CDOIF

Chemical and Downstream Oil Industries Forum

Guideline

Environmental Risk Tolerability for COMAH Establishments

Foreword

In promoting and leading on key sector process safety initiatives, CDOIF has developed through its members this guideline on environmental risk tolerability for COMAH establishments.

The intent of this document is to provide a reference for those organisations completing environmental risk assessments.

It is not the intention of this guidance to replace the existing DETR 1999 publication 'Guidance on the Interpretation of Major Accident to the Environment for the Purposes of the COMAH Regulations', but provide a framework and screening methodology by which regulators and duty holders can apply it.

There are no limitations on further distribution of this guideline to other organisations outside of CDOIF membership, provided that:

1. It is understood that this report represents CDOIF's view of common guidelines as applied to environmental risk assessment, and determining risk tolerability.
2. CDOIF accepts no responsibility in terms of the use or misuse of this document.
3. The report is distributed in a read only format, such that the name and content is not changed and that it is consistently referred to as "CDOIF Guideline – Environmental Risk Tolerability for COMAH sites".
4. It is understood that no warranty is given in relation to the accuracy or completeness of information contained in the report except that it is believed to be substantially correct at the time of publication.

This guidance is not intended to be an authoritative interpretation of the law; however Competent Authority (CA) inspectors may refer to it in making judgements about a duty holder's compliance with the law. This will be done in accordance with the CA's published enforcement policies (refer to www.hse.gov.uk/pubns/hse41.pdf) and it is anticipated that this document will facilitate a consistent national approach. Reference should also be made to the CA's 'All Measures Necessary Guidance' to local inspection teams

It should be understood however that this document does not explore all possible options for determining environmental risk tolerability or environmental risk assessment, nor does it consider individual site requirements – Following the guidance is not compulsory and duty holders are free to take other action.

Contents

1. Executive Summary

COMAH requires all Top Tier site operators to submit site safety reports to the Competent Authority (CA) that demonstrate that the environmental risk for the whole COMAH establishment has been reduced to a tolerable level. Lower Tier operators must prepare risk assessments making a demonstration proportionate and appropriate to the environmental risk, and whilst these are not required to be submitted to the CA these need to be available during CA inspection.

The purpose of this guidance is to provide a common methodology by which this risk assessment can be carried out. The methodology can be used by both duty holders and the Competent Authority when preparing or reviewing risk assessments.

The guidance will also help identify scenarios and areas of installations which are subject to COMAH vs. those that might be subject to other environmental legislation (e.g. EPR, PPC etc.). Where measures (physical or procedural) are necessary for prevention and mitigation of MATTE, then COMAH will be used to regulate those measures; conversely for potential environmental impacts below MATTE thresholds COMAH will not be used but other environmental legislation might apply (e.g. EPR, PPC etc.). If there is a potential for a Major Accident to people, but no MATTE potential then COMAH will apply to the measures, which might require measures related to environmental protection (e.g. those required by COMAH regarding emergency preparedness). In these circumstances HSE will carry out regulation of such activities under COMAH, whilst the Agencies will have limited involvement under COMAH (e.g. as their role as statutory consultees to emergency planning) and the Agencies will carry out regulation as required by other environmental legislation.

It is not the intention of this guidance to provide a detailed assessment process, but to provide a screening mechanism by which risks to environmental receptors can be reviewed. Depending on the result of this screening, further more detailed analysis may be required.

In summary, this publication provides:

- A clear definition of the types of harm that should be considered in an environmental risk assessment, and how the harm should be characterised for the assessment
- A definition of the risk criteria to be used in assessing the tolerability of the environmental risk from an establishment and, where appropriate, individual scenarios
- Guidance on how the risks may be evaluated
- Guidance on how to include the cost of environmental harm in a COMAH cost benefit analysis

2. Scope

This document provides a screening methodology to help Duty Holders and the Competent Authority in determining environmental risk tolerability from an establishment.

2.1 Competency requirements

When completing an environmental risk assessment there is a need to ensure that relevant competent resources are used throughout the process. In the context of this guidance, it is likely that environmental specialists will be involved with the identification of potential Major Accidents to the Environment (MATTE's), and in determining the thresholds that should apply to those receptors around the site. Similarly, it is likely that the skills of process safety specialists will be needed to evaluate the un-mitigated risk frequencies to these receptors, and to determine the mitigation and prevention measures already in place to reduce the risk.

In some circumstances it might be necessary to consult experts outside of the operator's organisation. For example, where a designated site could be impacted then discussions with the relevant conservation bodies might be required to ensure the assessment includes current information on the designated site status and vulnerability. Similarly, the Agencies (NRW, SEPA and EA) hold much information on water resources.

Caution should be taken when completing the screening process to ensure that over-simplification does not take place – there will often be a need for expert opinion and professional judgment.

2.2 Proportionality in Risk Assessment

For COMAH, environmental risk can be assessed within the established "As low as reasonably practicable" (ALARP) framework and evaluated to be either Intolerable, Tolerable if ALARP (TifALARP) or Broadly Acceptable. These terms have broadly the same meaning as used in relation to risks to people. Further guidance on their meaning and application can be found in the CA guidance on All Measures Necessary for environmental risk and other HSE ALARP guidance (see Appendix 1).

The level of environmental risk can be used to guide the type and depth of assessment that would be expected by the CA. For screening purposes, a qualitative or semi-quantitative approach (using this guidance), combined with conservative assumptions is appropriate.

There are no specific rules regarding the depth of further analysis, but generally, if risk is in the lower half of the TifALARP zone, then the semi-quantitative methods described in this document should be appropriate. , If risk falls in the upper half of the TifALARP or in the intolerable zone then Quantified Risk Assessment (QRA) may be appropriate. The level of risk assessment will also be influenced by data availability. If data is not available then a qualitative or semi-quantitative approach may need to be adopted, but as with screening this should be combined with conservative assumptions.

Further discussion of types and proportionality of assessment can be found in the references in Appendix 1, in particular paragraph 292 of HSG (190) and section 2.5 of Green Leaves III.

2.3 Using this guidance

As discussed above, this guideline provides a screening methodology for carrying out a COMAH environmental risk assessment (ERA). It does not provide detailed guidance on all aspects of ERA and for this reference should be made to Appendix 1, which signposts other available key guidance.

The process of ERA involves:

- Identification and evaluation of source – pathway – receptor linkages for different credible accident scenarios. This includes demonstrating an understanding of the hazards of the establishment, and the sensitivities of the environment.
- Identification of tolerability criteria for relevant receptors, dependent on the receptor type and potential level of consequence to the receptor.
- Evaluation of risks to the receptor, through examination of accident scenarios (their consequences and frequency) and comparing this to the tolerability criteria derived above.

Following completion of the ERA, determine what (if any) additional measures are required to demonstrate that the risk has been reduced to ALARP.

This guidance provides further information on specific elements of this process:

- Section 3 – How to quantify consequence to different receptor types, in terms of extent, severity and duration of harm. In particular to identify accident scenarios where the level of consequence exceeds thresholds for MATTE.
- Section 4 – Evaluating risk and making judgements against tolerability criteria. This process includes screening out of further assessment any scenarios where it can be demonstrated that the nature and quantity of material present do not have MATTE potential. Sub-sections include discussion of domino sites, failure rate data and the credit that can be claimed for mitigation.
- Section 5 – How environmental matters can be dealt with in CBA, if this is required
- Section 6 – An outline of the assessment process, by reference to the concepts introduced in previous sections, with examples.
- The appendixes provide links to a wealth of important information, much of which will be necessary to support an assessment of environmental risk. However, above all, Appendix 4 is most important since it provides the agreed tolerability thresholds for various differing consequence scales of MATTE.

Figure 1 below depicts how aspects of this approach are covered in the relevant sections within this guidance.

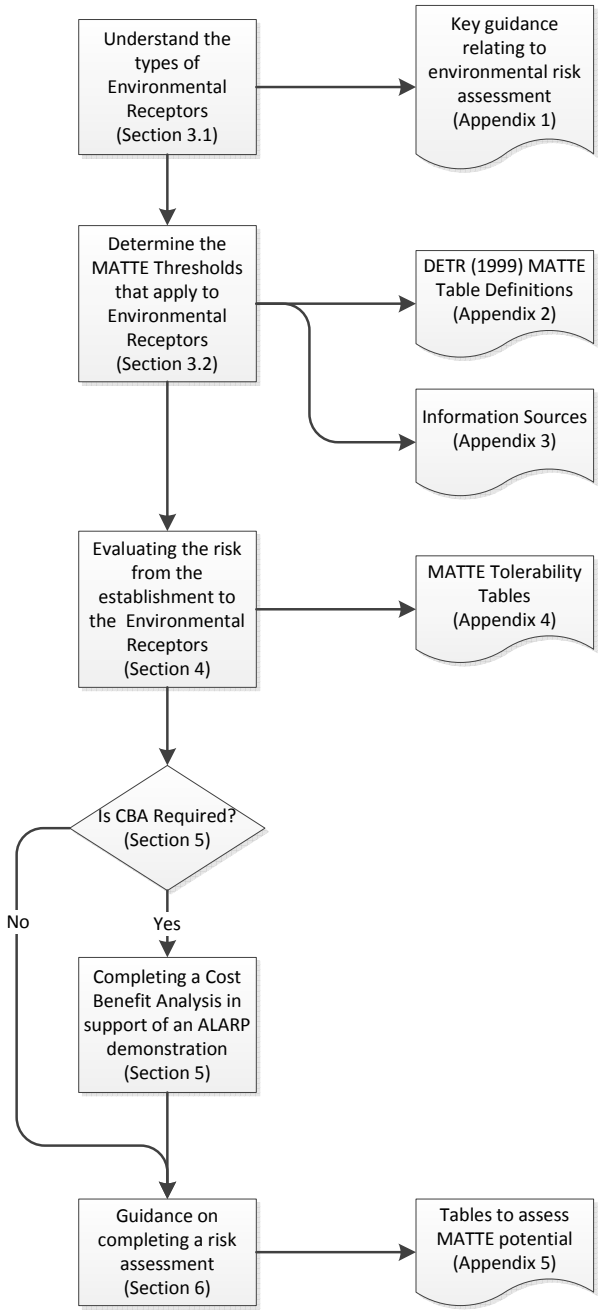


Figure 1 – Using this guidance

When preparing environmental risk assessments, operators of both Top and Lower Tier sites can usefully refer to Section 13 of the Safety Report Assessment Manual . This provides the structured approach the CA uses to assess and inspect environmental risk assessment for the purpose of demonstrating All Measures Necessary. It thus provides

a strong indication of CA expectations regarding risk based demonstrations and how they should be presented.

3. Definition of the types of environmental harm

The definition of major accident in the COMAH regulations requires serious danger (to people or the environment). Serious danger to the environment is considered to occur where there is potential for a Major Accident to the Environment (MATTE). A MATTE would be taken to require harm or damage to the environment above the described thresholds (refer to section 3.2 for extent, severity and duration thresholds).

In preparing this guidance, the following key technical documents have been referenced:

- DETR 1999, Guidance on the interpretation of Major Accident to the Environment for the purposes of COMAH regulations
- EA, 2004, Guidance identifying COMAH Major Accidents to the Environment (MATTEs)
- EA, 2010, Incidents and their classification: the Common Incident Classification Scheme (CICS)

Reference should also be made to Appendix 1, Key Guidance.

Appendix 2 provides a reference to the relevant tables from the DETR 1999 guidance on the interpretation of Major Accident to the Environment for the purposes of COMAH regulations.

3.1 Environmental Receptors

The types of environmental receptors that should be considered are as follows:

- Terrestrial habitats
- Freshwater habitats
- Marine habitats
- Groundwater bodies

When reviewing habitats the following points should be considered:

- Small areas within the larger overall area of a receptor may be significant, depending on the flora / fauna that inhabits them, reference should be made to the DETR 1999 guidance table 10 and Appendix 4 for further details.
- Any review of receptors should include migratory species which could be transient in the habitat
- Individual species (where appropriate) should be considered in the assessment, regardless of the pathway to the receptor.

Links to sources of information on environmental receptors are provided for each receptor in Appendix 3

3.2 MATTE Thresholds

The following thresholds should be used when determining the potential for a MATTE to each of the receptors described in section 3.1.

These thresholds have been developed with regard to the Major Accident EC reporting thresholds in the Seveso Directive (Sch. 7 of the COMAH regulations) and the DETR 1999 Guidance on MATTE.

Thresholds are presented in two dimensions

(i) Extent and Severity; and

(ii) Duration of harm

The minimum thresholds for both dimensions must be exceeded for the scenario to be considered to be a potential MATTE.

The thresholds referring to extent and severity are presented below and should be read in conjunction with Table 1 of Appendix 4. To avoid disproportionate application of percentage criteria in the MATTE thresholds on small receptors, for small sites, the percentage criteria will not reduce the threshold to lower than **half the absolute criteria**.

With respect to Duration of Harm, impacts with short term natural recovery (other than those to people) would not be considered MATTE – Appendix 4 table 2 provides natural recovery times for differing receptors that would or would not be considered MATTE.

3.2.1 Designated area

NOTE: The DETR 1999 guidance refers to 'Designated Land'. The CDOIF working group have agreed to refer to 'designated Area' as this also encompasses water.

Nationally important: SSSI and National Nature Reserves (NNR) [Refer to DETR 1999 table 1]:

The level of harm that would constitute a MATTE is defined as follows:

a) Greater than 0.5 ha or 10% of the area of the site adversely affected (whichever is the lesser); or,

b) Greater than 10% of a designated linear feature of the site adversely affected; or,

c) Greater than 10% of a particular habitat or population of individual species adversely affected (Population refers to the known or estimated population at the site, and individual species named in the designation, not the national population. For other species refer to table 10 of the DETR guidance)

Internationally important: SACs, SPAs & Ramsar sites [Refer to DETR 1999 table 2]

The level of harm that would constitute a MATTE is defined as follows:

a) Greater than 0.5 ha or 5% of the area of the site adversely affected (whichever is the lesser); or,

b) Greater than 5% of a designated linear feature of the site adversely affected; or,

c) Greater than 5% of a particular habitat or population of individual species adversely affected (Population refers to the known or estimated population at the site not the national population and individual species named in the designation, for other species refer to table 10 of the DETR guidance)

Other designated land (ESA's, AONB's LNRs, NSA's etc [Refer to DETR 1999 table 3])

The level of harm that would constitute a MATTE is defined as follows:

a) Greater than 10% or 10 ha seriously damaged, whichever is the lesser (seriously damaged is defined in 'EA, 2004, Guidance identifying COMAH Major Accidents to the Environment (MATTEs)', table 3

Scarce habitat [Refer to DETR 1999 table 4]

The level of harm that would constitute a MATTE is defined as follows:

a) Damage to 10% of the area of the habitat or 2 ha, whichever is the lesser. Refer to DETR 1999, table 4 for a definition of 'scarce habitats'. Note that 10% refers to the site area.

NOTE: Definition of 'Adversely Affected'

Means that the part of the site affected loses at least one of its reasons for designation, or favourable conservation status, and would not naturally recover (i.e. regain its designated status) within 3 years for terrestrial habitats and a single season for marine/freshwater.

Marine implies everything below the high water mark, for example mud flats, estuary.

Due consideration should be given to features such as estuaries and sea lochs. Further information on the definition of 'Adversely affected' can be found in the DETR 1999 guidance, tables 1 – 4.

3.2.2 Widespread habitat (land/Water)

Non-designated land [Refer to DETR 1999 table 5]

The level of harm that would constitute a MATTE is defined as follows:

a) Contamination of 10 ha or more of land which, for two growing seasons or more, prevents growing of crops or the grazing of domestic animals or renders the area inaccessible to the public because of possible skin contact with dangerous substances;

NB. The health effect above covers the impact on amenity

or,

b) Contamination of 10 ha or more of vacant land for three years or more. (Refer to Appendix 3, Table 1)

NOTE: Definition of 'Non-Designated Land'

Land means all non-designated land, not just agricultural land.

Non-designated water [Refer to DETR 1999 Table 5]

The level of harm that would constitute a MATTE is defined as follows:

a) Contamination of aquatic habitat (freshwater or marine) which prevents fishing or aquaculture or renders it inaccessible to the public

Where there is no potential to contaminate an aquatic habitat, the non-designated water will not have MATTE potential, and should therefore not be considered as part of the screening process.

3.2.3 Groundwater

[Refer to DETR 1999 table 6]

Because of the diverse nature of groundwater, it is not possible to attribute a single threshold to determine whether a MATTE has occurred. The following definition provides the basis against which a MATTE to groundwater can be determined:

1. Pollution could happen to any groundwater (as defined by the Water Framework Directive); however, any pollution to groundwater is not necessarily a MATTE. It is necessary to determine whether the groundwater is acting as a pathway, or is itself a receptor.

2. The EC reporting criteria for groundwater is 1ha or more of significant damage to an aquifer or underground water. CDOIF proposes that damage is only considered to be significant if the groundwater in the aquifer meets the definition of a groundwater body (Water Framework Directive). Groundwater bodies are therefore environmental receptors. Pollution of other groundwater (falling outside of the groundwater body definition) would not be considered a MATTE (unless the groundwater acted as a pollutant pathway to a separate receptor).

3. Groundwater bodies, in accordance with the Water Framework Directive and associated guidance, are those productive ground-waters which are used (or could be used in the future) as sources of public or private drinking water (minimum production of $10m^3$ per day), or which support ecosystems or recharge surface waters. Moreover, the EA Groundwater protection: Principles and practice (GP3) (2012) states that: "All groundwater bodies in England and Wales have been designated Drinking Water Protection Areas." Further detail on assessing groundwater is available on the Agencies' websites (for England, GP3 in particular).

4. For different functions of groundwater, different values can be attributed. For example, groundwater used for human consumption has a higher value. On this basis proportionality should be applied dependent on the value of the groundwater and the risk to it.

5. For screening purposes, Groundwater bodies can be identified by reference to aquifer maps (see Appendix 3). In accordance with Seveso reporting thresholds, the area threshold strictly relates to the aquifer (rock type) and not the area of groundwater within it. In England and Wales, all Principle and Secondary aquifers (coloured areas on mapping) are groundwater bodies, whilst unproductive strata (un-coloured areas) are not groundwater bodies. Scotland also has an equivalent aquifer map.

6. The resolution of mapping is such that at specific locations, the groundwater in an aquifer that is depicted on the map at that location might not actually meet the formal definitions for groundwater body, i.e. detailed assessment of local groundwater might show the groundwater is not a groundwater body and thus not a receptor for the purposes of MATTEs. This circumstance is expected to be exceptional and the level of demonstration would be resource intensive and beyond the level of work envisaged for screening.

This guidance sets out a MATTE definition, based on different areas/values dependent on the type of groundwater.

Groundwater body – Source of Public or Private Drinking Water

The level of harm that would constitute a MATTE is defined as follows:

a) For England and Wales only, 1 ha or more of an SPZ where public drinking water standards are breached; or,

b) Interruption of public or private drinking water supplied from a ground or surface water source, where: (persons affected x duration in hours {at least two hours}) > 1,000

Groundwater body – non Drinking Water Source

The level of harm that would constitute a MATTE is defined as follows:

a) 1 ha or more of a groundwater body where the Water Framework Directive (WFD) status has been lowered

Other Groundwater (outside of groundwater bodies)

Not applicable. Where the groundwater does not meet the definition of a groundwater body it is considered as a *pathway* to another receptor, and assessment should be against the criteria defined for that receptor (for example marine, fresh or estuarine water habitats)

3.2.4 Soil or Sediment (Land/Water)

[Refer to DETR 1999 Table 7]

For sediment, the DETR guidance refers to a change in overlying water quality - thus sediment should be considered a pathway and the MATTE threshold to consider is the one for the relevant overlying water or particular species.

For Soil, the level of harm that would constitute a MATTE is defined as follows:

a) Contamination of 10 ha or more of land which, for two growing seasons or more, prevents growing of crops or the grazing of domestic animals or renders the area inaccessible to the public because of possible skin contact with dangerous substances;

Note The health effect above covers the impact on amenity

or,

b) Contamination of 10 ha or more of land by substances, preparations, organisms or micro-organisms that results in a significant risk of adverse effects on human health.

Note This definition is taken from DEFRA publication "The Environmental Damage (Prevention and Remediation) Regulations 2009 Guidance for England and Wales"and this also covers the impact on amenity

NOTE: Land that is already contaminated

Refer to figure 2 below.

Where soil is already contaminated, a site-specific analysis of the potential impact of a MATTE scenario may be required as this could have the potential to cause additional contamination or suspend or reverse any existing recovery.

When completing this analysis, the following factors should be considered;

- The pollutant from the MATTE scenario may not have the same chemical nature/characteristics as any pre-existing pollutants, which may aggravate the current contamination effects (e.g. solubilisation).
- The pollutant from the MATTE scenario may suspend or reverse any existing recovery (Reference: Environmental Damage Regulations).

In concluding the analysis;

- If the potential MATTE scenario could exceed the MATTE thresholds in the absence of any existing contamination, the receptor would be deemed as having MATTE potential.
- If the potential MATTE scenario does not alter the existing contamination management (i.e. the existing pollution management system would not need to be updated following further pollution of the soil or sediment), then credit can be claimed in the risk assessment that the current remedial approach reduces the risk to ALARP.

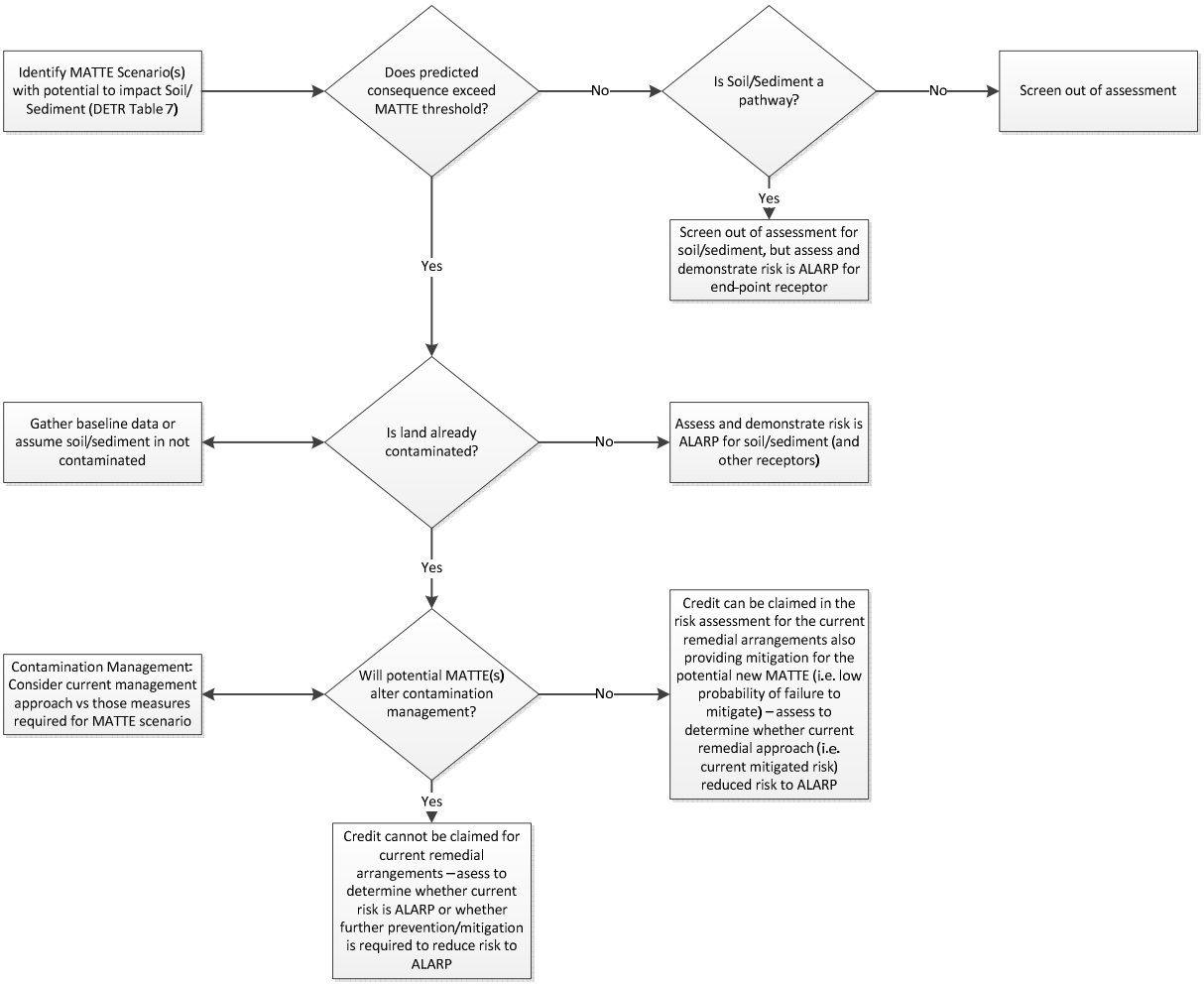


Figure 2 – Assessing contaminated land

3.2.5 Built environment (Land, man-made)

[Refer to DETR 1999 Table 8]

The level of harm that would constitute a MATTE is defined as follows:

a) Damage to the built environment (e.g. Grade 1/Category A listed buildings, scheduled ancient monuments, conservation areas) such that its designation of importance is withdrawn.

For other built heritage types (e.g. Grade 2 listed buildings), the MATTE definitions for widespread habitats (land, water) apply, refer to section 3.2.2.

3.2.6 Various receptors, as defined (Water)

[Refer to DETR 1999 Table 9]

Not applicable, the definition (based on standards applicable to continuous emissions which fall under other EU legislation) is not used to identify and assess a MATTE.

3.2.7 Particular species (Land, Water, Air)

[Refer to DETR 1999 Table 10]

The level of harm that would constitute a MATTE is defined as follows:

a) 1% or more of the population; or,

b) 5% or more of the plant ground cover

Note: the 1% and 5% above refer to national populations of England, Wales or Scotland. Note that for particular high value or special protection species, consult the relevant conservation organisation to determine the appropriate threshold.

3.2.8 Marine (Water)

[Refer to DETR 1999 Table 11]

The level of harm that would constitute a MATTE is defined as follows:

a) 2 ha or more of contamination to the littoral or sub-littoral zone; or,

b) 100 ha or more of open sea benthic community; or,

c) 100 or more dead sea birds (500 or more gulls); or,

d) 5 or more dead/significantly impaired sea mammals

Note: Further definition of these areas is defined below and in Figure 3.

- Supralittoral: area just above high water mark, only submerged during storms; otherwise ocean spray
- Benthic: benthic zone is the ecological region at the lowest level of a body of water such as an ocean or a lake, including the sediment surface and some sub-surface layers
- Littoral: intertidal zone between low and high water marks (e.g. from the Mean High Water Springs to the Mean Low Water Springs on the OS map)
- Sublittoral: subtidal zone below low water mark (e.g. from the Mean Low Water Springs on the OS map), permanently submerged; extends down to the continental shelf break (~200 m)

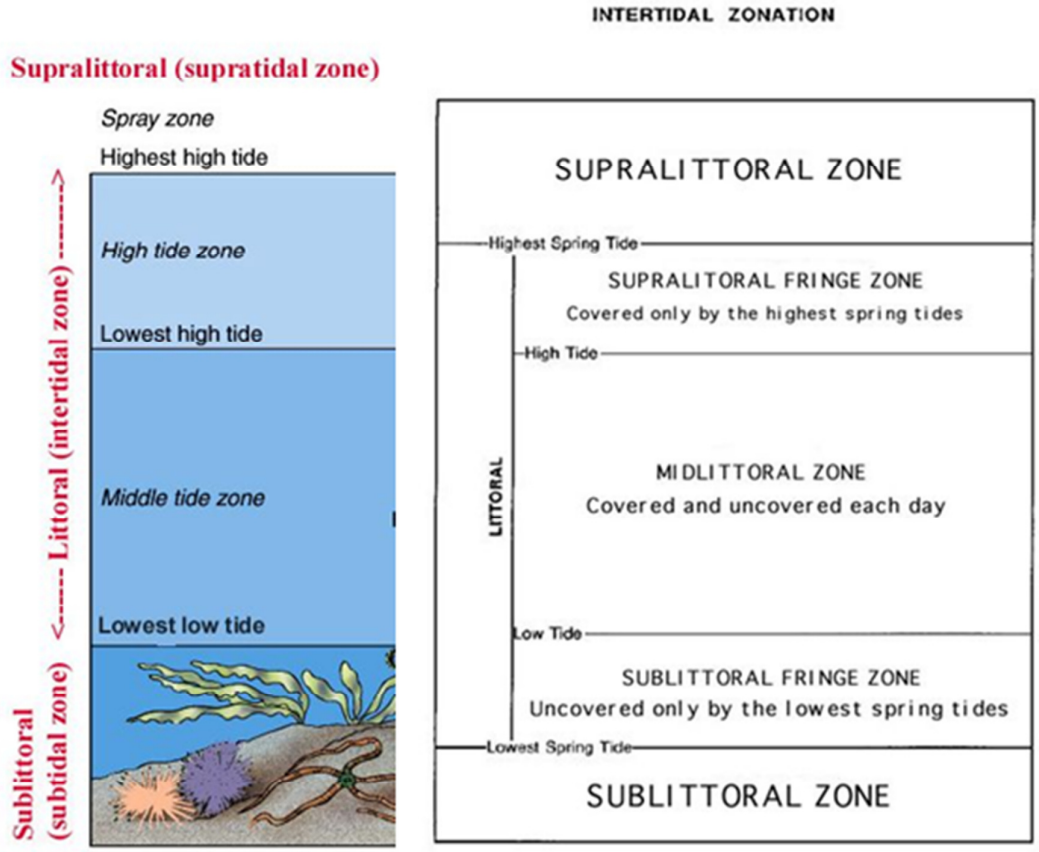


Figure 3 – Marine (Water) zones

3.2.9 Freshwater and estuarine habitats (Water)

[Refer to DETR 1999 Table 12]

The level of harm that would constitute a MATTE is defined as follows:

a) The chemical or ecological status given by the Water Framework Directive (WFD) has been lowered by one class for more than 2 km of a watercourse; or,

b) 10% or greater of the area (for estuaries and ponds, reservoirs and lakes); or,

c) 2 ha or more of the area for estuaries or ponds, reservoirs and lakes, or

d) Interruption of public or private drinking water supply, where: (persons affected x duration in hours {at least two hours}) > 1,000

Note (criteria a): In DETR guidance, the minimum length of watercourse for MATTE is stated as 10km or 10% of the length (whichever is lesser). In practice, for a large number of watercourses the 10% threshold will dominate, and for many a very short

distance would be derived. To avoid very short distances (<2 km, where a watercourse is <20km), CDOIF have agreed the minimum length of watercourse where serious harm could occur is taken here as a fixed value of 2km. This aligns to the EA Common Incident Classification System (CICS) category 1.

Note (criteria d): interruption of public or private drinking supplies is included here to take account of where abstraction points exist in rivers, reservoirs and lakes. Risk thresholds based on potential severity and duration are the same as for interruption of groundwater drinking water supplies (Refer to Appendix 4, MATTE Tolerability Tables, Table 1 row 7).

4. Risk criteria and Evaluating Risks

4.1 Assessing the risk of potential harm

Following the identification of possible environmental receptors around a site, it is necessary to evaluate whether the substance stored on site (or other substance which could be present, such as firewater or reaction by-products) has the potential to cause a MATTE to those receptors. Where this potential could be realised, a risk assessment is necessary to determine if any further prevention or mitigation (or both) techniques are required to reduce the risk to Broadly Acceptable or As Low as Reasonably Practicable (ALARP). The depth of assessment required is discussed in section 2.2.

To complete this assessment, it is necessary to understand the following:

- For each receptor
    - Is there a potential for a MATTE based on the quantities and types of substance stored on site? (Note: include substances that might credibly be produced/introduced in an emergency, such as firewater). This screening step can also be used to rule out from further assessment areas of larger sites where there is no MATTE potential if they will have no involvement in other areas that do have MATTE potential. A site plan may be a useful tool to highlight those areas which have or do not have MATTE potential.
- If there is potential
    - Determine unmitigated consequences from credible accident scenarios and use this to establish the tolerability thresholds per receptor per establishment per year (this is from the Appendix 4 risk matrix)
    - Determine the unmitigated aggregated risk to the receptor from all credible scenarios (i.e. risk with no mitigation measures in place)
    - Determine the mitigated risk (with existing measures in place) from all credible scenarios
    - Determine if further measures are required to reduce the risk to Broadly Acceptable or TifALARP (If mitigated risk remains in TifALARP then the CA will require an ALARP justification to demonstrate why further risk reduction is not reasonably practicable).

The methodology for assessing risk within this guidance begins with determining the *unmitigated* consequence (see definitions below figure 4). The unmitigated consequence could be sub-MATTE (enabling screening out from further assessment) or MATTE level A-D. Each MATTE level A-D has associated tolerability thresholds - the greater the consequence the lower the tolerable frequencies for a MATTE (Appendix 4).

The tolerability thresholds are then compared to the unmitigated risk to the receptor from the establishment. This approach may well indicate an intolerable risk from the outset. However once the total unmitigated risk has been calculated, the process then requires the analysis of mitigated risk by inclusion of all existing mitigation layers – this includes such elements as good design practices, inspection and maintenance, secondary and tertiary containment and emergency response procedures. It is important to recognise

the risk gap between unmitigated and mitigated risk since this is an evaluation of the amount of risk reduction provided by existing mitigatory measures and will illustrate the importance of maintaining these safety critical measures.

An overview of the process is given in Figure 4.

Note that the risk assessment process should consider only credible scenarios.

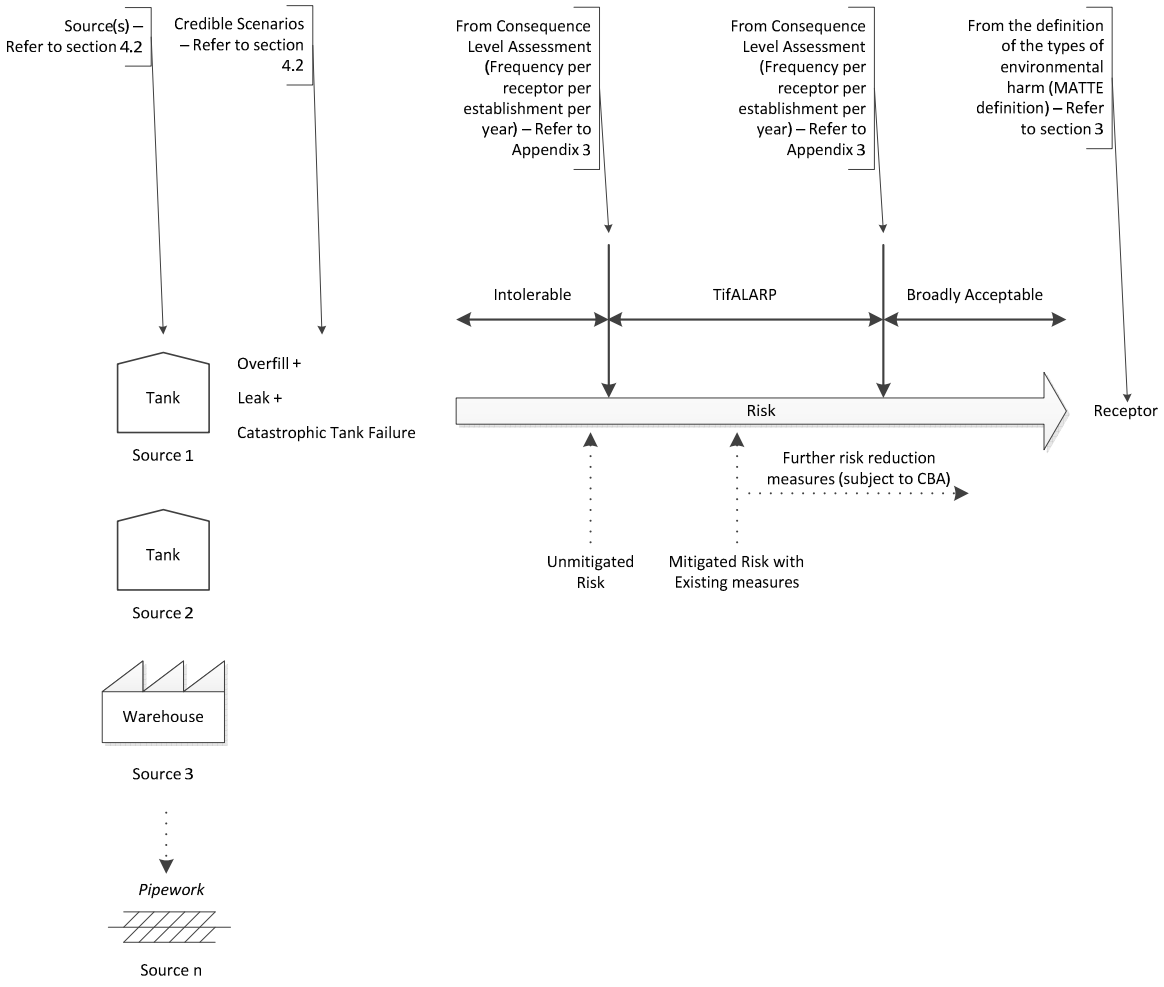


Figure 4 – Overview of the risk assessment process

4.1.1 Terms used in risk assessment

Sources

The sources of pollution which could give rise to a MATTE, (for example tanks, pipework, warehousing, process units, reactors, etc.) refer to section 4.2 'MATTE potential matrix'. Note that pipelines outside of the site boundary are not covered by COMAH when covered by the Pipeline Safety Regulations, and should therefore be excluded from this analysis.

Credible scenarios

The scenarios under which a source could credibly pollute a receptor (for example spills, fire, explosion), refer to section 4.2 'MATTE potential matrix'

Consequence

A combination of the following:

- the extent, severity and duration of harm to the receptor.

Refer to section 3 'Definition of the types of Environmental Harm'

Risk

A combination of

- consequence and
- frequency of occurrence (per receptor per establishment per year)

Receptor

The receptor that could be polluted by the source, refer to section 3 'Definition of the types of Environmental Harm'

Protection Layers

Risk reduction measures - either preventive layers (i.e. reduce the frequency of a hazardous event from occurring) or mitigatory layers (i.e. reduce the consequences of a hazardous event after it has occurred). Preventive layers typically include the primary containment (pipes, vessels and control systems) whilst mitigatory layers include secondary and tertiary containment or fire suppression systems.

Unmitigated consequence

The potential consequence from credible scenarios before any mitigation measures are employed, refer to section 4.3 'Aggregating Risk and Risk Frequencies'. This is essentially the worst credible consequence associated with the credible scenario, (with no protection layers in place) and is used to establish tolerability thresholds.

Unmitigated risk

The aggregated risk from credible scenarios, before any mitigation measures are employed, refer to section 4.3 'Aggregating Risk and Risk Frequencies'. This is the risk (consequence and frequency) associated with all credible scenarios given failure of prevention layers, escalation and no mitigation.

Mitigated risk

The level of risk that remains from all credible scenarios once existing protection layers (mitigation and/or prevention measures) are employed, refer to section 4.3 'Aggregating Risk and Risk Frequencies'.

Further risk reduction measures

Further risk reduction measures which could be employed to reduce the risk further to TifALARP or Broadly Acceptable. An ALARP demonstration, which might include Cost Benefit Analysis, may be required to further justify a claim of TifALARP.

4.2 MATTE potential matrix

The sources, or more importantly the substances which could give rise to a MATTE should be screened for each relevant receptor to determine their potential.

In order to screen for potential credible MATTE scenarios, it is important to understand the following:

- The types or groups of substances present on the site which could cause a MATTE
- The receptor itself, and how it could be polluted (or otherwise harmed) to the extent of causing a MATTE
- The site specific scenarios that could cause the receptor to be polluted (or otherwise harmed) to the extent of causing a MATTE

4.2.1 Grouping and compartmentalisation

To simplify the process of risk assessment, duty holders may consider grouping different product categories (or substances with similar risk phrases) which have a similar nature, and can damage the receptor in a similar way, for example:

- Petroleum products
- Dense non-aqueous phase liquid

Grouping of similar products can also be considered based on geographical location, for example, all products stored in a tank farm(s) have similar properties and all have the potential to pollute a nearby receptor(s).

On this basis it may not be necessary for sites to complete risk assessments for individual tanks and individual products but instead to group similar substances and 'compartments' of tanks within the site boundary.

4.2.2 Tables to assess MATTE potential

The tables defined in Appendix 5 provide a methodology for how to begin to assess the potential for substances (and cocktails of substances) to cause a MATTE if released to the receptor unmitigated. The tables are provided as guidance on the information that needs to be presented and provide a suggested format; however the information may be presented in another format.

Table 1 – MATTE Potential Summary Matrix

Table 1 can be used to summarise which substances or groups of substances could give rise to a MATTE if unmitigated (i.e. no prevention or mitigation measures are in place). The table should be completed for each receptor that is relevant to the site.

A tick (√) can be used in each box to indicate that a MATTE could occur if the credible scenario (as defined in table 3) occurred.

A cross (x) can be used in each box to indicate that a MATTE could not be caused by the substance.

Further footnotes could be referenced with each tick or cross to justify the prediction.

Note that it is important that this summary table is used to cover the potential consequence of all dangerous substances, both single releases and multi-release (for example from a tank farm or warehouse) and firewater – the substance groupings defined can be used to achieve this.

Table 2 – Receptor Detail

Table 2 can be used to provide further definition of each relevant receptor and the environmental vulnerabilities which they present. Reference should be made to section 3 of this guidance document for further definition of the receptor type, and to Appendix 2 for the original DETR 1999 tables.

Please note, for designated sites it is expected that information will be sought from the conservation bodies.

Table 3 – MATTE Scenarios

Table 3 can be used to provide a description of the consequences to the receptor from the credible scenarios under which a MATTE may occur to each of the receptors. Typical scenarios may be:

- Tank Overfill
- Catastrophic Tank Failure
- Leak from tank base
- Pipework failure
- Warehouse / Chemical plant fire.
- Escalation of the above or any other incidents.

The majority of MATTEs seen across Europe have been harm to surface waters from direct releases or runoff from fires, but toxic gas and aerial deposition impacts (e.g. Seveso) should not be discounted.

Further guidance on typical Major Accident scenarios can be found in the Safety Report Assessment Guides (see http://www.hse.gov.uk/comah/srag.htm), and in H1 Environmental Risk Assessment, Annex A, (see http://www.environment-agency.gov.uk/business/topics/permitting/36414.aspx)

Table 4 – Dangerous Substances with Environmental Risk

Table 4 can be used to provide further definition of the substances or groups of substances which have the potential to cause environmental damage. The final column can be used to include a reference to link to a fuller description (e.g. a section of the Safety Report or MSDS reference).

Where substances share similar properties, grouping can be performed on the basis of risk phrases.

N.B. a group of chemicals could be “contents of warehouse A, loss of containment during fire” or “chemicals in bund B (tanks 1-5) and firewater”

4.3 Aggregating risk and risk frequencies

When analysing the MATTE potential for each receptor from the establishment, several potential credible scenarios may be identified which could cause harm to that receptor. Moreover, if there are several tanks, warehouses, process units, etc., the frequency of a MATTE occurring from the credible scenarios associated with each of these, above the specified consequence level, needs to be summed (independent events only) since the establishment risk to a receptor is from all credible MATTE scenarios from all sources (multiple sources will increase the risk). In practice, assurance that the total risk is reduced below a specified target can be done in a number of ways.

4.3.1 Aggregating risk option 1 - Summation of risks

Add all independent risks from all sources affecting a single receptor and compare these (both unmitigated and mitigated risk) to the receptor’s establishment risk targets (e.g. Appendix 4 tolerability criteria) – this approach may suit small sites with a smaller number of Major Accident Scenarios.

4.3.2 Aggregating risk option 2 – Developing scenario based risk criteria

Once the consequence and frequency of an identified major accident scenario have been evaluated it is necessary to consider whether the risk from this scenario is 'Intolerable', 'TifALARP' or 'Broadly Acceptable'.

However the tolerability criteria are established for the frequency of ALL major accident scenarios from the establishment impacting on an environmental receptor. For larger sites this requires the summation of frequencies from a number of scenarios - which may be followed by identification of which scenario results in the 'Intolerable' or 'TifALARP' conclusion, and consequently requires risk reduction and/or ALARP assessment.

This approach can make it difficult for individual plant management teams to judge the tolerability of their own area scenarios and drive risk management processes. It is often more convenient, simpler and more empowering for plant management teams to 'allocate' a proportion of the 'Intolerable' risk criteria to each scenario, or each part of the site, against which the risks can be assessed.

The simplest way to achieve this is to estimate the total number of scenarios on the establishment which could result in specific MATTE severity level consequence to a receptor and divide the 'Intolerable' risk frequency criteria for this severity level by that

number to define a scenario based risk criteria. If the receptor chosen for this calculation is the one most at risk from the site, the resultant criteria will be conservatively low for all other receptors. Therefore a 'scenario based' tolerability of risk matrix can be defined for use in scenario based risk assessments.

At the conclusion of the establishment risk assessment, it is clearly necessary to check the validity of the 'number of scenarios' assumption. If a specific scenario risk is found to be 'Intolerable' against the scenario specific criteria, further consideration of the total establishment risk to the scenario will be required - it may be that other risks to the receptor are sufficiently low that a greater proportion of the establishment criteria can be allocated to that scenario and that the overall risk remains 'TifALARP' i.e. the site may allocate different risk criteria to different scenarios within the overall establishment risk.

4.3.3 Impacts from adjacent sites

If the site is not currently designated as a domino site, then the site should consider only its own source/pathway/receptor analysis, and not that of other neighbours – the risk analysis will apply only to the one establishment.

For Domino sites:

- If the site is designated as a domino site, then the site operator is legally required to consult with their neighbours (who will also be designated as an upstream or downstream domino site). In these circumstances the increased risk of a neighbouring domino site creating an increased risk of a MATTE from your site needs to be included in the establishment risk aggregation and may increase the whole establishment risk to environmental receptors.

- For domino events risk can be increased in two ways. 1) The neighbouring domino site could increase the frequency at which a Major Accident could occur on your site – i.e. be an additional off-site initiator. 2) The consequences of the domino event could increase as the scale of a domino-type incident from both sites could be greater. Both possibilities need to be reflected in assessment.

- Scenarios from a domino site that do not increase risk of a MATTE (scale of consequence or frequency) at your site should not be included in the aggregation of risk to a receptor for your site. i.e. even though events at a neighbouring domino site might be MATTEs in their own right, if they do not affect your site these do not need to be included in your aggregation.

Domino example

Two COMAH domino sites, fuel terminal A and chemical warehouse B.

- Fuel terminal A – MATTE scenarios: Leaks, Fires (including running pool fires) and Explosion.

- Warehouse B – MATTE scenario: Fire.

The domino scenarios are Fuel Terminal explosion or running pool fires, which could initiate a warehouse fire causing a combined consequence greater than any other scenarios. No other scenarios at site A or B would impact on each other.

The MATTE risk at fuel terminal A is the aggregate of all the scenarios at site A, and it must be considered that because of the COMAH warehouse B the potential consequences might be greater. The risk would not include the scenario of warehouse fire which cannot impact site A. Thus the implication for site A being domino (as opposed to not domino) is a potential increase in consequences, but not an increase in frequency.

The MATTE risk at warehouse B is the risk of fire, and this risk would be increased by the domino scenarios. The risk would not include the scenarios of leaks at the fuel terminal which cannot impact site B. Thus the implication for site B being domino (as opposed to not domino) is a potential increase in consequence and frequency of MATTE.

Note that the Habitats Directive does require the assessment to consider a combination of risks from multiple sites. The view of the CA is that so long as individual sites routinely review the condition of Habitat sites which they can potentially impact upon and can demonstrate use of all measures necessary (i.e.ALARP) for their own risks, this would be seen as being sufficient, and would not require consideration of risk of simultaneous Major Accidents from other neighbouring COMAH sites (except for those domino sites noted above). If a Major Accident to a Habitats Directive site does occur, then other operators will be expected to review the implications of that accident for their own sites after the event has occurred.

4.3.4 Determining risk frequencies

Company specific failure rate data (for the identified credible scenarios) could be used when completing environmental risk assessments. However the CA would require justification (for example hours of operation, circumstance of failures etc.) as to the figures used where they were significantly different to published industry figures. In the majority of cases it is anticipated that failure rate data will be the same for safety and the environment (i.e. the initiating event frequency should be the same).

Where company specific failure rate data is not available, duty holders can make reference to the table of typical failure rates and the Environmental QRA data and MATTE case studies available in the CA's 'All Measures Necessary Guidance'.

Note that when completing environmental risk assessments, consideration should be given to escalation of a scenario, which could give rise to a greater consequence.

4.3.5 Determining risk reduction of prevention and mitigation layers

Reference should be made to the CA's 'All Measures Necessary Guidance' for information relating to the risk reduction provided by different prevention and mitigation layers. Other sources may also be of use, for example insurance company databases may provide failure rate data for fire prevention systems.

5. Cost Benefit Analysis

This section provides advice on how to include the cost of environmental harm in COMAH Cost Benefit Analysis (CBA). Existing guidance on CBA within an ALARP demonstration is relevant to environmental CBAs and the general framework for carrying out the CBA is the same for risks to persons and risks to the environment. Relevant guidance includes application of CBA for decisions within the TifALARP zone, as outlined by HSE guidance on ALARP (including SPC/perm/37 & 39) and general principles associated with CBA, as outlined in the wider HSE CBA principles and CBA checklist.

5.1 Disproportion Factor (DF)

Disproportion Factors should be used in environmental CBAs in the same way as for Health and Safety CBAs, within the range 1 to 10, (10 at the intolerable border, and 1 at the broadly acceptable border). The operator needs to justify why a specific DF has been applied. . A Major Accident Hazard (MAH) could possibly result in several consequences to both persons and the environment and that each consequence could have a different DF. The CBA summation would be the last task following the application of each DF.

5.2 Benefits

Health, safety and environmental benefits should be included in the CBA where these relate directly to a MAH. Business related benefits such as avoided loss of production, higher insurance premiums, damage to an operators own assets, insurance costs etc. should not be included as a benefit. These business related benefits may be considered by the operator when considering investment, but this is not required to be included as part of a CBA supporting an ALARP demonstration to the CA.

5.3 Costs

Only those costs incurred solely from the implementation of the measure should be included.

5.4 Discounting Rates

It is recommended that the same discounting rate is used for costs and benefits for health, safety and the environment. Refer to http://www.hse.gov.uk/risk/theory/alarpcba.htm for further information.

5.5 Evaluation of Environmental Remediation

Where available, company specific costs should be used as this will often provide the most accurate information as it is based on the company's own experience of dealing with environmental incidents. If no company data is available, generic cost information can be found from a number of sources, including:

i. Worldwide Analysis of Marine Oil Spill Clean-up Cost Factors
ii. Cost Analyses for Selected Groundwater Clean-up Projects
iii. Assessing the Value of Groundwater

iv. Assessing fish kills

Refer to Appendix 1 for further details regarding these sources of information.

The following checklist may be helpful when considering activities to be included in the costing exercise:

i. Reference to pre‐accident baseline data set of the ecological condition of the impacted area
ii. Establishment of post‐accident data set for ecological condition of the impacted area, e.g. monitor, sample, test and analyse watercourses, groundwater, soil etc.
iii. Identification of the scope of remedial work
iv. Establishment of temporary facilities and utilities
v. Excavation and removal / storage / treatment of contaminated material
vi. Import and consolidation of fill material
vii. Pump out and removal / treatment of contaminated groundwater
viii. Mitigation / clean-up of surface waters (river / estuarine / coastal)
ix. Restoring the natural environment e.g. fish stocking
x. Restoring the built environment
xi. Clean-up of pollution to third party property
xii. Civil liability claims e.g. loss of fisheries / impact on tourism / loss of abstraction
xiii. Environmental fines

6. Completing the risk assessment

Risk assessments can be completed in two parts:

- Part 1 – MATTE Definition and Thresholds, refer to section 6.1
- Part 2 – Risk assessment process, refer to section 6.2

When considering receptors with MATTE potential, note that the Safety Report Assessment Manual (SRAM) indicates that it is reasonable to screen within 10km of the site. However, for linear pathways (such as rivers) this distance may be longer.

6.1 Part 1 - MATTE definition and thresholds

With reference to sections 3 and 4, the Source-Pathway-Receptor approach described in the flowchart below can be used to identify those scenarios from the establishment which could harm each environmental receptor:

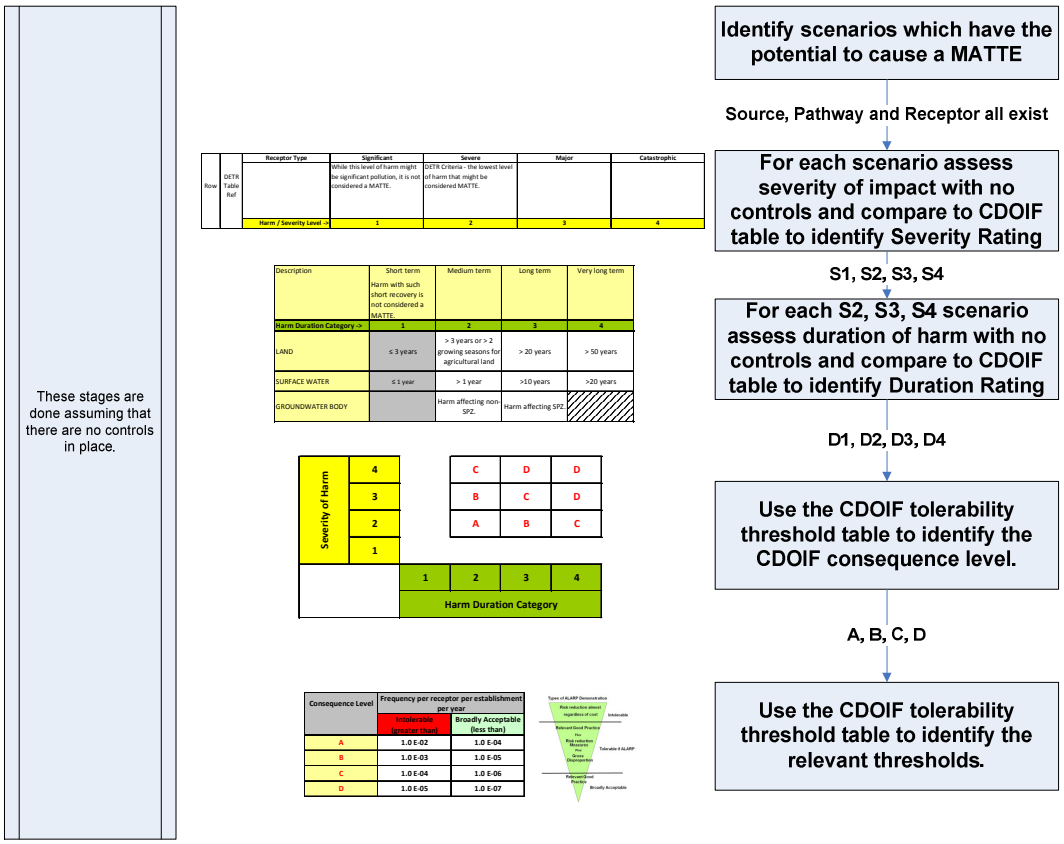


Figure 5 – Summary of MATTE Tolerability Tables (Refer to Appendix 4)

6.1.1 Identifying the major accident scenarios

When considering which credible major accident scenarios to consider as part of the risk assessment, two options are available:

- Evaluate all credible scenarios which could have a MATTE potential on the identified receptor, or

- Select a representative set of credible major accident scenarios, in line with the HSE guidance 'Risk analysis or 'predictive' aspects of COMAH safety reports guidance for explosive sites', http://www.hse.gov.uk/comah/assessexplosives/index.htm

Note that when using a representative set of credible major accident scenarios, it is likely that aggregation of risk will be based on developing scenario based risk criteria as described in section 4.3.2.

6.1.2 Determining the level of severity

For each credible major accident scenario (or representative set of credible major accident scenarios) and receptor affected, assign the Level of Severity that would be associated with the unmitigated consequences (see 4.1):

- Table 1 (Severity/Harm criteria for consideration as a major accident) in Appendix 4 contains consequence descriptions – the "severe" column represents the lowest level MATTE descriptor (as taken from the DETR 1999 guidance). Consequences lower than this, although pollution incidents are not regarded as MATTE or covered by COMAH. Consequences greater than this level may trigger the higher threshold categories in the table.

- Each column in the table has a number assigned to it: 1-4. This is the harm/severity level.

6.1.3 Assigning a duration/recovery category

For each credible major accident scenario (or representative set of credible major accident scenarios), assign a duration/recovery category that would be associated with the unmitigated consequences.

It has been recognised that environmental incidents differ in ultimate consequence depending on the (natural) recovery time of the environment. Longer term harm will produce a less tolerable consequence than one of only short duration.

For many scenarios there will be opportunities for clean-up and remediation as a post-incident measure which will reduce environmental harm. However, these should be disregarded at this stage, but discussed as "mitigation" measures within the ALARP demonstration.

To assign a duration/recovery category:

- Using Table 2 (Duration/Recovery criteria) in Appendix 4, select a duration descriptor for the relevant receptor category. These should be unaided recovery times, without restoration and clean-up activity (though natural attenuation can be taken into account). These are broad-brush categories, and as part of the screening process, estimates can be used.

- Each duration column has a category level assigned to it: 1-4. This is the harm/duration category.

6.1.4 Determining tolerability boundaries

Determine Tolerability boundaries from the Tolerability Assessment Matrix (Appendix 4 Table 3 - MATTE tolerability assessment matrix)

- Using the harm/severity level (1-4) and the harm/duration category (1-4), determine the overall unmitigated Consequence Level (A-D) from the matrix.

- Each consequence level (A-D) has been assigned tolerability thresholds to define the ALARP band. i.e. Intolerable and Broadly Acceptable frequencies per receptor, per establishment, per year.

The level of risk posed by the establishment, to each receptor, is then compared with these respective tolerability criteria, as explained in section 6.2 below.

6.2 Part 2 calculating the establishment risk frequencies

Part 1 of the risk assessment process has identified the ALARP band. Part 2 sets out how to assess the risk from the establishment to the receptor:

- Determine the risk from the establishment to a receptor

    - Determine the frequency of occurrence of all scenarios based on available failure rate and/or event data (which may include preventative or mitigatory layers and if so these should be clearly identified in the assessments).

    - Total the frequency of all scenarios from the establishment that result in each Consequence level (A-D) to the receptor.

    - The total frequency of events which meet or exceed each consequence level of harm should then be compared with the tolerability thresholds established in Part 1 (section 6.1). When comparing the establishment frequency of lower consequence levels (e.g. B) with the assigned ALARP bands, note that the total frequency to be considered is the total of that and higher consequence levels (i.e. B + C + D). An example of how aggregation is completed can be found in section 6.2.1.

- If the risk is still not Tolerable if ALARP (TifALARP) then assess other potential control measures, accept/dismiss these within an ALARP demonstration and integrate into site improvement plan as appropriate

6.2.1 Aggregating risk - Examples

Completing the initial screening (as described in section 6.1) will have discounted potential receptors from the risk assessment process as the screening will have determined that a MATTE is not credible.

For those substances and scenarios which do have MATTE potential, their risks to the relevant receptor must now be determined. As it is the total risk to the receptor that is required, i.e. from all substances, and credible scenarios, these risks must be aggregated. Examples of how this can be achieved for each receptor are provided in the following sections.

- 6.2.1.1 – Single substance stored in a single tank

- 6.2.1.2 – Tank farm or group of tanks containing similar substances

- 6.2.1.3 – Groups (e.g. tank farms) with dissimilar substances/incident consequences

In each of the examples below, the first step is to identify the credible scenarios that could cause a MATTE to the receptor being assessed (note that this could be credible scenarios from a single tank, multiple tank or facility based on the grouping of substances and compartmentalisation).

Once the credible scenarios have been identified, these should then each be categorised using the MATTE tolerability matrix (refer to Appendix 4) to give a consequence level of either A, B, C or D - this in turn provides the frequency per receptor per establishment per year and thus the thresholds for broadly acceptable and intolerable.

When aggregating the risk to a receptor from all credible scenarios, the following text can be used as a guide:

Tolerability of risk to the receptor, from the establishment as a whole, will depend on the aggregate predicted frequency of all independent accident scenarios which could impact a given receptor at or above the respective consequence level. Thus to confirm tolerability at level D then all independent level D predicted incident frequencies should be aggregated. To confirm tolerability at level A, all independent level A, B, C and D predicted incident frequencies should be aggregated.

Refer also to section 6.2.1.5 on interdependent scenarios.

6.2.1.1 Single substance stored in a single tank

If we assume that credible scenarios, consequence levels of those scenarios and event frequencies are as follows:

Scenario (Tank Farm Tank 1)	Consequence Level*	Event frequency*
Catastrophic tank failure	B	F1, $1x10^{-6}$
Large hole	A	F2, $1x10^{-5}$
Small leak from tank base	A	F3, $1x10^{-4}$

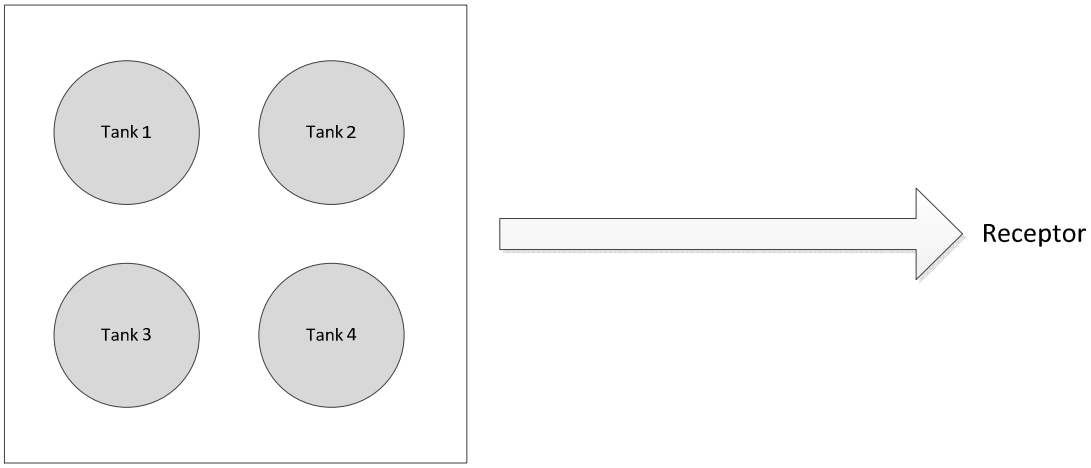
*Provided for illustrative purposes only, and at this stage does not include mitigation. For event frequencies refer to section 'Determining unmitigated risk frequencies' which is a sub-section of 6.2. For consequence level, refer to 'MATTE thresholds', section 3.2.

The aggregated risk to the receptor for all credible scenarios can be calculated as follows:

Category B incident frequency = F1 = $1x10^{-6}$

Category A incident frequency = F1 + F2 + F3 = $1x10^{-6} + 1x10^{-5} + 1x10^{-4} = 1.11x10^{-4}$

6.2.1.2 Tank farm or group of tanks containing similar substances



If we assume that credible scenarios, consequence levels of those scenarios and event frequencies for each of the tanks are the same (because of substance grouping/compartmentalisation), and can be defined as follows:

Scenario (Tank Farm Tanks 1-4)	Consequence Level*	Event frequency*
Catastrophic tank failure	B	F1, $1x10^{-6}$
Large hole	A	F2, $1x10^{-5}$
Small leak from tank base	A	F3, $1x10^{-4}$

* Provided for illustrative purposes only, and at this stage does not include mitigation. For event frequencies refer to section 'Determining unmitigated risk frequencies' which is a sub-section of 6.2. For consequence level, refer to 'MATTE thresholds', section 3.2

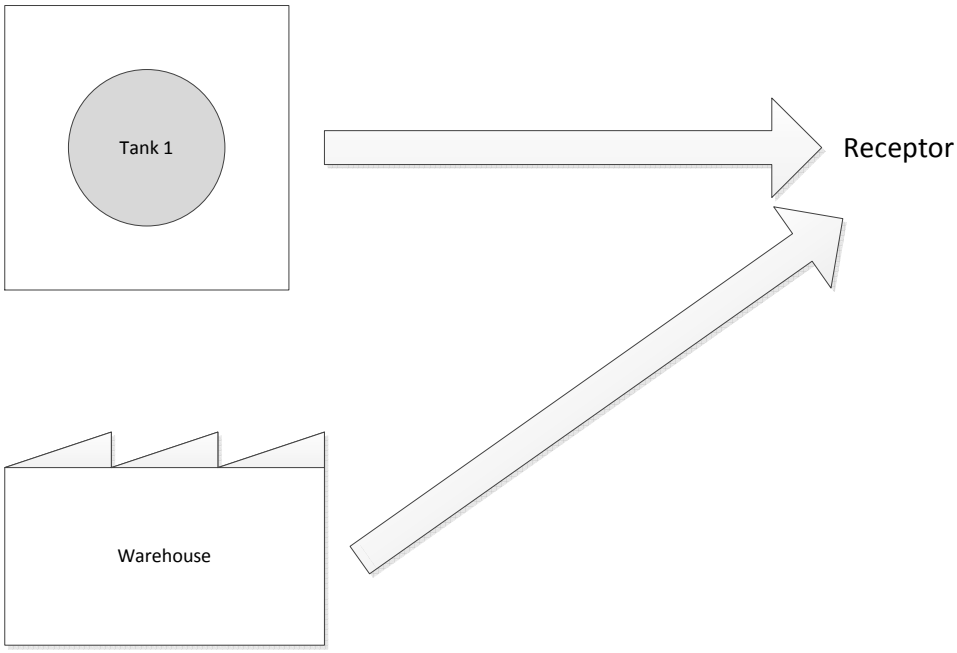
On the basis that there are now 4 tanks, the aggregated risk to the receptor for all credible scenarios can be calculated as follows:

Category B incident frequency = 4 * (F1) = $4x10^{-6}$

Category A incident frequency = 4 * (F1 + F2 + F3) = 4 * ($1x10^{-6}$ + $1x10^{-5}$ + $1x10^{-4}$) = $4.44x10^{-4}$

6.2.1.3 Groups (e.g. tank farms) with dissimilar substances/incident consequences

It is likely, particularly on chemical sites, that substances/scenarios will not be sufficiently similar to group together. However, the Category A, B, C or D incidents can be aggregated in the same way as indicated in the earlier examples.



If we assume that credible scenarios, consequence levels of those scenarios and event frequencies for each of the tanks are the same (because of substance grouping/compartmentalisation), and can be defined as follows:

Scenario (Tank Farm Tank 1)	Consequence Level*	Event frequency*
Catastrophic tank failure	B	F1, $1x10^{-6}$
Large hole	A	F2, $1x10^{-5}$
Small leak from tank base	A	F3, $1x10^{-4}$

Scenario (Warehouse)	Consequence Level*	Event frequency*
Warehouse fire	B	F4, $1x10^{-3}$

* Provided for illustrative purposes only, and at this stage does not include mitigation. For event frequencies refer to section 'Determining unmitigated risk frequencies' which is a sub-section of 6.2. For consequence level, refer to 'MATTE thresholds', section 3.2

The aggregated risk to the receptor for all credible scenarios can be calculated as follows:

Category B incident frequency = F1 + F4 = $1x10^{-6} + 1x10^{-3} = 1.001x10^{-3}$
Category A incident frequency = F1 + F2 + F3 + F4 = $1x10^{-6} + 1x10^{-5} + 1x10^{-4} + 1x10^{-3} = 1.111x10^{-3}$

It can be seen that in this example that the warehouse fire is by far the biggest contributor to the risk frequency, and hence this indicates where best to look at additional control measures.

6.2.1.4 Comparison with tolerability criteria

For the single tank and warehouse example above it was determined

Category B incident frequency = 1.001×10^{-3}

Category A incident frequency = 1.111×10^{-3}

These can then be compared to the tolerability criteria as follows:

	Frequency per establishment per receptor per year (**unmitigated**)						
Frequency at which CDOIF Consequence Level is equalled or exceeded	10^{-8}–10^{-7}	10^{-7}–10^{-6}	10^{-6}–10^{-5}	10^{-5}–10^{-4}	10^{-4}–10^{-3}	10^{-3}–10^{-2}	$>10^{-2}$
D - MATTE						Intolerable	
C - MATTE				TifALARP			
B - MATTE	Broadly Acceptable					**X**	
A - MATTE						**X**	
Sub MATTE	Tolerability not considered by CDOIF						

The unmitigated risk is depicted above by **X**.

Up to this point in the assessment, no mitigation has been considered. It is now necessary to consider what forms of mitigation are in place to further reduce risk. The calculations above need to be repeated to include the Probability of Failure on Demand (PFD) of any protection layers present (e.g. safety instrumented systems, secondary or tertiary containment, emergency arrangements) to estimate the mitigated risk to each receptor, for each consequence category and thus whether mitigated risk is tolerable.

So, for example, if the tank is bunded (PFD = 0.1) and the bunded tank and warehouse surrounded by site-wide tertiary containment designed to contain fire runoff (PFD = 0.1) then the mitigated risk to each receptor would be calculated by multiplying the event frequency with the relevant mitigation layer PFD(s) as follows:

Scenario (Tank Farm T1)	Consequence Level[1]	Event frequency[1]	Independent mitigation layers (PFD) [1]	Outcome frequency (mitigated)
Catastrophic tank failure	B	F1, $1x10^{-6}$	0.1 * 0.1	F5, $1x10^{-8}$
Large hole	A	F2, $1x10^{-5}$	0.1 * 0.1	F6, $1x10^{-7}$
Small leak from tank base	A	F3, $1x10^{-4}$	0.1 * 0.1	F7, $1x10^{-6}$

Scenario (Warehouse)	Consequence Level[1]	Event frequency[1]	Independent mitigation layer (PFD) [1]	Outcome frequency (mitigated)
Warehouse fire	B	F4, $1x10^{-3}$	0.1	F8, $1x10^{-4}$

Note 1: Provided for illustrative purposes only. For event frequencies refer to section 4.3.4 'Determining risk frequencies'. For consequence level, refer to 'MATTE thresholds', section 3.2.

The aggregated mitigated risk to the receptor for all credible scenarios can be calculated as follows:

Category B mitigated frequency = F5 + F8 = $1x10^{-8} + 1x10^{-4} = 1.0001x10^{-4}$

Category A mitigated frequency = Category A frequencies + Category B frequencies

= (F6 + F7) + (F5 + F8)

= $1x10^{-7} + 1x10^{-6} + 1x10^{-8} + 1x10^{-4} = 1.0111x10^{-4}$

These can then be compared to the tolerability criteria as follows:

	Frequency per establishment per receptor per year (**mitigated**)						
Frequency at which CDOIF Consequence Level is equalled or exceeded	10^{-8}–10^{-7}	10^{-7}–10^{-6}	10^{-6}–10^{-5}	10^{-5}–10^{-4}	10^{-4}–10^{-3}	10^{-3}–10^{-2}	>10^{-2}
D - MATTE						Intolerable	
C - MATTE				TifALARP			
B - MATTE	Broadly Acceptable				**X**		
A - MATTE					**X**		
Sub MATTE	Tolerability not considered by CDOIF						

The mitigated risk is depicted above by **X**.

It can now be seen that the mitigated risk is TifALARP. Further risk reduction needs to be considered and implemented so far as is reasonably practicable (but an ALARP demonstration may show the cost of further risk reduction is grossly disproportionate).

6.2.1.5 Interdependent scenarios

When summing frequencies it is important that this should only be done for independent events.

For example, from the four tank example above (6.2.1.2), consider a further possible level C scenario of a multi-tank fire arising from a spill followed by escalation. The overall escalated scenario frequency would be made up from the chance of any of the other events occurring (spills) and then escalating (ignition). The frequency of the escalation scenario would need to be compared to the level C tolerability criteria.

However, when considering the frequencies for A and B tolerability (all events with outcomes at or exceeding level A or B), the risk assessor would not in this case sum the A and B spill frequencies with the escalated event (level C) frequency. This is because the level C event is not independent from the level A and B initiating events. The escalated scenario frequency is derived from the frequencies of the lesser events and their probabilities of escalation (the spill frequency includes the frequency of both un-ignited and ignited events). Summing the spill events and the escalated fire events woud result in double counting of the same initiating events.

Conversely, if the level C scenario was caused by an event independent to the level A and B events (e.g. explosion from adjacent site) then the frequencies would be summed when examining level A or B tolerability.

Consideration of bowtie diagrams often helps to avoid errors in logic.

7. Abbreviations

Abbreviation	Description
ALARP	As Low As Reasonably Practicable
AONB	Areas of Outstanding Natural Beauty
CA	Competent Authority
CBA	Cost Benefit Analysis
CDOIF	Chemical and Downstream Oil Industry Forum
CICS	Common Incident Classification Scheme
COMAH	Control of Major Accident Hazards
DETR	Department of the Environment, Transport and the Regions
DF	Disproportion Factor
EA	Environment Agency
EPR	Environmental Permitting Regulations
ESA	Environmentally Sensitive Areas
EU	European Union
LNR	Local Nature Reserves (may be referred to as Local Wildlife Site)
MAH	Major Accident Hazard
MATTE	Major Accident to the Environment
MNR	Marine Nature Reserves
NNR	National Nature Reserves
NSA	Nitrate Sensitive Areas
OS	Ordnance Survey
PFD	Probability of Failure on Demand
PPC	Pollution Prevention and Control (Regulations)
SAC	Special Areas of Conservation
SEPA	Scottish Environment Protection Agency
SPA	Special Protection Areas
SPZ	Source Protection Zone
SRAM	Safety Report Assessment Manual
SSSI	Site of Special Scientific Interest
TifALARP	Tolerable if As Low As Reasonably Practicable
WFD	Water Framework Directive

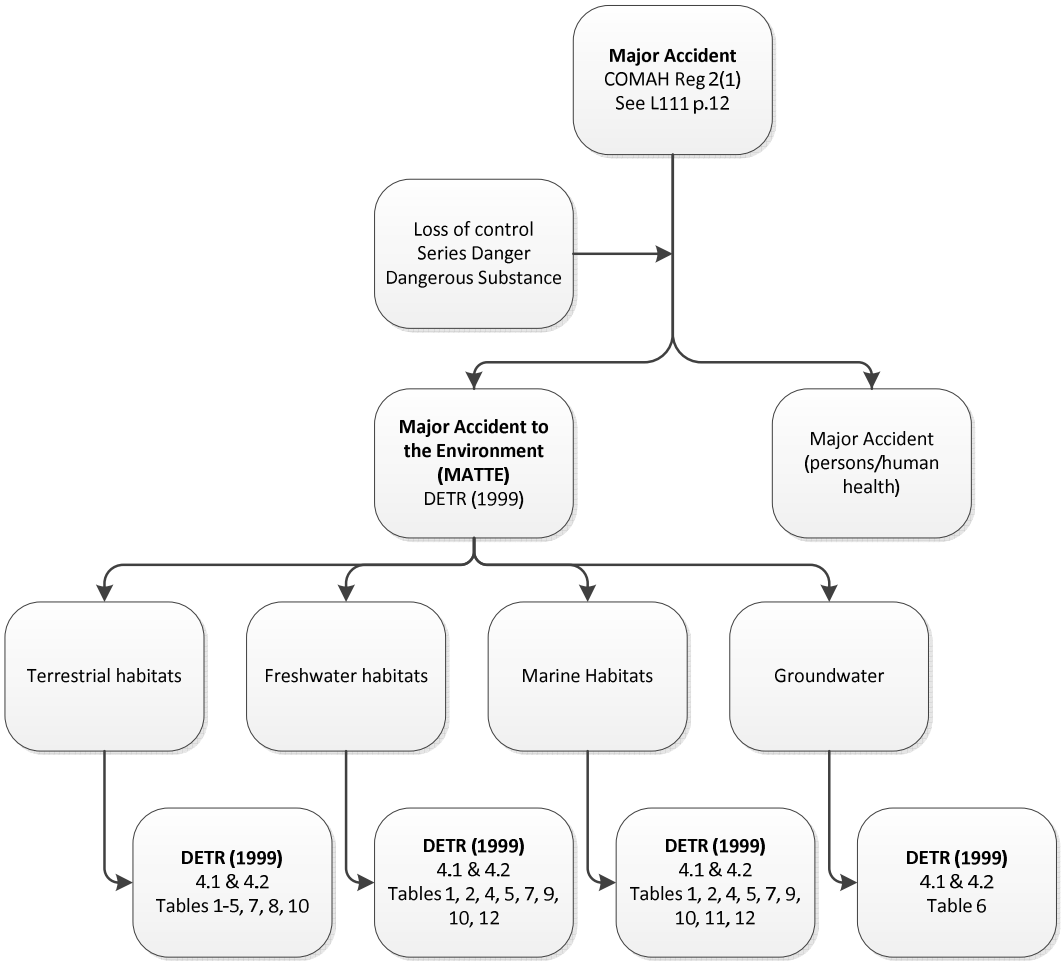
Revision History

Rev.	Section	Description	Date	Changed By
0.0	All	First Issue	23-Jan-2012	Peter Davidson
0.1	3	Updated with WP2 definitions	27-Jul-2012	Peter Davidson
0.2	3	Corrected WP2 definition	01-Aug-2012	Peter Davidson
0.3	3	Updated to include TA comments	08-Aug-2012	Peter Davidson
0.4	All	Updated following WP 3 Meeting 13/08/12	23-Aug-2012	Peter Davidson
0.5	All	Updated following road testing	24-Jan-2013	Peter Davidson
0.6	All	Updated to final draft – for stakeholder review	08-Feb-2013	Hugh Bray Ian Brocklebank Jackie Coates Mike Nicholas Peter Davidson

Appendix 1 - Key Guidance

The following provides reference to the key guidance relating to environmental risk assessment, and how that guidance inter-relates.

Reference should also be made to the table on the following page which provides links to access both L111 and DETR 1999 and other related guidance and legislation.



Topic	Guidance	Web reference
General COMAH	A guide to the Control of Major Accident Hazards Regulations 1999 (as amended) (L111) (HSE, 2006)	www.hse.gov.uk/pubns/books/l111.htm
	Guidance on the Interpretation of Major Accident to the Environment for the Purposes of the COMAH Regulations (DETR, 1999)	http://archive.defra.gov.uk/environment/quality/chemicals/accident/index.htm
	CA procedures and strategic topics (signposting CA expectations on necessary measures)	http://www.hse.gov.uk/comah/ca-guides.htm
	HSE ALARP suite of guidance	http://www.hse.gov.uk/risk/expert.htm
	Guidance Identifying COMAH Major Accidents to the Environment (MATTE) Table 3 EA, 2004	N/A
Risk Assessment for COMAH (guidance applicable to Safety Reports and LT risk assessment)	Safety Report Assessment Manual – Section 13 (remodelled for use with all Safety Reports)	http://www.hse.gov.uk/comah/guidance/sram.pdf
	Guidance on the Environmental Risk Assessment Aspects of COMAH Safety Reports, COMAH CA, Dec 1999	http://www.environment-agency.gov.uk/default.aspx (search for COMAH safety report – document filed as comah_1785585)
	HSG 190 Preparing Safety reports (HSE, 1999)	http://www.hse.gov.uk/pubns/books/hsg190.htm
Historic incident data	eMARS (European accident database)	https://emars.jrc.ec.europa.eu/
	ARIA	http://www.aria.developpement-durable.gouv.fr/index_en.html

Topic	Guidance	Web reference
General Risk Assessment	Guidelines for Environmental Risk Assessment and Management – Green Leaves III (DEFRA, 2011)	http://www.defra.gov.uk/publications/2011/11/07/green-leaves-iii-pb13670/
Related legislation (see also regulator and DEFRA websites)	Water Framework Directive	http://ec.europa.eu/environment/water/water-framework/index_en.html and http://www.wfduk.org/
	Habitats Directive	http://ec.europa.eu/environment/nature/legislation/habitatsdirective/index_en.htm
	Environmental Liability Directive	http://ec.europa.eu/environment/legal/liability/index.htm
General good practice	EA Pollution Prevention Guidance (PPGs)	http://www.environment-agency.gov.uk/business/topics/pollution/39083.aspx
	HSE Health and Safety Guidance (HSGs)	http://www.hse.gov.uk/pubns/books/index-hsg-ref.htm
Other useful references	My Environment Website	http://www.myenvironment.org.uk/

Appendix 2 – DETR 1999 Table References

The following provides reference to the relevant definition tables in the DETR 1999 Guidance on the interpretation of Major Accident to the Environment for the purposes of COMAH regulations.

Table 1 National Nature Reserves, Sites of Special Scientific Interest, Marine Nature Reserves (Land/Water)

Medium:
Land/Water (inter-tidal/near-shore sub-tidal)

Receptor:
NNRs, SSSIs, MNRs

Definition of receptor:
National Nature Reserves (NNRs)
Sites of Special Scientific Interest (SSSIs), both biological (terrestrial and water-based) and geological
Marine Nature Reserves (MNRs)

Threshold:
The following thresholds apply:

- Greater than 0.5 ha adversely affected, or greater than 10% of the area of the site affected (whichever is the lesser), or
- Greater than 10% of an associated linear feature adversely affected, or
- Greater than 10% of a particular habitat or population of individual species adversely affected.

Explanation/justification:
Sites of Special Scientific Interest (SSSIs) represent areas judged to be special on the basis of their plant or animal communities, geological features or landforms. They represent the basic minimum area of habitat that should be conserved to maintain the current range and distribution of native plants and animals. SSSIs can be terrestrial (biological or geological), freshwater or marine. In practice, the seaward limit of an SSSI depends upon the definition of 'land', but generally can extend to mean low water (inter-tidal).

SSSIs are notified under Section 28 of the Wildlife & Countryside Act 1981.

National Nature Reserves (NNRs) are a key selection of nationally important SSSIs. NNRs have been established to protect the most important national areas of wildlife habitat and geological formation. They are among the best examples of particular habitat types, and therefore represent a nationally important resource. The selection of NNRs is based on criteria including fragility of, and threats to, habitats and species, size, lack of disturbance, presence of species-rich communities and rare species, and the degree of 'naturalness' of the site.

NNRs are designated under Section 19 of the National Parks and Access to the Countryside Act 1949.

Marine Nature Reserves (MNRs) are designated under Section 36 of the Wildlife & Countryside Act 1981 in areas between the high water mark and the territorial limit.

Table 2 Natura 2000 sites, Ramsar sites (Land/Water)	
Medium: Land/Water Receptor: Natura 2000 sites (SPAs, SACs), Ramsar sites Definition of receptor: Special Areas of Conservation (SACs) Special Protection Areas (SPAs) Ramsar sites [Note that these receptors are often also SSSIs] Threshold: Lower thresholds than for SSSIs. For SACs, SPAs, and Ramsar sites, the thresholds are: • Greater than 0.5 ha or 5% of the area of the site adversely affected (whichever is the lesser), or • Greater than 5% of an associated linear feature adversely affected, or • Greater than 5% of a particular habitat or population of individual species adversely affected.	Explanation/justification: Central to the European Union's policy of protecting and conserving wildlife and habitats is the creation of an ecological network of protected areas – Natura 2000. Natura 2000 sites are SACs and SPAs. SPAs are aimed at conserving bird species listed in Annex I of Council Directive 79/409/EEC on the conservation of wild birds (the 'Birds Directive'), and also migratory birds. This is primarily through designation of bird habitats, and particularly wetlands. SACs conserve the habitat types, animals and plant species listed under Council Directive 92/43/EEC on the conservation of natural habitats and of wild flora and fauna (the 'Habitats Directive'), and thus contribute towards maintenance of favourable conservation status of selected habitats and species. Marine habitats and species are included. The Habitats Directive (Article 6) sets out a legal framework for protecting these sites. Article 6(2) outlines a general duty for Member States to avoid habitat deterioration and significant species disturbance within a site. Ramsar sites are wetlands of international importance (arising from the Convention on Wetlands of International Importance especially as Waterfowl Habitat). As a matter of policy the Government wishes sites listed as potential SPAs and candidate SACs to be treated as if they are already designated. Further details may be found in Appendix 2.

Table 3 Other designated land (Land)	
Medium: Land Receptor: Other designated land Definition of receptor: Environmentally Sensitive Areas (ESAs) Areas of Outstanding Natural Beauty (AONBs) Greenbelt land National Parks Local Nature Reserves (LNRs), Wildlife Trust sites National Trust land Common land/country parks Threshold: • Greater than 10% or 10 ha of land damaged, whichever is the lesser.	Explanation/justification: Nature conservation values are covered by designations such as SSSI and NNR. However, there are many more land designations that aim to conserve areas purely for amenity and aesthetic reasons. Such areas may (or may not) have associated wildlife value, but are valued for landscape, aesthetic (outstanding natural beauty), historic and archaeological, geological amenity or recreational features.

Table 4 Scarce habitat (Land/Water)	
Medium: Land/Water Receptor: Scarce habitat Definition of receptor: Biodiversity Action Plan habitats Geological features: caves, fossil beds, mineral veins, moraines, etc. Threshold: • Damage to 10% of the area of the habitat or 2 ha, whichever is the lesser, would be considered a major accident.	Explanation/justification: Scarce/key habitats are awarded protection principally on the basis of the declines in distribution and extent of such habitats within the recent past. Those habitat types which have undergone major or rapid declines, or which are rare, are considered to be 'at risk'. Additionally, certain areas, particularly marine/coastal/estuarine, are extremely important in terms of their functioning, and are thus 'key' in this respect. Other habitats, whilst not necessarily of great intrinsic value in themselves, are worthy of consideration/protection because of the particular species that they may support. The local English Nature/Scottish Natural Heritage/Countryside Council for Wales office should be consulted to identify these receptors locally.

Table 5 Widespread habitat (Land/Water)	
Medium: Land/Water Receptor: Widespread habitat Definition of receptor: More widespread habitat, including agricultural land, that has not been otherwise classified, i.e. is not designated or scarce Forestry Threshold: • Contamination of 10 ha or more of land which, for one year or more, prevents the growing of crops or the grazing of domestic animals or renders the area inaccessible to the public because of possible skin contact with dangerous substances, or • Contamination of any aquatic habitat which prevents fishing or aquaculture or which similarly renders it inaccessible to the public.	Explanation/justification: The size criteria of 10 ha of land can relate either to the total area contaminated or the total land taken out of production as a result of a smaller area being contaminated. It is assumed that contamination of a proportion of a field will result in the whole field being unusable due to the difficulties associated with determination of 'safe' and 'unsafe' areas of the same field. It should be remembered that there may still be areas within the wider countryside of high conservation value, and that the lack of current designation does not necessarily imply that an area is of no ecological worth.

Table 6 Aquifers or groundwater (Water)	
Medium: Water Receptor: Aquifers or groundwater Definition of receptor: Water resources in or under the soil Threshold: A major accident would be: • Any incident likely to require large-scale and long-term remedial measures, or • Any incident of contamination/pollution (by persistent compounds) occurring within groundwater protection zone 1 (the most vulnerable groundwater resources).	Explanation/justification: Groundwater is water that is held underground, mainly within rock formations. Approximately 75% of the groundwater that is abstracted in England and Wales is used for drinking water. Because groundwater is inaccessible, it is difficult to remediate contamination incidents. Therefore, any incident likely to result in pollution of groundwater should be considered to be serious. The Environment Agency has published a groundwater protection policy for England and Wales, classifying groundwater vulnerability to pollution on the basis of the nature of the overlying soils, the presence and nature of unconsolidated deposits overlying solid rock formations, the nature of the rock strata, and the depth to the water-table. Vulnerability maps have been produced which identify areas in which groundwater requires protection. Similarly, the Scottish Environment Protection Agency (SEPA) has produced a Groundwater Protection Policy for Scotland. This information should be used to identify the presence of vulnerable groundwaters locally. The Directive on the protection of groundwater against pollution caused by certain dangerous substances (80/68/EEC) will be integrated into the forthcoming Water Framework Directive. The current Directive aims to control the direct and indirect discharge of certain substances into groundwater: List 1 substances, which should be prevented from entering groundwater; and List 2 substances, which could have a harmful effect on groundwater.

Table 7 Soil or sediment (Land/Water)	
Medium: Land/Water Receptor: Soil or sediment Definition of receptor: Material at the earth's surface or the base of the water column to a depth of 1 metre (soil samples to be obtained from the top 10 cm for chemical analysis) Threshold: Contamination or pollution of the receptor such that • Soil would be regarded as contaminated land by relevant authorities (i.e. contamination such that planned present or future uses could be compromised), or • Sediment would become loaded with sufficient material to compromise the chemical or biological quality of overlying waters for any period in excess of a few days. Deterioration of the biological quality of soil or sediment such that • Common organisms of these ecosystems (e.g. earthworms) were absent, the structure of the biological community altered for periods in excess of a season, or normal ecosystem function was severely impaired for a period in excess of one year.	Explanation/justification: There are no existing numerical criteria for soil quality that are thought adequate for indicating what might constitute a major accident to the environment in relation to soils and sediments. Thus, thresholds have been set in non-numerical terms. As a guide, long-term 'capping' or other forms of physical amendment of soil or sediment are likely to lead to loss of soil biodiversity, as will high levels of chemical contamination with a range of individual substances (such as metals and persistent organic compounds) and mixtures of substances. Operators' attention is drawn (a) to earlier work by the Interdepartmental Committee on the Redevelopment of Contaminated Land (ICRCL 59/83) that lists trigger thresholds for different contaminants according to future uses of the land, and (b) to work from the Netherlands that sets optimum and action levels for a range of contaminants in soil (the so-called 'Dutch list'). These documents provide particular perspectives on soil contamination that mean they cannot be used to meet the requirements of Seveso II/COMAH. Similar documents available from North America have similar limitations.

Table 8 Built heritage (Land – man-made)

Medium:
Land – man-made

Receptor:
Built heritage

Definition of receptor:
Buildings
Listed buildings

Threshold:

- Damage to a Grade I listed building (England and Wales) or a category A building (Scotland) or a scheduled ancient monument such that it no longer possesses its architectural, historic or archaeological importance, and which would result in it being de-listed or de-scheduled if no remedial/restorative work was undertaken, or
- Damage to an area of archaeological importance or to a conservation area similarly resulting in loss of importance.

Explanation/justification:
Buildings of architectural or historic interest (England and Wales) are listed in accordance with the Planning (Listed Buildings and Conservation Areas) Act 1990. The list includes most buildings constructed before 1840, together with others depending on quality, character and/or architect. Grade I buildings are of 'exceptional importance'.

Buildings of special architectural or historic interest (Scotland) are listed under the terms of the Town and Country Planning (Scotland) Act 1972, using similar criteria to those used in England. Category A buildings are those of national architectural or historic importance.

Ancient monuments of national importance (England and Wales) are scheduled under the Ancient Monuments and Archaeological Areas Act 1979.

Table 9 Various receptors, as defined (Water)

Medium: Water	Explanation/justification: Groundwater Directive (80/68/EEC) on the protection of groundwater pollution caused by certain dangerous substances aims to control the direct and indirect discharge of these substances into groundwater.
Receptor: Various, as defined	The Drinking Water Directive (80/778/EEC) relates to the quality of water for human consumption, and establishes standards for quality of drinking water designed to safeguard human health.
Definition of receptor: Groundwater Drinking water Fish and shellfish water Bathing waters	The Surface Water for Drinking Water Abstraction Directive (75/440/EEC) lays down requirements to ensure that surface water intended for the abstraction of drinking water meets certain minimum specified standards.
Threshold: Standards relating to continuous emissions and contained within the relevant European legislation (listed here) should not be adopted to define a major accident. However, the specific level of exceedence of these standards should be considered in the post-accident remediation and restoration works.	The Dangerous Substances Discharges Directive (76/464/EEC) on pollution caused by certain dangerous substances discharged into waters requires control of emissions. Directive 78/659/EEC on fish water quality seeks to protect fresh waters identified as fish waters and sets water quality standards for salmonid and cyprinid waters. Where the water quality in such waters does not comply with the standards, pollution reduction is required. Directive 79/923/EEC on shellfish water quality similarly seeks to protect those coastal and brackish water bodies identified as shellfish waters. The Bathing Water Directive (76/160/EEC) seeks to ensure the quality of bathing waters, both freshwater and coastal. Nineteen physical, chemical and microbiological parameters are set, and monitoring of bathing waters is required. The Integrated Pollution Prevention and Control Directive (96/61/EC) deals with emissions to air and soil as well as to water, and will have a central role in the control of point source pollution. The proposed Water Framework Directive will establish a common approach to environmental objectives for all ground and surface waters. The target of 'good water status' would have to be achieved within a specified period of the Directive coming into force.

Table 10 Particular species (Land/Water/Air)

Medium:
Land/Water/Air

Receptor:
Particular species

Definition of receptor:
'Common' species
Species listed under European legislation
Species listed in the Wildlife & Countryside Act
Red Data Book species

Threshold:

- For common species, where reliable estimates of population numbers exist, the death of, or serious sub-lethal effects within, 1% of any species would be significant.
- For common plant species, the death of, or serious sub-lethal effects within, 5% of the ground cover would be considered a major accident.
- For species listed in Appendix 4, the threshold may be lower than 1% or 5%, and liaison with the appropriate statutory conservation organisation should be used to determine the appropriate threshold.

Moreover, for all species, where reliable estimates of population numbers do not exist, liaison with the statutory authority will be necessary to determine appropriate thresholds.

Any loss of a Red Data Book species (or a Red Data Book species site) would be considered a major accident.

Explanation/justification:
Damage to individuals (sub-lethal effects and death) within populations may not only have implications for the survival of that species, but may also have knock-on consequences for other species, the habitat or the ecosystem. Thus major accidents to species need to be considered not only in terms of the sustainability of the affected species, but also in terms of other species that may be wholly or partly dependent upon that species.

For species listed in Appendix 4 (threatened and rare species), a major accident will generally be deemed to have occurred at lower thresholds than for common species, i.e. the definition of a major accident will depend upon the commonness or rarity of that species.

Furthermore, the mobility and dispersal ability of species could be considered in the context of other suitable habitat in the locality. Certain species may be able to move away from a site following an incident and utilise resources elsewhere, whereas others may be unable to move or be dependent upon that area.

In addition, the effect of the same event at different times of the year should be considered, i.e. between seasons different species may be present at differing population densities; an event coinciding with the breeding season may be more serious than the same event at a different time of year.

Table 11 Marine (Water)

Medium:
Water

Receptor:
Marine

Definition of receptor:
Non-estuarine marine waters
Littoral, sub-littoral zone
Benthic community adjacent to coast
Fish spawning grounds

Threshold:
Permanent or long-term damage to

- An area of 2 ha or more of the littoral or sub-littoral zone, or the coastal benthic community, or the benthic community of any fish spawning ground, or
- An area of 100 ha or more of the open sea benthic community.

Or a count of

- 100 or more dead sea birds (not gulls), or
- 500 dead sea birds of any species, or
- 5 dead or significantly injured/impaired sea mammals of any species.

Explanation/justification:
Damage is assessed relative to the area impacted, or the number of individuals affected, rather than by contaminant concentrations in the water. Dilution may subsequently reduce the concentration of a released substance to levels difficult to measure (and thus monitor), although initial concentrations may be sufficiently high to damage sub-littoral, littoral and inshore organisms. Moreover, low concentrations of substances may still pose a hazard if they are highly toxic or if they are persistent and bioaccumulate.

The number of animal casualties detected following an accident will depend on local circumstances, such as geographical location, season and whether the incident occurred near a breeding colony. Moreover, the extent of the impact on species will rarely be quantifiable immediately following the accident, and will require long-term monitoring to adequately assess the true extent of the impact.

The number of animals killed in an incident is almost certain to be considerably more than the number of casualties detected. For example, the proportion of casualties recovered may be as low as 10-20% of the total number of animals impacted.

Table 12 Freshwater and estuarine habitats (Water)

Medium:
Water

Receptor:
Freshwater and estuarine habitats

Definition of receptor:
Stream, river, canal, reservoir, lake, pond or estuary

Threshold:
- Effects on a significant part of any receptor defined above which, when assessed using the Environment Agency General Quality Assessment (GQA) scheme, either lower the chemical water quality by one class for more than one month or lower the biological quality by one class for more than one year or cause long-term damage to the habitat overall (but see explanation).

Explanation/justification:
A 'significant part' of a river, canal or stream is taken to be a 10 km stretch or 10% of the length of the water course, whichever is the lesser.

For estuaries and ponds, a significant area is taken to be 2 ha or 10% of the area, whichever is the lesser.

Long-term damage will be deemed to have occurred if the system takes longer than 3 years to recover.

There are several factors to be taken into consideration when assessing the severity of impacts to fresh waters:

The importance of lowering the quality of the water when assessed using the Environment Agency GQA scheme may be considered to be of greater importance in the case of higher quality water courses than already degraded systems.

The precise location of the impact relative to the water course may be important, such that an impact affecting the head waters may be more serious than one further down stream, particularly in relation to the potential for recovery. Downstream habitats may be readily recolonised by organisms from further upstream, but upstream areas may take much longer to recover.

Increased consideration should be given to the use to which the water is put when assessing the severity of an impact.

Evaluation techniques exist to assess not only water quality but also existing vegetation and fauna, i.e. RIVPACS (see Glossary).

Appendix 3 – Information Sources

Note: For Wales, please contact site officer – further guidance to be available after the formation of Natural Resources Wales

DETR Table	Receptor Type		How can I decide which receptors I have around my site?	How do I use/interpret the information on the website?	What features are most relevant and where can I find detail of them – for example designation land, categorisation for water	Which agency or body should I contact if I need further information on helping me determine MATTE potential?	What impact have 'similar' incidents had, and where can I find more information about these?	How do I use the information gathered above to help me work out Consequence (Extent, Severity and Duration)?
1	Designated Land/Water Sites (National)	England	www.magic.gov.uk/ http://www.natureonthemap.naturalengland.org.uk/ International sites tab www.jncc.gov.uk/	As per item 2 below but focus on sites of national importance	SSSIs, National Nature Reserves, Marine Conservation Zones	Natural England Environment Agency See also guidance on Environmental Damage (http://www.defra.gov.uk/environment/quality/environmental-liability/) for interpretational guidance on Damage to species and habitats.	see item 2 below	
		Wales						
		Scotland	Scotland's Environmental Web interactive mapping page (SEWeb) "Wildlife" tab Scottish Natural Heritage Website "Protected Areas" tab www.jncc.gov.uk/	On both websites interactive maps can be used to search for and identify designated sites. The Marine Atlas can assist in identifying the location and population of some species which may be of interest.	SSSIs, National Nature Reserves etc. The area of the site can be found on the relevant information sheet or citation for the area this can be accessed via the Joint Nature Conservation Committee (JNCC) website. In some cases the qualifying population may also be included.	Scottish Natural Heritage (SNH) http://www.snh.gov.uk/ Relevant Fishery Board List of fisheries boards See also guidance on Environmental Damage (http://www.scotland.gov.uk/Resource/Doc/211199/0087791.doc) for interpretational guidance on Damage to species and habitats.		

DETR Table	Receptor Type		How can I decide which receptors I have around my site?	How do I use/interpret the information on the website?	What features are most relevant and where can I find detail of them – for example designation land, categorisation for water	Which agency or body should I contact if I need further information on helping me determine MATTE potential?	What impact have 'similar' incidents had, and where can I find more information about these?	How do I use the information gathered above to help me work out Consequence (Extent, Severity and Duration)?
2	Designated Land/Water Sites (International)	England	www.magic.gov.uk/ http://www.natureonthemap.naturalengland.org.uk/ International sites tab www.jncc.gov.uk/	In magic the interactive map can be used to search "Rural Designations – Statutory" (step 1) around a given location (step 2). This opens a new map with further map tools such as a radius / linear and polygon searches or identify features at specific point. Depending on site location, other layers, such as "Coastal and marine resources atlas" might also be relevant.	SAC, SPA, Ramsar sites and their component SSSIs Use magic to find the sites (e.g. radius search or manually explore map along length of a stream/river) – then follow links to data (e.g. on the JNCC and Natural England websites)	Natural England, http://www.naturalengland.org.uk/ Environment Agency See also guidance on Environmental Damage (http://www.defra.gov.uk/environment/quality/environmental-liability/) for interpretational guidance on Damage to species and habitats	https://emars.jrc.ec.europa.eu/ http://www.aria.developpement-durable.gouv.fr/index_en.html Accident databases, like the two above can be searched using substance based keywords / CAS / industry type and the impacts from the shortlisted incidents compared to those that might be credible for the installation under assessment.	Once receptors have been identified either assume impact is possible and screen scenario in or gather more detailed data on the vulnerability of those to impact from the chemicals concerned need to be assessed. e.g. data at http://evidence.environment-agency.gov.uk/ChemicalStandards/home.aspx This to be considered along with the site conservation objectives and status.
		Wales						
		Scotland	Scotland's Environmental Web interactive mapping page (SEWeb) "Wildlife" tab Scottish Natural Heritage Website "Protected Areas" tab www.jncc.gov.uk/	On both websites interactive maps can be used to search for and identify designated sites. The Marine Atlas can assist in identifying the location and population of some species which may be of interest.	SAC, SPA, Ramsar sites and their component SSSIs The area of the site can be found on the relevant information sheet or citation for the area this can be accessed via the links on the SNH website or via the Joint Nature Conservation Committee (JNCC) website. In some cases the qualifying population may also be included.	Scottish Natural Heritage (SNH) http://www.snh.gov.uk/ Relevant Fishery Board List of fisheries boards See also guidance on Environmental Damage (http://www.scotland.gov.uk/Resource/Doc/211199/0087791.doc) for interpretational guidance on Damage to species and habitats.		

DETR Table	Receptor Type		How can I decide which receptors I have around my site?	How do I use/interpret the information on the website?	What features are most relevant and where can I find detail of them – for example designation land, categorisation for water	Which agency or body should I contact if I need further information on helping me determine MATTE potential?	What impact have 'similar' incidents had, and where can I find more information about these?	How do I use the information gathered above to help me work out Consequence (Extent, Severity and Duration)?
3	Other designated land	England	As per Table 1 row 1 "International sites)			Local Wildlife Trusts Local Authority Local Records Centre		
		Wales						
		Scotland	Useful webpages include: Map of National Scenic Areas National Parks in Scotland webpage SNH Local nature reserves webpage Wildlife Trust Site search			Scottish Natural Heritage Local Wildlife Trusts Local Authority Local Records Centre		

DETR Table	Receptor Type		How can I decide which receptors I have around my site?	How do I use/interpret the information on the website?	What features are most relevant and where can I find detail of them – for example designation land, categorisation for water	Which agency or body should I contact if I need further information on helping me determine MATTE potential?	What impact have 'similar' incidents had, and where can I find more information about these?	How do I use the information gathered above to help me work out Consequence (Extent, Severity and Duration)?
4	Scarce Habitat	England	www.magic.gov.uk/ http://www.natureonthemap.naturalengland.org.uk/ International sites tab www.jncc.gov.uk/	In magic, lower designations might also be found in other datasets such as "Rural Designations – Other" and "Rural Land-Based Schemes"		Local Wildlife Trusts Local Authority Local Records Centre		
		Wales						
		Scotland	UK BAP species and habitats webpage SNH Bio-diversity webpage Local authority biodiversity action plans SNH Geo-diversity webpage			Local Wildlife Trusts Local Authority Local Records Centre		
5	Widespread Habitat – Non-designated land	England	See table 1.2 of H1 Annex A for data sources e.g. OS mapping	Use data sources to establish main types of land use, and in particular any agricultural or areas of public access	Generally land use can be determined by OS mapping, and if not by local field surveying (walking / driving round to see what land-use is evident.)	For food safety – FSA For risk to people, HSE & HPA		
		Wales						
		Scotland	e.g. OS mapping					

DETR Table	Receptor Type		How can I decide which receptors I have around my site?	How do I use/interpret the information on the website?	What features are most relevant and where can I find detail of them – for example designation land, categorisation for water	Which agency or body should I contact if I need further information on helping me determine MATTE potential?	What impact have 'similar' incidents had, and where can I find more information about these?	How do I use the information gathered above to help me work out Consequence (Extent, Severity and Duration)?
5	Widespread Habitat – Non-designated water	England	See table 1.2 of H1 Annex A for data sources e.g. OS mapping Angling trust http://www.anglingtrust.net/	Use data sources to establish main types of land use, and in particular angling trust to find the local angling society, club or fishery.	Generally land use can be determined by OS mapping, and if not by local field surveying (walking / driving round to see what land-use is evident.)	For food safety – FSA For risk to people, HSE & HPA For fishing – local angling society		
		Wales						
		Scotland	e.g. OS mapping					
6	Source of public or private drinking water (groundwater or surface water)	England	See What's in your Backyard - http://www.environment-agency.gov.uk/ For surface water abstraction information discuss with EA site officer or contact 03708 506 506 or enquiries@environment-agency.gov.uk	In WIYBY, enter place or postcode, select the groundwater topic and check the Groundwater Source Protection Zone box (in Map legend on Left Hand side). N.B. you may need zoom in or out – this layer only displays at certain map scales.	SPZs are depicted as a colour overlay	Environment Agency		If drinking water is a relevant receptor the drinking water standards will need to be considered – see http://evidence.environment-agency.gov.uk/ChemicalStandards/home.aspx
		Wales						
		Scotland	Contact SEPA and the relevant local Authority asking for the location of Drinking Water abstraction in the area concerned.			SEPA Private water supplies are the responsibility of owners and users and are regulated by local authorities.		

DETR Table	Receptor Type		How can I decide which receptors I have around my site?	How do I use/interpret the information on the website?	What features are most relevant and where can I find detail of them – for example designation land, categorisation for water	Which agency or body should I contact if I need further information on helping me determine MATTE potential?	What impact have 'similar' incidents had, and where can I find more information about these?	How do I use the information gathered above to help me work out Consequence (Extent, Severity and Duration)?
6	Groundwater body (non- drinking water source)	England	See What's in your Backyard - http://www.environment-agency.gov.uk/	In WIYBY, enter place or postcode, select the groundwater topic and check the Aquifer Maps (either superficial or bedrock or both). Aquifers will appear as coloured areas. See also the topic "River basin Management Plans – Groundwater" for current and predicted status.	Groundwater bodies are a distinct volume of groundwater within an aquifer or aquifers	Environment Agency See also guidance on Environmental Damage (http://www.defra.gov.uk/environment/quality/environmental-liability/) for interpretational guidance on Damage to water		
		Wales						
		Scotland	SEPA has mapped all bedrock aquifers and selected extensive sand and gravel aquifers as groundwater bodies, and these underlie the whole mainland of Scotland and many islands. These groundwater bodies can be seen on our interactive map.	Open the map and click on the double down arrow next to table of contents. From the menu click the 2008 Classification status box. Groundwater bodies will now be shown on the map. Use the "identify" icon from the menu at the top of the map to identify which groundwater body is under the area being assessed. Other more localised sand and gravel aquifers have not been mapped as groundwater bodies due to their inherent variability and a lack of information. The presence of these more localised aquifers can only be determined using site specific data.		SEPA See also guidance on Environmental Damage (http://www.scotland.gov.uk/Resource/Doc/211199/0087791.doc) for interpretational guidance on damage to water.		

DETR Table	Receptor Type		How can I decide which receptors I have around my site?	How do I use/interpret the information on the website?	What features are most relevant and where can I find detail of them – for example designation land, categorisation for water	Which agency or body should I contact if I need further information on helping me determine MATTE potential?	What impact have 'similar' incidents had, and where can I find more information about these?	How do I use the information gathered above to help me work out Consequence (Extent, Severity and Duration)?
				SEPA's Position Statement WAT-PS-10-01, Assigning groundwater assessment criteria for pollutant inputs provides more details on how to make this determination.				
6	Other Groundwater (outside of groundwater bodies)	England	See What's in your Backyard - http://www.environment-agency.gov.uk/	Area outside of SPZs, aquifers (groundwater bodies) would not appear as coloured when the layers are selected as described above.				
		Wales						
		Scotland	See groundwater bodies above.	Groundwater bodies underlie the whole mainland of Scotland and many islands, and therefore in most cases an assessment will be required in order to justify use of this category.		SEPA		
7	Soil or sediment (i.e. as receptor rather than purely a pathway)	England	Further information on Environmental Damage Regulations http://www.defra.gov.uk/environment/quality/environmental-liability/ and see the in depth guide in particular	The definitions of Environmental damage to conservation sites and water is aligned to the MATTE thresholds above and thus covered by the above rows, thus potential environmental damage to land should be the key consideration for this receptor.	Damage to land is: ...contamination of land by substances, preparations, organisms or micro-organisms that results in a significant risk of adverse effects on human health.	Environment Agency or Local Authority	see http://www.defra.gov.uk/environment/quality/environmental-liability/ which includes incident returns detailing previous Environmental Damage cases	
		Wales						
		Scotland	Further information on the application of the Environmental Liability	The Scottish Government ELR Technical Guidance gives definitions and		SEPA or Local Authority		

DETR Table	Receptor Type		How can I decide which receptors I have around my site?	How do I use/interpret the information on the website?	What features are most relevant and where can I find detail of them – for example designation land, categorisation for water	Which agency or body should I contact if I need further information on helping me determine MATTE potential?	What impact have 'similar' incidents had, and where can I find more information about these?	How do I use the information gathered above to help me work out Consequence (Extent, Severity and Duration)?
			Regulations can be found at the SEPA Environmental Liability Regulations web-page and the Scottish Government Environmental Liability Regulations web-page	examples of "Environmental Damage".				
8	Built environment	England	http://www.english-heritage.org.uk/ www.magic.gov.uk/ "Rural Designations – statutory" for scheduled monuments and world heritage sites	In the English heritage site you can search The National Heritage List for England to search for listed buildings in your area and download copies of individual entries. The site also provides world heritage information	Use English Heritage site advanced search to limit search to Grade I listing in a given location then from the search results see list entry summary for detail	English Heritage, Local planning authority for listed buildings, Institute of historic building conservation (www.ihbc.org.uk), The National Trust, County Archaeologist (local county council)		
		Wales						
		Scotland	Scotland's Environmental Web interactive mapping page "Built Environment" Tab	Marked on the map as: Listed Buildings; Conservation Areas; Scheduled Monuments; or World Heritage sites.		Historic Scotland		

DETR Table	Receptor Type		How can I decide which receptors I have around my site?	How do I use/interpret the information on the website?	What features are most relevant and where can I find detail of them – for example designation land, categorisation for water	Which agency or body should I contact if I need further information on helping me determine MATTE potential?	What impact have 'similar' incidents had, and where can I find more information about these?	How do I use the information gathered above to help me work out Consequence (Extent, Severity and Duration)?
9	Various receptors							
10	Particular species	England	In addition to magic and JNCC (links above), see the National Biodiversity Netwok's Gateway http://data.nbn.org.uk/	In NBN gateway search for data by species or site Explore species distributions, whole datasets, protected sites and habitats using the interactive map	See in particular note on appendix 4 where such species might be associated with a designated site (thus proportion of the local population harmed, not national population is used)	Natural England and others species specific bodies such as the Amphibian and Reptile Conservation trust and the British Trust for Ornithology		
		Wales						
		Scotland						
11	Marine	England	www.magic.gov.uk/ Select "Coastal and marine resources atlas" (step 1 of interactive map). OS mapping See also What's in your Backyard - http://www.environment-agency.gov.uk/	For the status of coastal waters - In WIYBY, enter place or postcode, select the River Basin Management Plan (Coastal or estuarine) topic	Water body status depicted as a colour overlay	Environment Agency and Inshore Fishery and Conservation Authorities, See also guidance on Environmental Damage (http://www.defra.gov.uk/environment/quality/environmental-liability/) for interpretational guidance on Damage to water		
		Wales						
		Scotland	Scotland's Environmental Web (SEWeb) interactive mapping webpage	For the status of coastal waters - In SEWeb, enter place or postcode, select "Advanced Maps" then "Water" and the relevant		SEPA See also guidance on Environmental Damage (http://www.scotland.gov		

DETR Table	Receptor Type		How can I decide which receptors I have around my site?	How do I use/interpret the information on the website?	What features are most relevant and where can I find detail of them – for example designation land, categorisation for water	Which agency or body should I contact if I need further information on helping me determine MATTE potential?	What impact have 'similar' incidents had, and where can I find more information about these?	How do I use the information gathered above to help me work out Consequence (Extent, Severity and Duration)?
			The Marine Atlas and the Interactive Marine Planning Tool can assist in identifying the location and population of some species which may be of interest.	classification requirements (Coastal or estuarine). OS Explorer series (1:25 000 scale) shows the position of high and low tide marks.		.uk/Resource/Doc/211199/0087791.doc) for interpretational guidance on damage to water.		
12	Fresh and estuarine water habitats	England	www.magic.gov.uk/ For estuaries select "Coastal and marine resources atlas" (step 1 of interactive map). OS mapping See also What's in your Backyard - http://www.environment-agency.gov.uk/	For the status of fresh and estuarine waters - In WIYBY, enter place or postcode, select the River Basin Management Plan (Rivers, Lakes, Estuarine) topics	Water body status depicted as a colour overlay	Environment Agency See also guidance on Environmental Damage (http://www.defra.gov.uk/environment/quality/environmental-liability/) for interpretational guidance on Damage to water		
		Wales						
		Scotland	Scotland's Environmental Web (SEWeb) interactive mapping webpage	For the status of fresh and estuarine waters - In SEWeb, enter place or postcode, select "Water" and the relevant classification requirements (Rivers, Lochs, Estuarine)	Water body status can be selected	SEPA See also guidance on Environmental Damage (http://www.scotland.gov.uk/Resource/Doc/211199/0087791.doc) for interpretational guidance on damage to water.		

Appendix 4 – MATTE tolerability tables

Table 1 - Severity/Harm criteria for consideration as a major accident (based on unmitigated consequence)

Row	DETR Table Ref	Receptor Type	Severity of Harm				Reference to Table 2	Comments
			Significant *While this level of harm might be significant pollution, it is not considered a MATTE.*	**Severe** *DETR Criteria - the lowest level of harm that might be considered MATTE.*	**Major**	**Catastrophic**	*Corresponding Harm/Duration / Recovery row in Table 2*	*The 'Severe' to 'Catastrophic' levels of harm are considered to be included as 'Serious' with respect to the COMAH definition of a major accident.* *Receptors include:*
		Severity Level →	**1**	**2**	**3**	**4**		
1	**1**	Designated Land/Water Sites (Nationally important)	<0.5ha or <10%	>0.5ha or 10-50% of site area, associated linear feature or population	>50% of site area, associated linear feature or population	*N/A*	Land or Surface Water	NNR, SSSI, MNR
2	**2**	Designated Land/Water Sites (Internationally important)	<0.5ha or <5% (<5% LF/Pop)	>0.5ha or 5-25% of site area or 5-25% of associated linear feature or population	25-50% of site area, associated linear feature or population	>50% of site area, associated linear feature or population	Land or Surface Water	SAC, SPA, RAMSAR
3	**3**	Other designated Land	<10ha or <10%	10-100ha or 10-50% of land	>100ha or >50% of land	*N/A*	Land	ESA, AONB, National Park, etc.
4	**4**	Scarce Habitat	<2 ha or <10%	2-20ha or 10-50% of habitat	>20ha or >50% of habitat	*N/A*	Land or Surface Water	BAP habitats, geological features

Row	DETR Table Ref	Receptor Type	Severity of Harm				Reference to Table 2	Comments
			Significant *While this level of harm might be significant pollution, it is not considered a MATTE.*	**Severe** *DETR Criteria - the lowest level of harm that might be considered MATTE.*	**Major**	**Catastrophic**	*Corresponding Harm/Duration / Recovery row in Table 2*	*The 'Severe' to 'Catastrophic' levels of harm are considered to be included as 'Serious' with respect to the COMAH definition of a major accident.* *Receptors include:*
		Severity Level →	**1**	**2**	**3**	**4**		
5	**5**	Widespread Habitat - Non-designated Land	<10ha	Contamination of 10-100ha of land, preventing growing of crops, grazing of domestic animals or renders the area inaccessible to the public because of possible skin contact with dangerous substances. Alternatively, contamination of 10ha or more of vacant land.	100-1000ha (applied as per text under 'Severe')	>1000ha (applied as per text under 'Severe')	Land	Land/water used for agriculture, forestry, fishing or aquaculture
6	**5**	Widespread Habitat - Non-designated Water		Contamination of aquatic habitat which prevents fishing or aquaculture or renders is inaccessible to the public.	*N/A*	*N/A*	Surface Water	Land/water used for agriculture, forestry, fishing or aquaculture

Row	DETR Table Ref	Receptor Type	Severity of Harm				Reference to Table 2	Comments
			Significant *While this level of harm might be significant pollution, it is not considered a MATTE.*	**Severe** *DETR Criteria - the lowest level of harm that might be considered MATTE.*	**Major**	**Catastrophic**	*Corresponding Harm/Duration / Recovery row in Table 2*	*The 'Severe' to 'Catastrophic' levels of harm are considered to be included as 'Serious' with respect to the COMAH definition of a major accident.* *Receptors include:*
		Severity Level →	**1**	**2**	**3**	**4**		
7	**6**	Source of Public or Private Drinking Water (Groundwater or Surface Water)	Interruption of drinking water supply <1000 person-hours or For England & Wales only <1ha SPZ	Interruption of drinking water supplied from a ground or surface source (where persons affected x duration in hours [at least 2] > 1,000) or For England & Wales only 1-10ha of SPZ where drinking water standards are breached	>1 x 10^7 person-hours interruption of drinking water (a town of ~100,000 people losing supply for month) or For England & Wales only 10-100ha SPZ drinking water standards breached	>1 x 10^9 person-hours interruption of drinking (~1 million people losing supply for 1 month) or For England & Wales only >100ha SPZ drinking water standards breached	Groundwater body or Surface Water Public Drinking Water Source	In England the area of groundwater, used for public drinking water, at risk from pollution is mapped using Source Protection Zones (SPZs). In Scotland, there is not an equivalent mapping of SPZs and only the interuption criteria should be used.

Row	DETR Table Ref	Receptor Type	Severity of Harm				Reference to Table 2	Comments
			Significant *While this level of harm might be significant pollution, it is not considered a MATTE.*	**Severe** *DETR Criteria - the lowest level of harm that might be considered MATTE.*	**Major**	**Catastrophic**	*Corresponding Harm/Duration / Recovery row in Table 2*	*The 'Severe' to 'Catastrophic' levels of harm are considered to be included as 'Serious' with respect to the COMAH definition of a major accident.* *Receptors include:*
		Severity Level →	**1**	**2**	**3**	**4**		
8	**6**	Groundwater Body (non- Drinking Water Source)	<1ha	1-100ha of groundwater body where the WFD status has been lowered	100-10,000ha	>10,000ha	Groundwater body or Surface Water Public Drinking Water Source	UKTAG has determined that to qualify as a body of groundwater, an aquifer must be capable of supplying 10m3 per day or 50 people (on a continuous basis) and that such aquifers/groundwater bodies have future resource value which must be protected.
9	**6**	Other Groundwater (outside of groundwater bodies)	Groundwater not a pathway to another receptor.	*Where the groundwater is a pathway for another receptor assess against relevant criteria for the receptor.*			*N/A*	

Row	DETR Table Ref	Receptor Type	Severity of Harm				Reference to Table 2	Comments
			Significant *While this level of harm might be significant pollution, it is not considered a MATTE.*	**Severe** *DETR Criteria - the lowest level of harm that might be considered MATTE.*	**Major**	**Catastrophic**	*Corresponding Harm/Duration / Recovery row in Table 2*	*The 'Severe' to 'Catastrophic' levels of harm are considered to be included as 'Serious' with respect to the COMAH definition of a major accident.* *Receptors include:*
		Severity Level →	**1**	**2**	**3**	**4**		
10	**7**	Soil or sediment (i.e. as receptor rather than purely a pathway)	Contamination not leading to environmental damage (as per ELD), or not significantly affecting overlying water quality.	Contamination of 10-100ha of land etc. as per Widespread Habitat; Contamination sufficient to be deemed environmental damage (Environmental Liability Directive)	Contamination of 100-1000ha of land, as per Widespread Habitat; Contamination rendering the soil immediately hazardous to humans (e.g. skin contact) or the living environment, but remediation available.	Contamination of >1000ha of land, as per Widespread Habitat; Contamination rendering the soil immediately hazardous to humans (e.g. skin contact) or the living environment and remediation difficult or impossible.	Land	
11	**8**	Built environment	Damage below a level at which designation of importance would be withdrawn.	Damage sufficient for designation of importance to be withdrawn.	Feature of built environment subject to designation of importance entirely destroyed.	*N/A*	Built Environment	This is limited to Grade 1 / Cat A Listed buildings, scheduled ancient monuments, conservation area, etc.

Row	DETR Table Ref	Receptor Type	Severity of Harm				Reference to Table 2	Comments
			Significant *While this level of harm might be significant pollution, it is not considered a MATTE.*	**Severe** *DETR Criteria - the lowest level of harm that might be considered MATTE.*	**Major**	**Catastrophic**	*Corresponding Harm/Duration / Recovery row in Table 2*	*The 'Severe' to 'Catastrophic' levels of harm are considered to be included as 'Serious' with respect to the COMAH definition of a major accident.* *Receptors include:*
		Severity Level →	**1**	**2**	**3**	**4**		
12	**9**	Various receptors. Should not be used to identify and assess MATTE.	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	Refer to DETR. Standards relating to continuous emissions, contained in other EU legislation.
13	**10**	Particular species (Note - these criteria apply nationally - i.e. England, Wales, Scotland)	Loss of <1% of animal or <5% of plant ground cover in a habitat.	Loss of 1-10% of animal or 5-50% of plant ground cover.	Loss of 10-90% of animal or 50-90% of plant ground cover.	Total loss (>90%) of animal or plant ground cover.	Land	
14	**11**	Marine	<2ha littoral or sub-littoral zone, <100ha of open sea benthic community, <100 dead sea birds (<500 gulls), <5 dead/significantly impaired sea mammals	2-20ha littoral or sub-littoral zone, 100-1000ha of open sea benthic community, 100-1000 dead sea birds (500-5000 gulls), 5-50 dead/significantly impaired sea mammals	20-200ha littoral or sub-littoral zone, 100-10,000ha of open sea benthic community, 1000-10,000 dead sea birds (5,000-50,000 gulls), 50-500 dead/significantly impaired sea mammals	>200ha littoral or sub-littoral zone, >10000ha of open sea benthic community, >10000 dead sea birds (>50000 gulls), >500 dead/significantly impaired sea mammals	Surface Water	

Row	DETR Table Ref	Receptor Type	Severity of Harm				Reference to Table 2	Comments
			Significant *While this level of harm might be significant pollution, it is not considered a MATTE.*	**Severe** *DETR Criteria - the lowest level of harm that might be considered MATTE.*	**Major**	**Catastrophic**	*Corresponding Harm/Duration / Recovery row in Table 2*	*The 'Severe' to 'Catastrophic' levels of harm are considered to be included as 'Serious' with respect to the COMAH definition of a major accident.* *Receptors include:*
		Severity Level →	**1**	**2**	**3**	**4**		
15	**12**	Fresh and estuarine water habitats	Impact below that of Severity level 2	WFD Chemical or ecological status lowered by one class for 2-10km of watercourse or 2-20ha or 10-50% area of estuaries or ponds. Plus interruption of drinking water supplies, as per DETR Table 6	WFD Chemical or ecological status lowered by one class for 10-200km of watercourse or 20-200ha or 50-90% area of estuaries and ponds. Plus interruption of drinking water supplies, as per DETR Table 6	WFD Chemical or ecological status lowered by one class for >200km of watercourse or >200ha or >90% area of estuaries and ponds. Plus interruption of drinking water supplies, as per DETR Table 6	Surface Water	

Notes for Table 1:

In applying the criteria on this sheet, an estimate of the mean population of species will be required, subject to data available. Variability in population might be relevant for later detailed scenario assessments, but a mean is more relevant to the initial selection criteria here.

When applying the criteria above, note that receptors are not mutually exclusive - for example some sites are both Ramsar and SSSI, while the 'widespread habitat' rows might apply irrespective of any specific designations.

To avoid disproportionate application of percentage criteria on small receptors, for small sites, the percentage criteria will not reduce the threshold to lower than half the absolute criteria.

Glossary of terms for table 1

Littoral: pertaining to the shore of a lake, sea, or ocean.
Sub-littoral zone: from the low water line to the edge of the continental shelf
Benthic community: is made up of organisms that live in and on the bottom of the ocean floor.
WFD: Water Framework Directive
SAC: Special Area of Conservation
SPA: Special Protection Area
RAMSAR: Wetlands of international importance,
NNR: National Nature Reserve
MNR: Marine Nature Reserve
BAP habitat: Biodiversity Action Plan habitat
ESA: Environmentally Sensitive Area

Table 2 – Duration/Recovery criteria (based on unmitigated consequence)

Description	Short term	Medium term	Long term	Very long term
	Harm with such short recovery is not considered a MATTE.			
Harm Duration Category → (From Table 1)	**1**	**2**	**3**	**4**
LAND	≤ 3 years	> 3 years or > 2 growing seasons for agricultural land	> 20 years	> 50 years
SURFACE WATER (ALL EXCEPT PUBLIC OR PRIVATE DRINKING WATER SOURCE)	≤ 1 year	> 1 year	>10 years	>20 years
GROUNDWATER BODY OR SURFACE WATER PUBLIC OR PRIVATE DRINKING WATER SOURCE	*N/A*	Harm affecting non-public drinking water source.	Harm affecting public drinking water source or SPZ.	*N/A*
BUILT ENVIRONMENT	Can be repaired in < 3 years, such that its designation can be reinstated	Can be repaired in > 3 years, such that its designation can be reinstated	Feature destroyed, cannot be rebuilt, all features except world heritage site	Feature destroyed, cannot be rebuilt, world heritage site

Notes for Table 2:

Separate criteria are provided in Table 2 depending on the nature of the site, be it land, surface water or groundwater - these shall be applied in conjunction with the corresponding harm criteria in Table 1.

These criteria are based on estimating the likely time for the habitat (or species, etc.) has substantially recovered (unaided) from the damage caused. Complete recovery is difficult to judge for the environment, and hence it is suggested that this should be clarified as >80% of the damage.

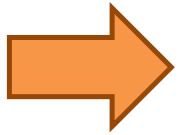
There are no obvious time criteria to apply to groundwater bodies or drinking water sources. In this case, Table 2 effectively reduces the tolerability of affecting a drinking water source compared with non-drinking water groundwater bodies.

The time specified for long and very long term harm durations are stated as guides to help assess potential recovery time if the impact to the receptor was left to natural recovery alone. Consider the mechanisms that could influence this, such as (weathering, natural bio-remediation or breakdown and replenishment through flushing, dilution etc.) and if these alone could achieve the natural recovery in this specified time.

Table 3 - Method and Matrix for Deriving Receptor Tolerability for MATTE
(based on unmitigated consequence)

1 Identify scenario and receptor affected.
2 Select Harm Severity Level (Table 1)
3 Select Duration / Recovery Category (Table 2)
4 Apply to Tolerability Assessment Matrix to determine tolerability boundaries.

Severity of Harm					
	4		C	D	D
	3		B	C	D
	2		A	B	C
	1	*Sub-MATTE Harm*			
		1	2	3	4
		Harm Duration Category			



Frequency at which the CDOIF consequence level is reached or exceeded	Frequency per receptor per establishment per year	
	Intolerable (greater than)	Broadly Acceptable (less than)
A	1.0 E-02	1.0 E-04
B	1.0 E-03	1.0 E-05
C	1.0 E-04	1.0 E-06
D	1.0 E-05	1.0 E-07

Appendix 5 – Tables to assess MATTE potential

Table 1 – MATTE Potential Summary Matrix

Row	DETR Table Ref	Receptor Type See Table 2 of Appendix 5 for receptor detail	MATTE threshold See Table 3 of Appendix 5 for description of identified MATTE scenarios	Substance / group of substances (see table 4 of Appendix 5 for description of substances or substance groups) 1	2	3	4	5	6	7	Etc.	Etc.	
1	1	Designated Land/Water Sites (Nationally important)	>0.5ha or 10-50%										
2	2	Designated Land/Water Sites (Internationally important)	>0.5ha or 5-25% (5-25% LF/Pop)										
3	3	Other designated Land	10-100ha or 10-50%										
4	4	Scarce Habitat	2-20 ha or 10-50%										
5	5a	Widespread Habitat - Non-designated Land	>10ha										
6	5b	Widespread Habitat - Non-designated Water	Contamination of aquatic habitat which prevents fishing or aquaculture or renders is inaccessible to the public.										

Row	DETR Table Ref	Receptor Type	MATTE threshold	Substance / group of substances (see table 4 of Appendix 5 for description of substances or substance groups)									
		See Table 2 of Appendix 5 for receptor detail	See Table 3 of Appendix 5 for description of identified MATTE scenarios	1	2	3	4	5	6	7	Etc.	Etc.	
7	6	Groundwater Body - Source Protection Zone (SPZ) for Public Drinking Water Supplies (Note - refer to EA website for SPZ aquifer maps.)	>1ha SPZ or >1000 person-hours interruption										
8	6	Groundwater Body (non-SPZ)	>1ha										
9	6	Groundwater (non-groundwater body wrt Water Framework Directive)	Please indicate if non groundwater body is a pathway to another receptor.										
10	7	Soil or sediment (i.e. as receptor rather than purely a pathway)	>10ha Contamination leading to environmental damage (as per ELD), or significantly affecting overlying water quality.										
11	8	Built environment	Damage above a level at which designation of importance would be withdrawn.										

Row	DETR Table Ref	Receptor Type	MATTE threshold	Substance / group of substances (see table 4 of Appendix 5 for description of substances or substance groups)									
		See Table 2 of Appendix 5 for receptor detail	See Table 3 of Appendix 5 for description of identified MATTE scenarios	1	2	3	4	5	6	7	Etc.	Etc.	
12	9	Various receptors. Not used to identify and assess MATTE.											
13	10	Particular species (Note - these criteria apply nationally - i.e. England, Wales, Scotland)	Loss of >1% of animal or >5% of plant ground cover in a habitat.										
14	11	Marine	>2ha littoral or sub-littoral zone, >100ha of open sea benthic community, >100 dead sea birds (>500 gulls), >5 dead/significantly impaired sea mammals										
15	12	Fresh and estuarine water habitats	WFD Chemical or ecological status lowered by one class for >2km of watercourse or >10% area (estuaries or ponds) or >2 ha of estuaries and >2ha of ponds. Plus interruption of drinking water supplies, as per DETR Table 6										

Table 2 – Receptor Detail

Row	DETR Table Ref	Receptor Type	MATTE threshold	Receptor Detail
1	1	Designated Land/Water Sites (Nationally important)	>0.5ha or 10-50%	
2	2	Designated Land/Water Sites (Internationally important)	>0.5ha or 5-25% (5-25% LF/Pop)	
3	3	Other designated Land	10-100ha or 10-50%	
4	4	Scarce Habitat	2-20ha or 10-50%	
5	5a	Widespread Habitat - Non-designated Land	>10ha	
6	5b	Widespread Habitat - Non-designated Water	>10ha	
7	6	Groundwater Body - Source Protection Zone (SPZ) for Public Drinking Water Supplies (Note - refer to EA website for SPZ aquifer maps.)	>1ha SPZ or >1000 person-hours interruption	
8	6	Groundwater Body (non-SPZ)	>1ha	
9	6	Groundwater (non-groundwater body wrt Water Framework Directive)	Please indicate if non groundwater body is a pathway to another receptor.	

Row	DETR Table Ref	Receptor Type	MATTE threshold	Receptor Detail
10	7	Soil or sediment (i.e. as receptor rather than purely a pathway)	Contamination leading to environmental damage (as per ELD), or significantly affecting overlying water quality.	
11	8	Built environment	Damage above a level at which designation of importance would be withdrawn.	
12	9	Various receptors. Not used to identify and assess MATTE.		
13	10	Particular species (Note - these criteria apply nationally - i.e. England, Wales, Scotland)	Loss of >1% of animal or >5% of plant ground cover in a habitat.	
14	11	Marine	>2ha littoral or sub-littoral zone, >100ha of open sea benthic community, >100 dead sea birds (>500 gulls), >5 dead/significantly impaired sea mammals	

Row	DETR Table Ref	Receptor Type	MATTE threshold	Receptor Detail
15	12	Fresh and estuarine water habitats	WFD Chemical or ecological status lowered by one class for >2km of watercourse or >10% area (estuaries or ponds) or >2 ha of estuaries and >2ha of ponds. Plus interruption of drinking water supplies, as per DETR Table 6	

Table 3 – MATTE Scenarios

Row	DETR Table Ref	Receptor Type	MATTE threshold	Credible MATTE Scenarios
1	1	Designated Land/Water Sites (Nationally important)	>0.5ha or 10-50%	
2	2	Designated Land/Water Sites (Internationally important)	>0.5ha or 5-25% (5-25% LF/Pop)	
3	3	Other designated Land	10-100ha or 10-50%	
4	4	Scarce Habitat	2-20 ha or 10-50%	
5	5a	Widespread Habitat - Non-designated Land	>10ha	
6	5b	Widespread Habitat - Non-designated Water	>10ha	
7	6	Groundwater Body - Source Protection Zone (SPZ) for Public Drinking Water Supplies (Note - refer to EA website for SPZ aquifer maps.)	>1ha SPZ or >1000 person-hours interruption	
8	6	Groundwater Body (non-SPZ)	>1ha	
9	6	Groundwater (non-groundwater body wrt Water Framework Directive)	Please indicate if non groundwater body is a pathway to another receptor.	

Row	DETR Table Ref	Receptor Type	MATTE threshold	Credible MATTE Scenarios
10	7	Soil or sediment (i.e. as receptor rather than purely a pathway)	Contamination leading to environmental damage (as per ELD), or significantly affecting overlying water quality.	
11	8	Built environment	Damage above a level at which designation of importance would be withdrawn.	
12	9	Various receptors. Not used to identify and assess MATTE.		
13	10	Particular species (Note - these criteria apply nationally - i.e. England, Wales, Scotland)	Loss of >1% of animal or >5% of plant ground cover in a habitat.	
14	11	Marine	>2ha littoral or sub-littoral zone, >100ha of open sea benthic community, >100 dead sea birds (>500 gulls), >5 dead/significantly impaired sea mammals	

Row	DETR Table Ref	Receptor Type	MATTE threshold	Credible MATTE Scenarios
15	12	Fresh and estuarine water habitats	WFD Chemical or ecological status lowered by one class for >2km of watercourse or >10% area (estuaries or ponds) or >2 ha of estuaries and >2ha of ponds. Plus interruption of drinking water supplies, as per DETR Table 6	

Table 4 – Dangerous Substances with Environmental Risk

Part 1 - Substance List

Substance Reference	**Substance (or group of substances)**					**Maximum Inventory (tonnes)**	**Description**	**Physical State**	**Quantity**	**Ref for further info (e.g. SR section...)**
	Common name	IUPAC Name	CAS Number	CHIP Index	Risk Phases					
1										
2										
3										
4										
5										
6										
7										
Etc.										
Etc.										

CDOIF **Chemical and Downstream Oil Industries Forum**	*CDOIF is a collaborative venture formed to agree strategic areas for joint industry / trade union / regulator action aimed at delivering health, safety and environmental improvements with cross-sector benefits.*

Part 2 - Chemical Hazards

Substance Reference	A	B	C	D	E	F	G	Etc.	Etc.
Explosion/Flammability Hazards									
Fire									
Deflagration/Detonation									
Electrical Static									
Reactivity/Stability Hazards									
Immediate Health Hazards									
Inhalation Toxicity									
Other Toxicity									
Irritant/Corrosive									
Sensitizer									
Long Term or Delayed Health Hazards									
Chronic Health Hazards									
Radiation									
Nuisance									
Odour									
Environmental Hazards									
Aqueous									
Gaseous									
Ground									
Hazardous Breakdown Products									