken during the second and subsequent stages of the multi-staged approach. Consolidation of data from each individual location is used as the basis for options appraisal and strategy development.

A critical element of the planning process is the identification and selection of processing techniques which are suitable for treating the waste streams which are generated. Once waste characteristics and quantities are known, available treatment/disposal routes complying with local regulations (and ideally the waste hierarchy) can be investigated. Dependent on the location/country of the impacted shoreline, access to waste processing facilities may or may not be available. The optimum strategy will almost certainly vary considerably, dependent on the types and quantities of waste and the locally available treatment facilities, infrastructure, regulatory framework etc. Regional Waste Management Plans have therefore been developed for some operators to reflect this – again focusing attention on the criticality of the impacted location.

It is likely that compromises will need to be made between the most effective treatment process and the availability of processes (for example, an existing waste processing facility) and this should be taken into account in developing strategy. To facilitate process and/or facility selection, either a comprehensive database or expert advice should be available to planners.

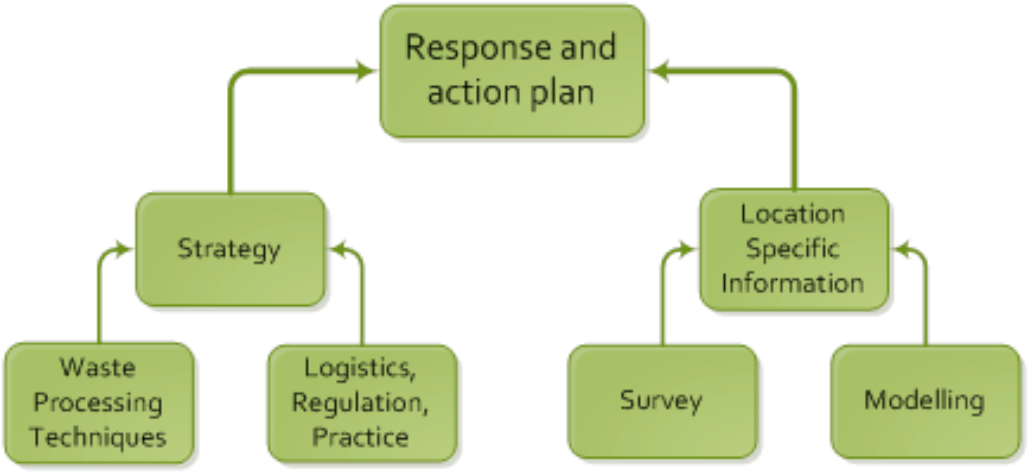
A complete waste management plan would therefore comprise four documents:

- Location data
- Waste Processing Techniques assessment
- Strategy development and conclusions
- Response and Action Plan

The overall waste management plan development process can therefore be broadly summarised as shown in Figure 2 below:

Downloaded from http://meridian.allenpress.com/iosc/article-pdf/2014/1/1633/1748676/2169-3358-2014_1_1633.pdf by guest on 16 April 2024

Figure 2 – Waste Management Plan Development



LOCATION-BASED WASTE MANAGEMENT PLANNING:

Overview

In the case of oil spill response-generated waste, the characteristics, qualities and quantities are largely a function of the shoreline substrate (i.e. sand, pebbles etc) and the method(s) used to clean-up the beach, which are both a function of the location. Ease of access (which also contributes to clean-up technique selection); space and ground characteristics (which influence local storage options) and the availability of local resources (including power and personnel) are also clearly a function of location. It is therefore clear that some of the key influences on oil spill waste management and processing are location-based.

If the oil is spilled from a ship, the oil type is not known in advance and release could take place anywhere, making it difficult to plan effectively. However, in many jurisdictions, vessels are required to prepare geographic specific plans for the areas where they will navigate. Therefore, it is possible to develop at least an outline of a waste management plan for these areas and the coastline potentially impacted.

In situations where the release originates from an exploration or production facility the situation is different:

- The oil characteristics are known
- The point of release and the rate and profile of the release are also known or can be forecast.
- Oil spill trajectory forecasting software is well established and can provide reasonable predictions of routing, dispersion, the impact of response tactics etc and the probable location of shoreline impacts.

As indicated above, many of the key factors which influence the selection and optimisation of waste management arrangements are dependent on the impacted location. The availability of information regarding the sections of shoreline likely to be impacted enables considerable options appraisal and pre-incident planning to be undertaken, as

Downloaded from http://meridian.allenpress.com/iosc/article-pdf/2014/1/1633/1748676/2169-3358-2014_1_1633.pdf by guest on 16 April 2024

outlined in the following sections. In many parts of the world, detailed surveys have been undertaken which have recorded considerable quantities of data relating to environmental, social and economic sensitivities of potentially impacted locations, and these are often contained and managed through GIS databases. Thus mechanisms for storing and accessing location-specific data may already exist, and waste management related information can easily be added and retrieved.

Waste Quantity Modelling

Estimates of the characteristics and quantities of waste are essential before any effective waste management planning can take place. Waste stream characteristics are dependent on the materials present on the shore (the "substrate") and waste quantities can be estimated from information about these, the oil characteristics and the method adopted to clean individual sections of coast. Estimates can be based on output from trajectory modelling software such as OSCAR, which provides indications of oil concentrations on impacted beaches, or models based on the consolidation of historical oil spill data.

It should be emphasised that the modelling process is not accurate – outputs will be estimates, but the development of models has three key benefits:

a) The creation of the model requires identification of all of the factors influencing waste generation and the consideration of their effect.

b) The ability to consider alternative scenarios during pre-incident planning

c) The ability to quickly modify estimates of waste quantities during an incident as more accurate data becomes available – this is a continuing process.

The modelling is used in two ways:

- To estimate the quantities of each type of waste produced at each location
- To consolidate this data into overall waste stream quantities.

Examples of output from such models are shown in Figure 3, Figure 5 and Figure 5.

Downloaded from http://meridian.allenpress.com/iosc/article-pdf/2014/1/1633/1748676/2169-3358-2014_1_1633.pdf by guest on 16 April 2024

Figure 3 – Waste Generated from a single location

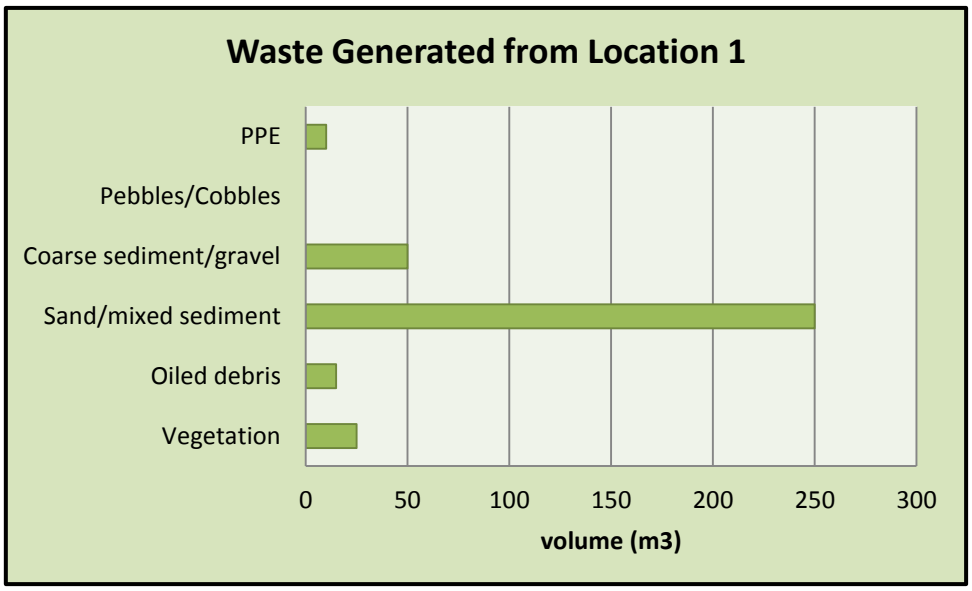
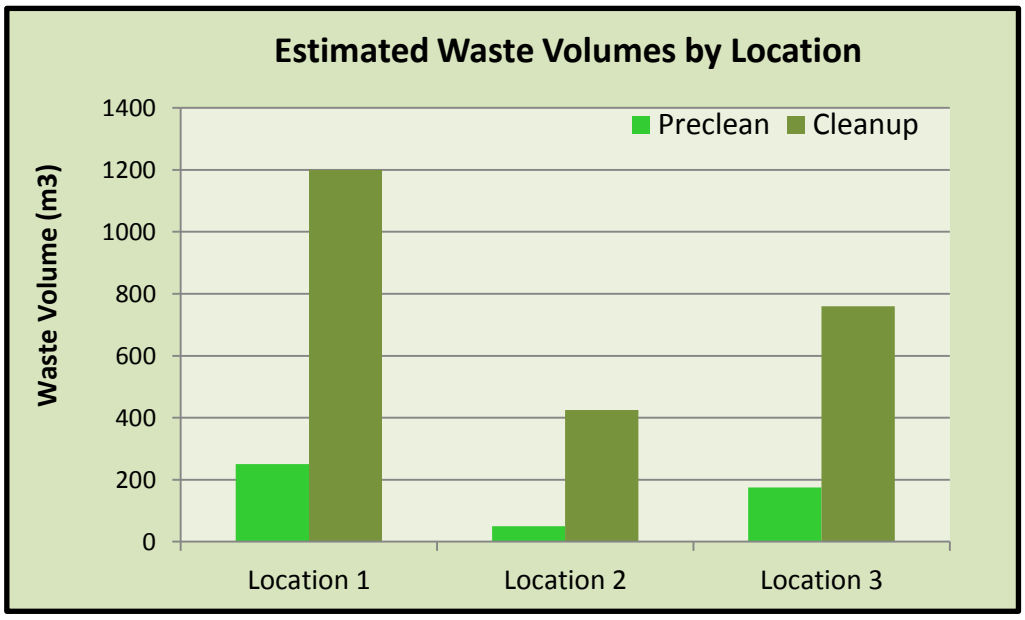
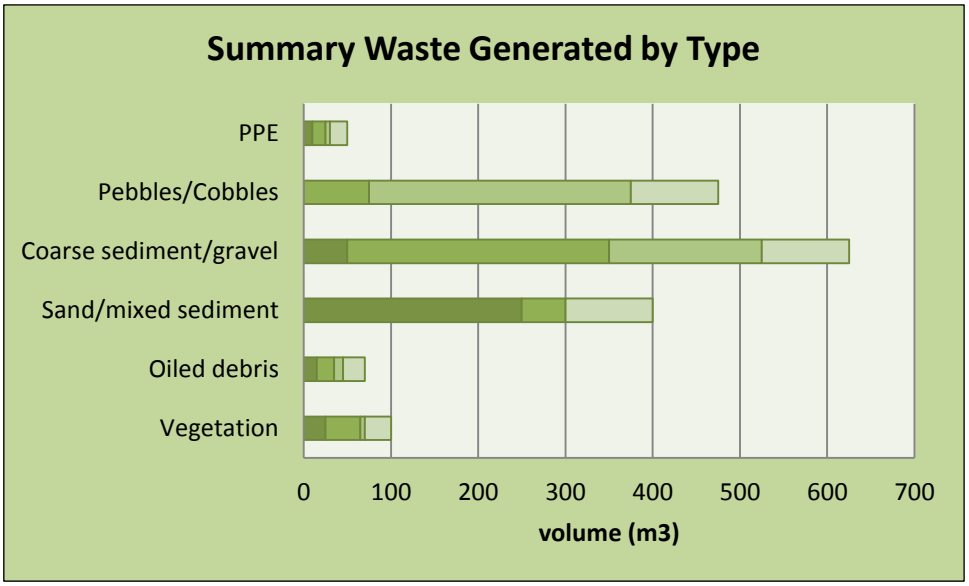


Figure 4 – Estimated Waste Volumes – Pre-clean and Clean



Downloaded from http://meridian.allenpress.com/iosc/article-pdf/2014/1/1633/1748676/2169-3358-2014_1_1633.pdf by guest on 16 April 2024

Figure 5 – Summary Waste Generated from Several Locations



This data is fed into the options appraisal process, which can itself be to some extent automated and modelled.

In addition to the modelling of waste quantities, modelling can also be extended to provide a much wider range of planning information to assist in the development of strategy and the management of a response. These include:

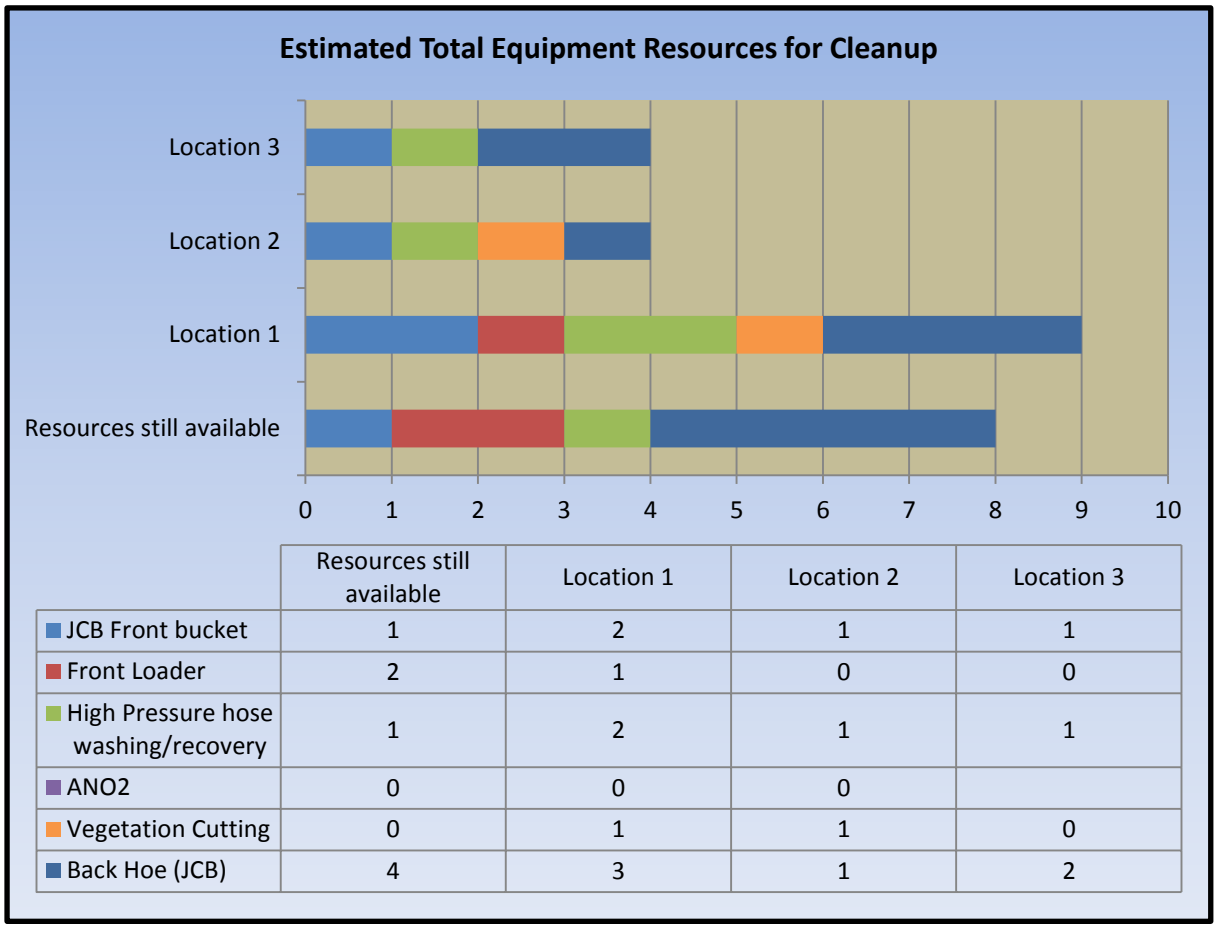
- Temporary storage requirements
- Intermediate storage requirements
- Resources (Personnel, Equipment, Costs)
- Activity programmes

The data gathered from location surveys can be used to assess the space available for the construction of temporary storage areas and/or temporary waste processing areas (if he practicable). Information from oil spill responder and contractors can determine whether sufficient temporary storage can be provided to accommodate all the waste it is anticipated will be generated or whether additional intermediate storage will be required, enabling the identification of suitable sites for such purpose and the initiation of negotiations with site owners etc.

The outputs are again based on information collected from historical spill management and local knowledge/contractors, and are similarly able to be refined as more data becomes available. They also enable discussions to be entered in to with possible suppliers/contractors in advance of any spill. Examples of these outputs are shown in Figure 6, Figure 7 and Figure 8.

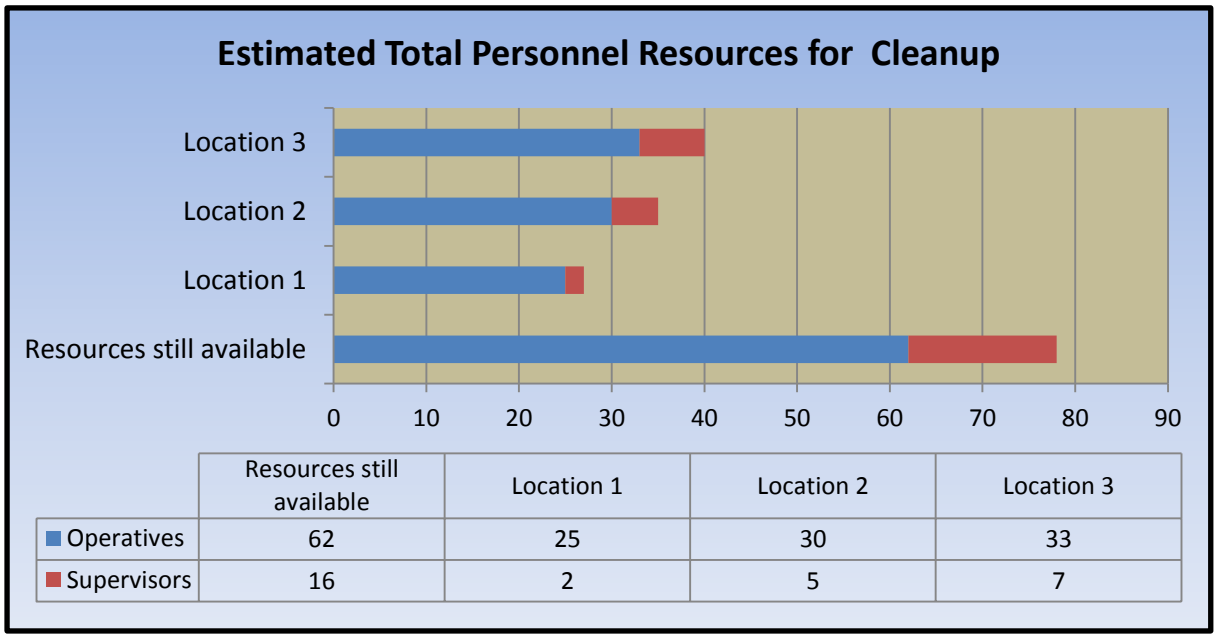
Downloaded from http://meridian.allenpress.com/iosc/article-pdf/2014/1/1633/1748676/2169-3358-2014_1_1633.pdf by guest on 16 April 2024

Figure 6 – Estimated Resources for Clean-up



	Resources still available	Location 1	Location 2	Location 3
JCB Front bucket	1	2	1	1
Front Loader	2	1	0	0
High Pressure hose washing/recovery	1	2	1	1
ANO2	0	0	0	
Vegetation Cutting	0	1	1	0
Back Hoe (JCB)	4	3	1	2

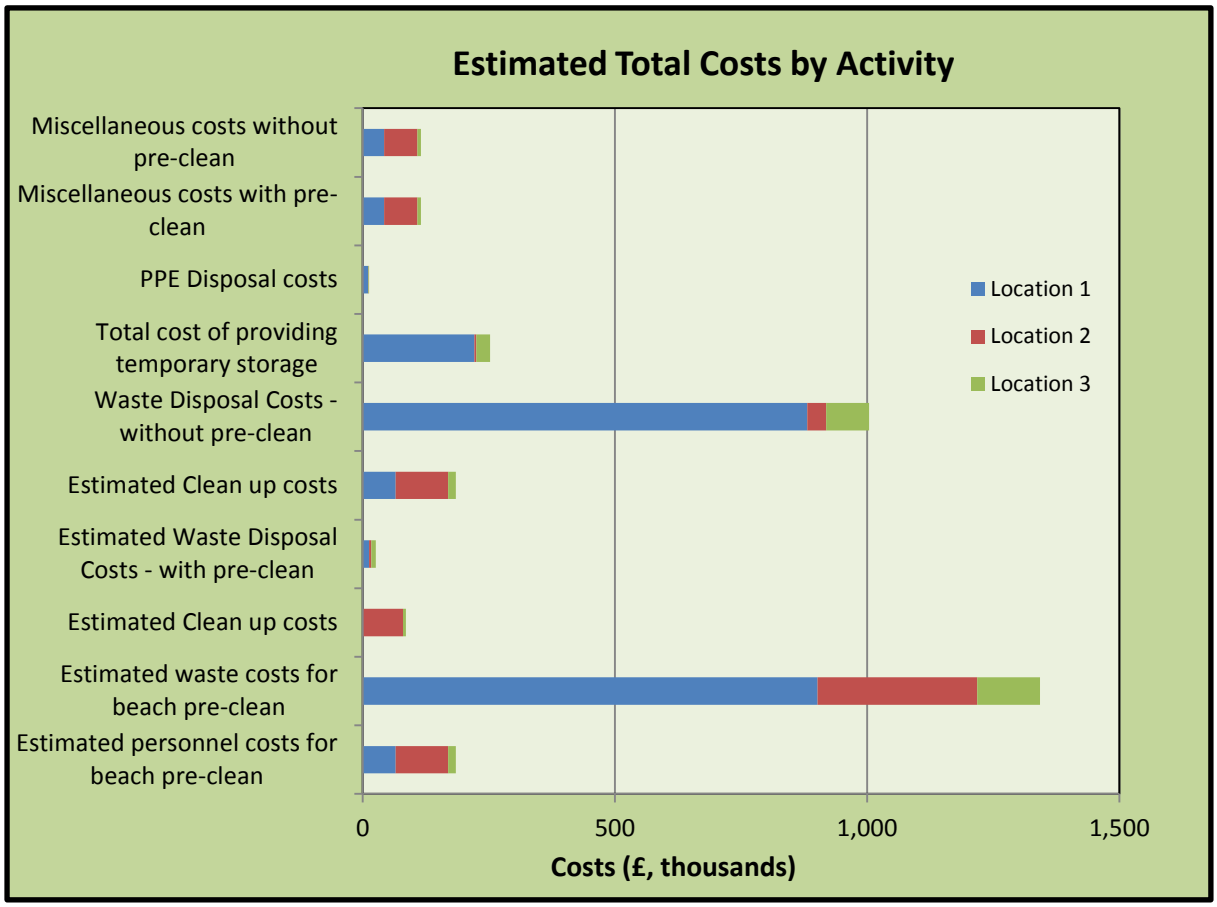
Figure 7 – Estimated Personnel Resources



	Resources still available	Location 1	Location 2	Location 3
Operatives	62	25	30	33
Supervisors	16	2	5	7

Downloaded from http://meridian.allenpress.com/iosc/article-pdf/2014/1/1633/1748676/2169-3358-2014_1_1633.pdf by guest on 16 April 2024

Figure 8 – Estimated Costs



SUMMARY:

Planning for the management of waste arising from the response to a marine oil spill is regarded as a critical element of the overall contingency planning process, but one which has to date been largely of a superficial nature, with detailed planning left until an incident arises.

The factors critical to the development of effective waste management plans have been identified. Many of these relate to the section of shoreline where the oil impacts. An approach has been proposed which utilises this information as the basis for developing models which estimate the quantities of the various waste types which might be generated and consolidates this data in such a way as to inform waste management strategy development. The benefits of modelling waste generation are considered and the possible outputs of such models demonstrated. The modelling process can be extended to provide estimates of storage requirements, resource demands and other key factors in the decision-making process.

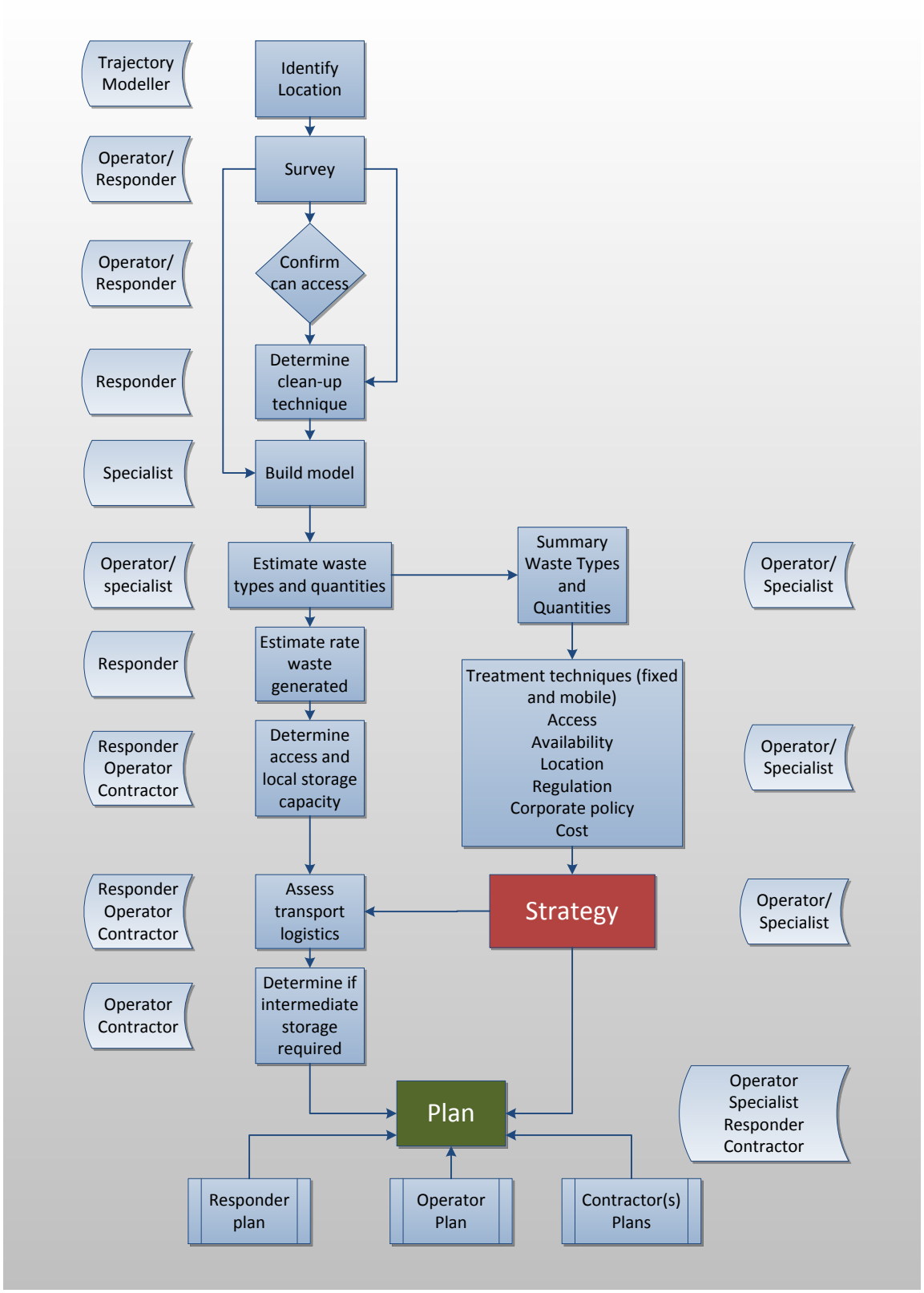
A crucial benefit of this approach is the opportunity it gives for assessing local and strategic waste management options for all potentially impacted locations in advance of an incident. When accurate forecasts become available once an incident has arisen, the models allow a rapid reappraisal to be made of the strategy and the implementation of the most effective.

Downloaded from http://meridian.allenpress.com/iosc/article-pdf/2014/1/1633/1748676/2169-3358-2014_1_1633.pdf by guest on 16 April 2024

Figure 9 presents a summary flow chart of the approach.

Downloaded from http://meridian.allenpress.com/iosc/article-pdf/2014/1/1633/1748676/2169-3358-2014_1_1633.pdf by guest on 16 April 2024

Figure 9 – Summary Flow Chart – Waste Management Plan Development



Downloaded from http://meridian.allenpress.com/iosc/article-pdf/2014/1/1633/1748676/2169-3358-2014_1_1633.pdf by guest on 16 April 2024