A SCOPING METHODOLOGY FOR LEGACY MUNITION ENVIRONMENT ASSESSMENTS AND RANGE ENVIRONMENTAL SUSTAINABILITY PROCEDURE

Peter Barnes, Peter Eickhoff, Ron Moss & Steve Norbury
DOSG, DPA, MoD(UK)
Abbey Wood, Bristol, UK

Peter Flower & Matt Horne
QinetiQ
Fort Halstead
Sevenoaks, Kent, UK

ABSTRACT

The paper concentrates on the development of a pragmatic cost effective process for carrying out initial environmental assessments for legacy munitions.

It is UK MoD policy that environmental assessments are carried out on all munitions in the weapons inventory. With well over 1000 legacy natures of munitions in the inventory this would be far too costly to achieve for each munition. A second major problem is that there is a dearth of scientific evidence to back up any decision as to whether or not a munition has significant adverse environmental impacts.

The procedure taken has been to select about 30 munition 'fleet' leaders based on the categories used in the US DAC MIDAS system. Read across is then made from these 'fleet' leaders to the complete weapons inventory. The next stage is to determine what emissions are produced from these munitions when they are functioned. The toxicity and environmentally harmful properties of these emissions are then assessed together with a review of any unfriendly environmental materials that the munition may contain e.g. heavy metals, to assess the extent, if any, of significant adverse environmental impact. This first stage of the environmental assessment is then inputted into the specific munition environmental and safety case.

The second stage is to make use of the emissions data on ranges from individual munitions for training, firings etc on ranges to produce a range environmental sustainability procedure based on the type and quantities of munitions to be tested. Therefore on an annual basis the extent of emissions e.g. CO_2 and any other adverse harmful effects can be calculated based on what has been used on that particular range. This will enable the sustainability of the range to be maintained over an extended period of time, by knowing any adverse emissions from what is being tested.

BACKGROUND

The assessment of safety and environmental impact of Ordnance, Munitions and Explosives (OME) has become more demanding over recent years. This is in part due to the requirement for more comprehensive safety cases for OME entering into service. Additionally, European environmental legislation requires more detailed assessment of potential environmental impacts.

These arguments require supporting data, and as the cost of trials increases so there is a need to rationalise the amount of testing to reduce duplication of effort and make best use of scarce resources.

There is an ever increasing amount of data needed to meet the Safety, Suitability and Survivability for Service (S^4) OME requirements, Figure 1, to assess OME against the requirements, some of which are indicated in below. There is real scope to benefit from having a joined up approach to meeting all the requirements for OME. Such an approach should allow one to identify opportunities during the development of munitions where data can be used to meet the requirements of multiple stakeholders.

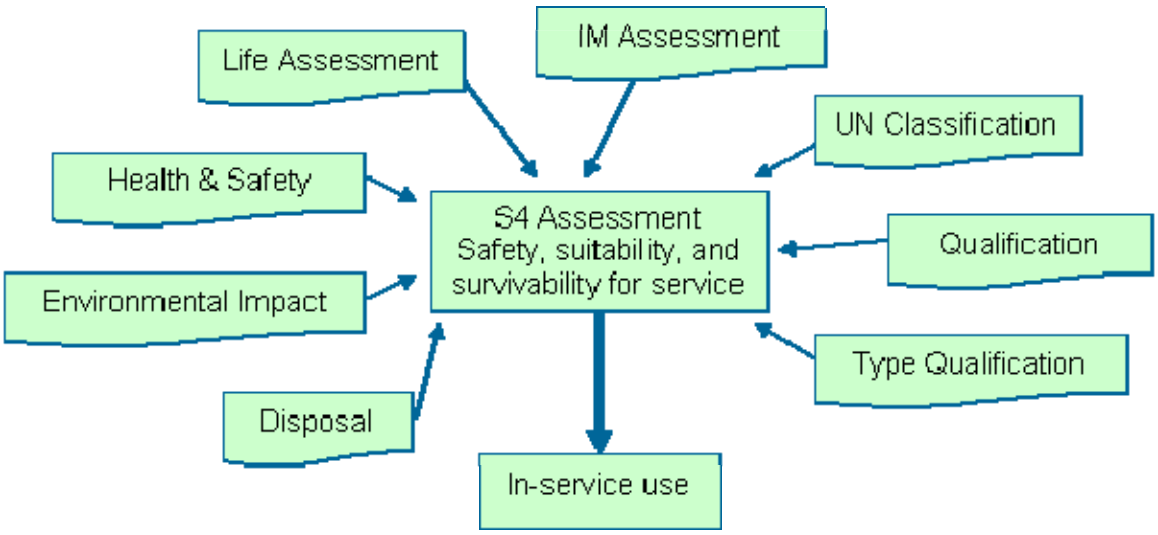


Figure 1. S^4 requirements for OME

Much can be done to improve on what is done already and it should be possible to make significant improvement through better availability of data and co-ordinating testing. In the above Figure the technical and scientific data for the Environmental Impact is shown and integrated within the other S4 requirements

DPA (the UK MOD Defence Procurement Agency) has already identified the virtues of a joined up approach to safety and environmental assessment in its Acquisition Safety and Environmental Management System (ASEMS), which is also applicable for OME. Such an approach has the following benefits:

- Generic, one approach for all domains
- Standard and recognised structure
- Alignment between Safety and Environment
- Builds on current practice
- Better understanding = better products
- Improved assurance
- Cost savings

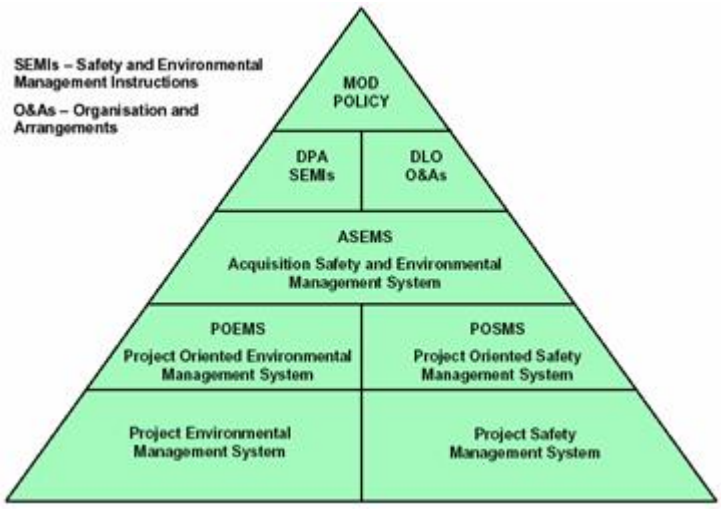


Figure 2. MOD Policy and Guidance Hierarchy

As part of this system, procedures and guidance are proposed to help IPTs meet their requirements. For safety there is POSMS (Project-Orientated Safety Management System) and for environmental there is POEMS (Project Orientated Environmental Management System). Figure 2 below indicates the relationship and hierarch of policy and guidance.

DESCRIPTION OF THE POEMS

In this paper the authors have assumed that the readers have sufficient understanding of the well established POSMS, therefore only POEMS needs to be reviewed here. However it should be emphasised that the scope of POSMS includes the safety issues relating to the environment (e.g. health and safety risk from the use of hazardous materials) and hence overlaps with some of the aspects of POEMS.

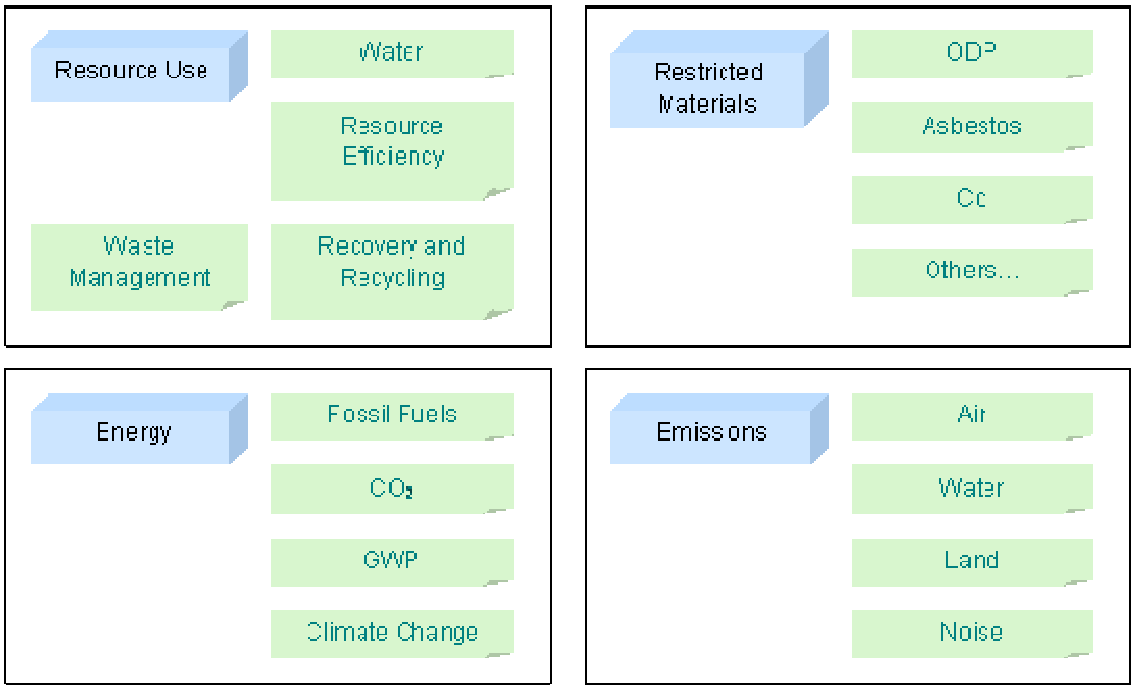


Figure 3. Environmental Impact Areas for MOD equipment

It is important that MOD can demonstrate that it has put in place appropriate management controls and procedures to manage its potential environmental impacts, and any related risks throughout the lifetime of defence projects. This is applicable to OME and hence an environmental impact assessment has to be prepared for the munitions life cycle and includes all activities and situations that a munition is likely to see between development and demilitarisation, Figure 3 indicates the environmental impact areas that need to be considered

The POEMS covers the work of all Integrated Project Teams (IPTs) and is designed to comply with Government policy whilst meeting many stakeholders' expectations. In essence, through POEMS, IPTs will identify the significant potential environmental impacts and risks associated with systems and demonstrate either elimination or management and continuous improvement of these throughout the life cycle of the project.

CONTENT AND PURPOSES OF THIS PAPER

A review of a paper presented at the last NDIA IM/EM conference[1] has been made of material relevant to the remaining sections of this paper. These areas have concentrated on similarities bewteen the POSMS and POEMS management systems as well as to briefly describe the possibilities for more efficient OME safety, suitability and sustainability for service (S^4) assessment.

The main remaining sections of this paper outline the principles behind a recommended scoping methodology for initial scoping of Munition Environmental Assessments and a Range Environmental Sustainability Procedure. How this process (further referred to as Environmental Hazard Assessments) fits into the OME safety review procedure (via the Ordnance

Safety Assessment Panel) is described . It is important to stress that targets cannot be achieved overnight with current limited resources. By addressing environmental effects of OME in a pragmatic way with buy-in from all the key stakeholders a cost effective and justifiable way ahead is being taken.

.ENVIRONMENTAL IMPACT SCREENING AND SCOPING: EHA

Any screening and scoping exercise should be conducted to identify the potential direct and indirect, positive and negative environmental aspects and impacts of the project. This procedure should be undertaken as early as possible in the Concept stage, prior to Initial Gate approval, for new munitions, and outputs reviewed as the project progresses. Projects should maximise read across of data from similar projects whenever possible. For example, an EHA performed recently for a similar project may negate the need for another EIHA to be produced, as the necessary information has already been compiled and analysed.

In the case of legacy projects it is important not to over engineer this particular procedure, or the application of POEMS generally, as there is often limited scope to reduce the project's overall environmental impact. However in the future pressure will increase to develop a 'green energetics/munitions' culture.

Below are a series of questions that will help determine the environmental significance of a legacy project:

- Does the remaining length of time in service exceed 5 years?
- Are a significant number likely to be functioned?
- Has recent legislation imposed a requirement for new mitigation measures?
- Are there future plans for modifications or capability enhancements?
- Is there any evidence of environmental incidents occurring in the past?
- Have there been any environmental compliance problems?
- Has there been any negative stakeholder interest in the project?
- Could additional Operational Controls be readily adopted to reduce environmental impact?

The application of an environmental management tool to each and every OME legacy project is not practical on the grounds of resource use. Consideration should be given to grouping similar "projects" together and applying an environmental management system to cover each group of projects.

The outputs from this stage EHA will influence whether or not an other more detailed assessment is required, and if so, the type and level of assessment that is required. Hence, whilst potentially being coarse due to a lack of available information, it needs to be an 'as accurate as possible' reflection of the key aspects and impacts associated with the project.

ENVIRONMENTAL HAZARD ASSESSMENT

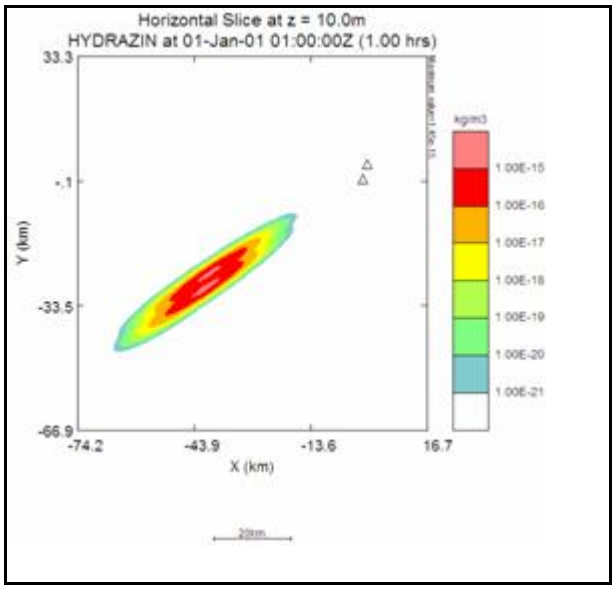
The EHA seeks to generate quantitative data which:

(i) allows an assessment of the significance or otherwise of any emissions to the environment,

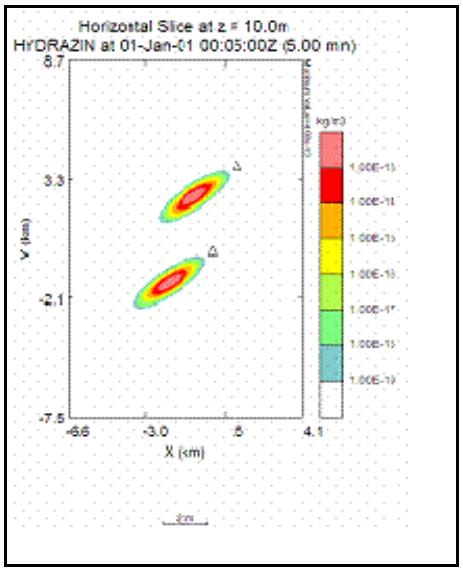
(ii) to generate information which would prove useful to anyone e.g. a Range Safety Officer, responsible for conducting site specific environmental management tasks and (iii) provides a unified approach preventing duplication of effort by maximising the use of available data. Key stakeholders for the process therefore include IPTs, Defence Estates and Range Management staff.

The first stage of an environmental assessment is to determine whether outputs are likely to cause environmental harm. Two approaches may be used, a Source/Pathway/Receptor risk based model which requires a Conceptual Site Model (CSM) to be developed or a regulatory approach based on guidance from the Environment Agency (EA). For the initial assessment the former technique was considered inappropriate and so the EHA methodology relies on comparing emissions from a weapon with regulatory values and comparing them to the Environment Agency`s own guidance to determine significance. This initial assessment requires data describing the emissions and this has proved difficult to source, resort finally being made to a coherent set of emissions data generated jointly by the US DoD and Environmental Protection Agency (EPA). Reliance on an overseas data set is obviously a weakness and highlights the need for the UK to generate a similar data set. At first this may sound expensive but the work conducted thus far has demonstrated clearly that data can be applied to a number of different scenarios; generate the data once for multiple use. An example is the emissions from warheads filled with a particular type or class of explosive. It is noteworthy that the same emissions data can also be applied to the assessment of human health adding weight to the need for a efficient data management system which allows multiple use of a single data sets.

Figure 4 illustrates the output generated from an air dispersion model. The data were generated from two Mine Anti Tank HE Blast munitions, and shows the dispersion plume of gaseous hydrazine liberated on detonation in a 15 mph 55º wind.



A



B

Figure 4: The dispersion of hydrazine emitted on simultaneous double detonation.

A = Concentration of hydrazine 10 m above the ground 5 minutes post detonation.

B = Concentration of hydrazine 10 m above the ground 1 hour post detonation

INTERFACE WITH ORDNANCE SAFETY REVIEW PANEL (OSRP) PROCESS

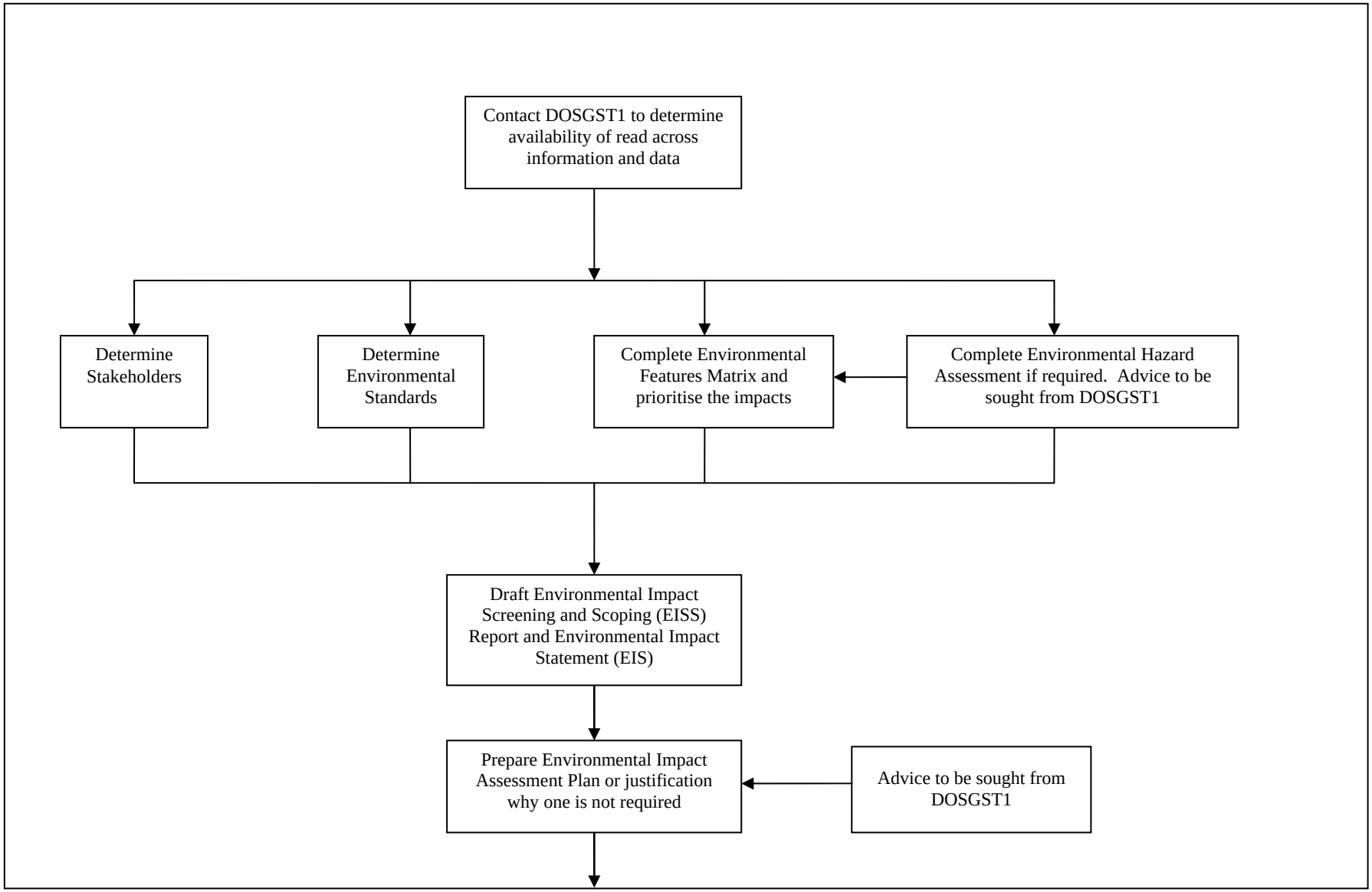
Where appropriate there should be one management system. Environmental issues should be included in the Safety Case and covered by the Safety Case Report. This may not always be possible, particularly if the Environmental Management System (POEMS) has been applied to a group of projects. In such cases, the environmental section of the Safety Case Report would reference the group Environmental Management System and be supported by the Group Environmental Impact Statement annexed to the report. The Safety Case Report for the OSRP should include as a minimum, the EHA Plan and the Environmental Impact Statement, if one is available. The report should be forwarded to the Environmental Effects of Munitions Assessment Panel (EEMAP) for endorsement prior to being submitted to the OSRP. In the event that it has been established that an Environmental Impact Assessment is required at a later date, then the updated Environmental Impact Statement along with supporting documentation (Environmental Impact Assessment Report) should be forwarded to the EEMAP and OSRP, when available, in order that they may review their earlier comments and judgements. Figure 5 is a flow diagram depicting the environmental management for OME projects..

EEMAP

The panel consists of a number of members, these include an appropriately qualified Environmental Scientist, an DOSG Explosive Chemist and Environmental compliance experts. An EEMAP can be convened at any time during the CADMID process, to help with the production of the Environmental Hazard Assessment by the Integrated Project Team responsible for OME procurement.

EEMAP and OSRP

The Environmental Effects Munition Assessment Panel is modelled on the Insensitive Munitions Assessment Panel (IMAP) in that it reports to the Defence Ordnance Safety Board.The EEMAP will assess the EHA, the results of the EEMAP assessment are presented to the OSRP along with the results of the IMAP and the OME Safety Case Report. The OSPR's sits to assess the OME safety and suitability and either issues a Certificate of Safety for OME (CSOME) or recommends that further work is necessary. Figure 6 shows how the OSRP interfaces with the Munition Assessment Panels


Contact DOSGST1 to determine availability of read across information and data
Determine Stakeholders
Determine Environmental Standards
Complete Environmental Features Matrix and prioritise the impacts
Complete Environmental Hazard Assessment if required. Advice to be sought from DOSGST1
Draft Environmental Impact Screening and Scoping (EISS) Report and Environmental Impact Statement (EIS)
Prepare Environmental Impact Assessment Plan or justification why one is not required
Advice to be sought from DOSGST1

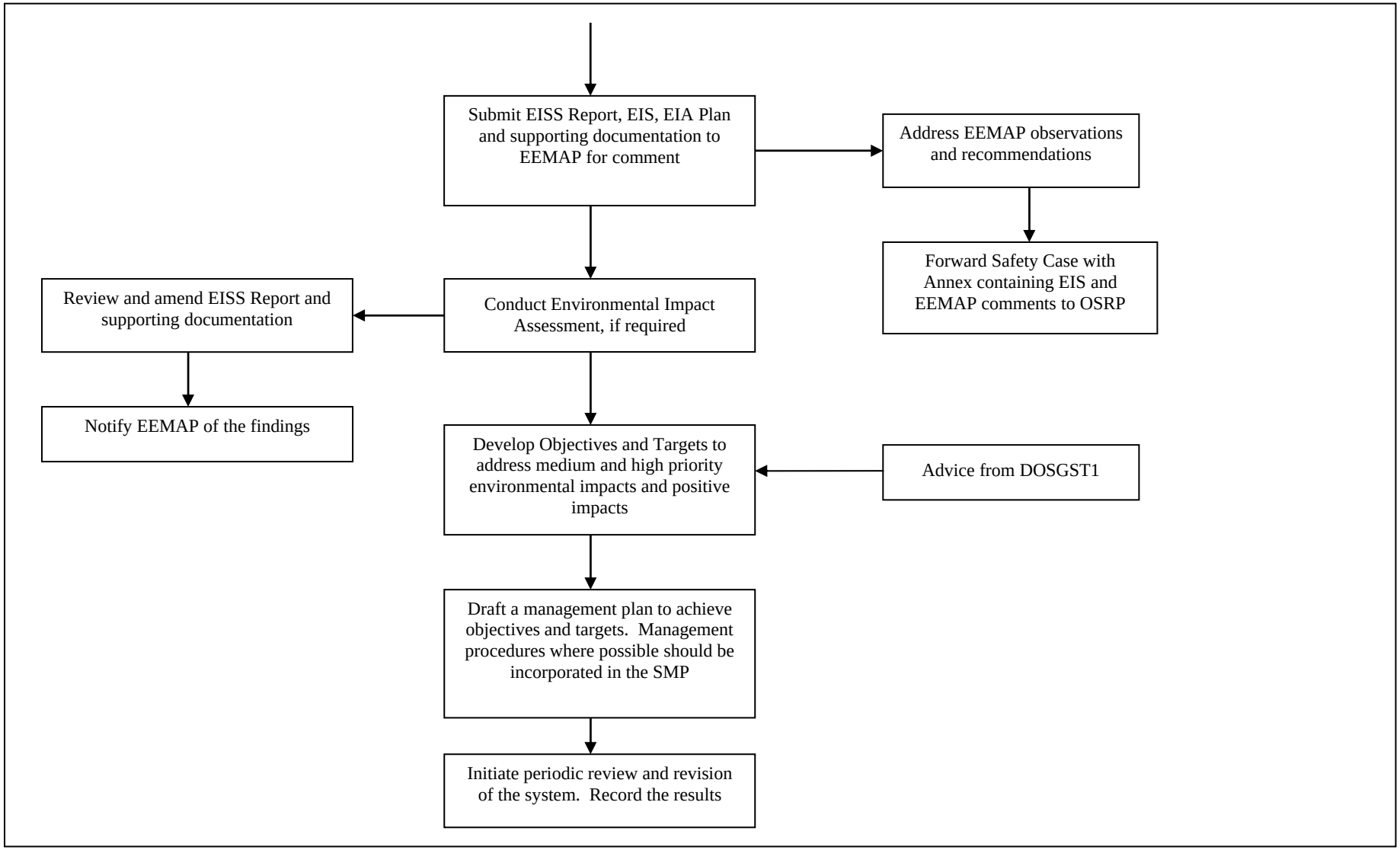


Figure 5. Flow Diagram – Environmental Management for OME projects

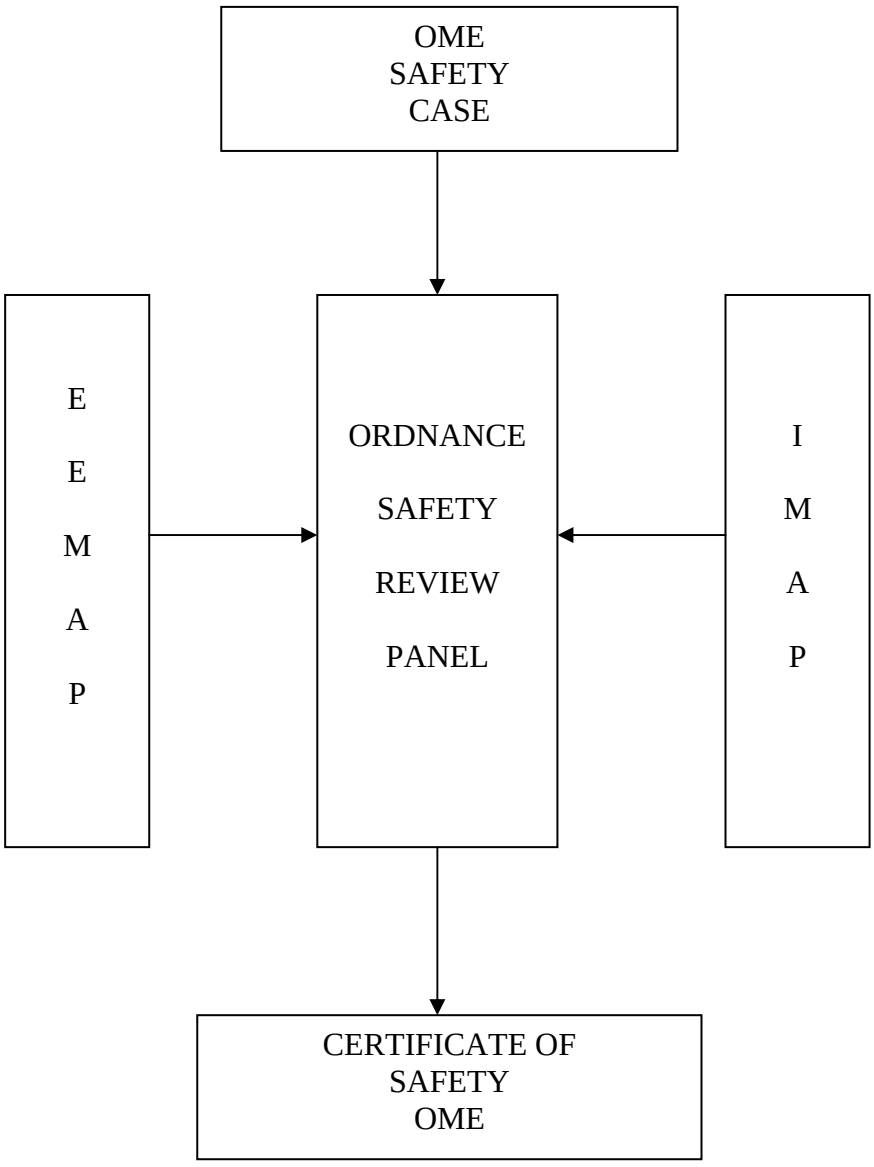


Figure 6. OSRP and Assessment Panel Relationship

RANGE ENVIRONMENTAL SUSTAINABILITY

The purpose behind environmental management is to ensure that damage to the natural environment is minimised to acceptable levels. Pollution can damage ecosystems, both in the short and long term and ultimately can have a significant negative effect on human health. History abounds with examples. Whilst many of the MoD ranges attract national and international levels of wildlife protection (e.g. Special Sites of Scientific Importance, (SSSI), Ramsar sites etc.) new European water regulations mean that even greater care must be taken to avoid diffuse sources of pollution entering ground water and aquifers, pollution which if it occurs can be extremely difficult and costly to remediate. As a major landowner in the UK Defence Estates and Range Management staff re therefore key stakeholders in environmental management.

For site assessment the use of a CSM has advantages and disadvantages. To attempt to develop a conceptual site, though initially attractive, does not offer a sound method of managing individual sites. MoD ranges extend throughout the United Kingdom and as such reflect a wide range of meteorological, geological and hydrological conditions. Ranges may be found on a number of geological formations (e.g. limestones, chalk, sandstones,) differing soil types with different soil chemistries and different climatic conditions with potentially significant variations in rainfall pH. Aquifers exist under many ranges and the potential for damage to the aquifer will be dependent on many factors including whether the aquifer is capped or uncapped by what is, essentially, a potentially protective surface stratum.

The EHA therefore has to provide sufficient information for site environmental managers to assess the effects of, not just single munitions, but multiple use of many different types of weapon. The accumulative effects of emissions must be taken into account and data in the EHA must allow for this to be done. The use of appropriate air dispersion models coupled with details of the range topography and meteorology allows airborne emissions to be mapped across the range and surrounding areas, permitting those areas at high risk of possible contamination to be identified and monitored.

At this juncture it is worth noting earlier comments about the scientific environmental status of many of the UK MOD sites. As SSSIs etc. many sites enjoy extensive monitoring of flora and fauna. This potentially offers a method of substantiating the justification of weapons use on many sites.

Once emissions are understood it then becomes possible to offer implement a range sustainability model by which the environmental footprint of the range and the activities undertaken can be described. As such this aspect fits very well with government policies directed to develop improvements in sustainability, through, for instance, reduced carbon emissions.

CONCLUSIONS

- Similarities between POEMS and POSMS have been highlighted
- The need to address all S^4 requirements together is considered the most effective way ahead
- The outputs from the recommended EHA can be used by key stakeholders:-IPTs, Defence Estates and Range Management staff
- Any key environmental concerns can only be efficiently identified, and mitigated against, at site specific (eg range) sites by taking account of all munition testing which has taken place over an extended period
- How the EHA fits into the overall OSRP process has been explained
- The need for a centrally developed knowledge base for OME environmental emissions data which is freely available to all stakeholders has been identified