Lessons Learned from Practical Implementation of CDOIF Environmental Risk Tolerability Guideline for COMAH Establishments

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The Chemical and Downstream Oil Industries Forum (CDOIF) Environmental Risk Tolerability Guideline was published in December 2013 and remained live to allow industry to use the process and provide feedback on any significant issues that arose from its implementation.

The purpose of the guidance is to provide a common methodology by which environmental risk assessments for establishments subject to the Control of Major Accident Hazards (COMAH) Regulations can be carried out to demonstrate environmental risk has been reduced to a tolerable level.

ABB has practically implemented the CDOIF Guideline methodology for COMAH establishments within the chemical and petroleum industry sectors, which have been situated in a variety of environmental settings.

This Paper provides some background to the COMAH Regulations and the requirement to complete an environmental risk assessment, an overview of the previous guidance for completing an environmental risk assessment for a COMAH establishment, a brief overview of the new CDOIF Environmental Risk Tolerability Guideline and details of the experience and lessons learned during implementation of the CDOIF methodology. In summary the experience and lessons learned include:

- The environmental risk assessment should be underpinned by a comprehensive desk based study. It is critical that as much relevant information on the site and its surrounds as possible is collated. It is important to have experienced environmental experts to work with the operators of the establishments to utilise their knowledge and obtain site based information (such as existing site investigation reports) to ensure critical pollutant linkages are not missed.
- A full understanding of sources (major environmental hazards), pathways and receptors (S-P-R) and the linkage between them is critical as this forms the basis of the assessment of the potential for a Major Accident to the Environment (MATTE). It is important to spend time on this element of the environmental risk assessment.
- Identification and characterisation of the environmental receptors is critical. Understanding why environmental receptors are designated and their sensitivity is required to allow an assessment of the consequences of a release from an establishments and whether it would be classified as a MATTE.
- Whilst addressing environmental risk, the application of the CDOIF methodology requires a multi-disciplinary team consisting of environmental expertise and process safety expertise, to implement it effectively. An integrated team approach ensures the environmental risk and major hazard scenarios have been thoroughly assessed. Process Safety experts provide the key input into characterising the major environmental hazards, providing the necessary frequency analysis for credible major hazard events and the tolerability assessment within the CDOIF methodology, whilst also offering expertise in As Low As Reasonably Practical (ALARP) demonstration and cost benefit analysis.
- Whilst the CDOIF Guideline is considered a screening tool at establishments that have a wide ranging and large inventory of chemicals and/or where sites are located in sensitive environmental settings with a number of environmental receptors the MATTE assessment of the individual S-P-R linkages can be time consuming, and should not be underestimated.
- The CDOIF Guideline does provide a good common methodology for assessing environmental risk from establishments. Where the methodology has been applied this has provided sensible, measured outcomes which allow establishments to target the high risk areas with respect to resources and facility improvements.
- The CDOIF Guidance itself could, in ABB's opinion, be simplified as currently the way the Guidance is written over complicates the process.

Keywords: CDOIF Guideline, Environmental Risk Assessment, COMAH, Risk Tolerability

COMAH and Environmental Risk Assessment

The COMAH Regulations ensure that every operator shall take measures to prevent major accidents. Their main aim is to prevent and mitigate the effects of those major accidents involving dangerous substances, which can cause serious damage/harm to people and/or the environment.

The Control of Major Accident Hazards (COMAH) Regulations 1999 came into force in 1999 and was amended by the in 2005. COMAH regulations implement the Seveso II Directive and replaced the Control of Industrial Major Accident Hazards Regulations 1984 (CIMAH). The current COMAH Regulations 1999 will be repealed on 31 May 2015 to be replaced on 1 June 2015 with the COMAH Regulations 2015 that will implement the majority of the Seveso III Directive. The Seveso III Directive does not fundamentally alter the regulatory regime laid out in Seveso II but does strengthen a number of areas such as public access information and standards of inspections.

The European industrial safety regulations known as the Seveso II Directive were brought into force following the Seveso disaster. This was an industrial accident that occurred in 1976, in a small chemical manufacturing plant approximately 9

miles north of Milan in the Lombardy region in Italy. It resulted in the highest known exposure to 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) in residential populations and contamination of some ten square miles of land and vegetation.

Requirements to protect the environment from the consequences of major accidents were strengthened in Seveso II. Unlike its predecessor, (CIMAH), the COMAH Regulations place a stronger emphasis on the protection of the environment as well as human health. Under the COMAH regime there is a fundamental requirement for operators to perform an environmental risk assessment to clearly demonstrate that risks have been identified and prevention measure put in place.

The COMAH Regulations are enforced by a competent authority (CA) consisting of the Health and Safety Executive and the Environment Agency (in England) / Natural Resources Wales (in Wales) / Scottish Environment Protection Agency (in Scotland), thus ensuring both health and safety and environmental risks are jointly regulated.

The duty on operators under the COMAH Regulations is to take all measures necessary to prevent major accidents and limit their consequences to persons and the environment. The duty is to protect the whole environment from the potentially devastating effects of a major accident such as those occurring in the past at Seveso or to the River Rhine following the chemical warehouse fire at Basle in 1986.

The leak at the Sandoz factory was Europe's worst environmental disaster for a decade and instigated the strengthening of legislation to protect the environment from major accidents. A catastrophic fire at the chemicals factory near Basel, Switzerland, sent tons of toxic chemicals (pesticides, mercury and other highly poisonous agricultural chemicals) into the nearby river Rhine, turning it red. Within 10 days the pollution had travelled the length of the Rhine and into the North Sea. An estimated half a million fish were killed and some species were wiped out entirely.

Operators of sites that hold larger quantities of dangerous substances ('top tier' sites) are subject to more onerous requirements than those of 'lower tier' sites. Top tier operators have to comply with the requirements for a lower tier site including preparing a major accident prevention policy, but also have to prepare and maintain a safety report, prepare and test an on-site emergency plan, supply information to local authorities for off-site emergency planning purposes, and provide certain information to the public about their activities. Risk to the environment needs to be considered by both top tier and lower tier sites. As part of the safety report submitted to the Competent Authority, top tier sites need to demonstrate that the environmental risk for the whole 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. Whilst not required to be submitted to the Competent Authority these must be available for inspection by the Competent Authority.

Existing Environmental Assessment Guidance for COMAH

Guidance on what should be regarded as a major accident to the environment (MATTE) was first published by the then Department of the Environment in June 1991. The guidance was designed to help inspectors in the Health and Safety Executive who were undertaking the assessment of safety reports submitted under the CIMAH Regulations but also proved helpful to the operators preparing the reports in the first place.

When the COMAH Regulations were implemented, the 1991 guidance on major accidents to the environment was reviewed to ensure that its scope was adequate for the purposes of COMAH. In initiating the review process, the then Department of the Environment, Transport and the Regions (DETR) was also aware of progress made in understanding ecosystem operation and recovery following accidents and wanted to take account of the experience of industry in preparing safety reports under the CIMAH Regulations.

Guidance on the Interpretation of Major Accident to the Environment for the Purposes of the COMAH Regulations was published in June 1999. The DETR 1999 guidance was intended to help regulators and operators judge the scale of an event which would be interpreted as leading to serious damage to the environment under COMAH and to assist operators with the identification of potential major accident scenarios for the compilation of safety reports for top tier COMAH sites. It was also intended to help with the development of preventive measures to be taken to avoid such an accident, and in the preparation of emergency plans and clean-up and restoration strategies to be followed in the event of an incident.

Background on CDOIF Guideline on Environmental Risk Tolerability

At the end of 2013 new guidance on environmental risk assessment for COMAH sites was published. This was the Chemicals and Downstream Oil Industries Forum (CDOIF) Guideline on Environmental Risk Tolerability for COMAH Establishments. The document remained live during 2014 to allow feedback on its use and application.

The CDOIF guidance on environmental risk tolerability builds on the existing environmental assessment guidance published by the Department for the Environment, Transport and Regions in June 1999. The DETR 1999 Guidance sets out receptor types requiring assessment and provided guidance on the identification of MATTE, however there is limited understanding of risk within the document with more emphasis placed on consequence. As stated in the Forward of the document, the intention of the CDOIF Guideline is not to replace the existing DETR 1999 Guidance but to provide a framework and screening methodology by which regulators and duty holders can apply it.

In summary, as stated in the document, the CDOIF Guideline 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 risks may be evaluated.
- Guidance on how to include the cost of environmental harm in a COMAH cost benefit analysis.

The CDOIF Guideline introduces proportionality into environmental risk assessment for the purpose of COMAH, in a similar way as the assessment of risks to people, with environmental risk assessed within the established 'As Low As Reasonably Practicable' (ALARP) framework.

The CDOIF Guidance provides a screening methodology for carrying out a COMAH Environmental Risk Assessment. The assessment requires the identification of the hazards that will result in a Major Accident to the Environment (MATTE).

The process involves:

- Identification and evaluation of 'source-pathway-receptor' linkages for different credible 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 the methodology ultimately allows an assessment of the tolerability of risk to each receptor from a COMAH establishment site as a whole. The tolerability scale ranges from intolerable (which would require risk reduction almost regardless of cost) to broadly acceptable (and meeting relevant good practice), with a region in between referenced as Tolerable If As Low As Reasonably Practicable (TifALARP) i.e. good practice has been achieved alongside risk reduction measures unless the risk reduction measures are not practicable or costs are 'grossly disproportionate' to the identified risks.

This understanding of risk tolerability can then be used to target the greatest risk areas that may be present at an establishment.

The guidance requires a staged approach to assessment. The initial step is the identification of potential receptors in the vicinity of an establishment. The next step is to screen for potential credible MATTE scenarios (as shown on Table 1 of the MATTE assessment tables). This is underpinned by the assessment of plausible 'Source-Pathway-Receptor' (S-P-R) linkages. The screening is based on the unmitigated consequence case i.e. the potential consequence from credible scenarios before any mitigation measures are employed. For each identified SPR linkage based on a credible scenario a MATTE consequence level A to D (as applicable) is assigned based on the evaluation of the severity of harm and the duration of harm to the receptor. This is a qualitative assessment using Table 1 and 2 in Appendix 4 of the CDOIF guidance.

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 described below.

The unmitigated and mitigated frequency of occurrence of all credible scenarios is calculated. The aggregated total frequency of all scenarios from the establishment are then compared to the CDOIF tolerability thresholds to determine whether the risks to each receptor at each consequence level are 'Broadly Acceptable', 'Intolerable' or 'Tolerable if ALARP'. This assessment is carried out for both the unmitigated and mitigated cases.

The guidance is not intended to provide a detailed assessment process but to provide a screening mechanism by which risks to environmental receptors can be reviewed. This allows focus to be placed on those areas of an Establishment posing the greatest risk with either further more detailed assessment carried out or provision of additional preventative measures.

Lessons Learned from Practical Implementation of the CDOIF Guideline

ABB applied the CDOIF Guideline methodology at a number of COMAH establishments during 2014 within the chemical and petroleum industry sectors. These sites have been situated in a variety of environmental settings, ranging from city centre urban locations to sensitive estuarine locations with numerous international and national ecological designations. The lessons learned from this practical implementation of the CDOIF Guideline are detailed below. The methodology has been applied at Establishments that were updating their safety reports and had existing COMAH environmental risk assessments and also at an Establishment preparing a safety report for the first time due to the introduction of a new plant and process that meant the Establishment is now a top tier site under the COMAH Regulations.

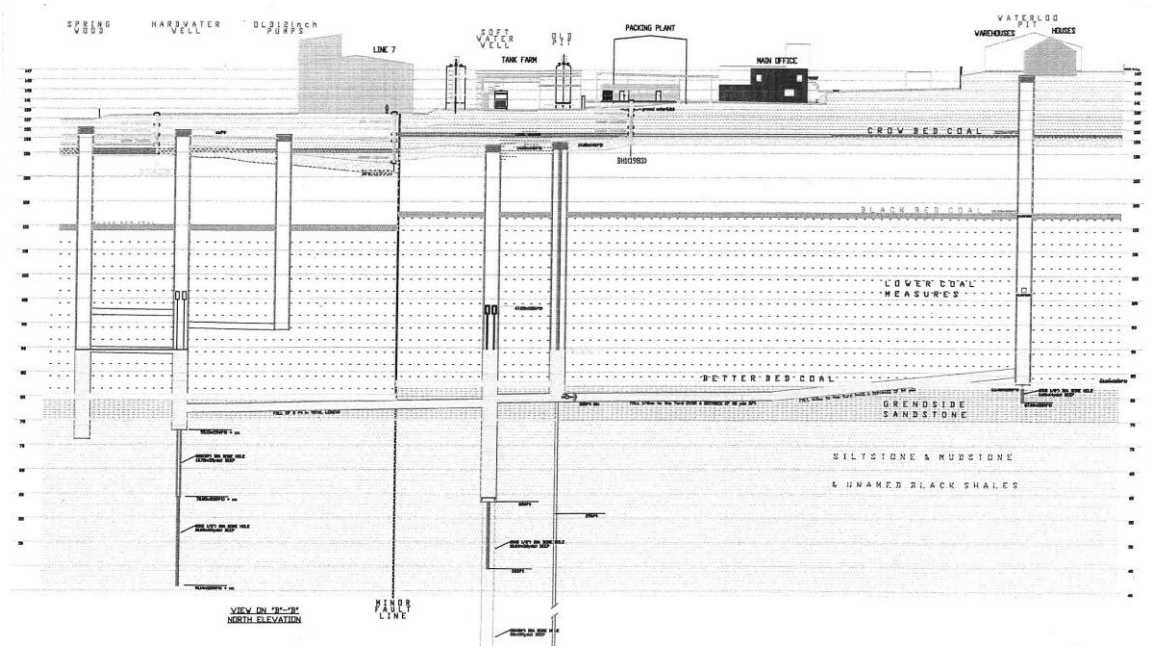
Desk Study

Establishments tend to have an extensive amount of information regarding sources, pathways and receptors. This may be in the form of environmental assessments conducted for previous safety reports, information used to support environmental permits (such as Site Monitoring and Maintenance Plans) and historic site investigation information from former construction work or due diligence assessments. The key is working closely with Clients to obtain the relevant information held by the Establishment to help develop the conceptual site model of sources, pathways and receptors. Environmental assessments carried out for other regulatory regimes may not be directly relevant but the information within the assessments, for example on ground and groundwater conditions, will be critical to assessing whether any pathways to identified receptors exist and can be utilised in the COMAH environmental risk assessment.

As an example, one Establishment worked on had not previously fallen under the COMAH Regulations but the planned introduction of a new process meant that they would be classified as a top tier site and would require an environmental assessment as part of the safety report. Initially when starting the process of producing the safety report, the Establishment believed they had only limited environmental information. Basic desk based information was gathered by interrogating the data sources listed within the CDOIF Guideline and through purchase of an Envirocheck Report and utility information. However, during discussions with a number of personnel in initial meetings and a site walkover it became apparent that the Establishment held site investigation information from construction works carried out on site and from the Application Site Report that had been prepared historically as part of the original PPC application for the site.

This provided critical supplemental site specific information on ground conditions at the site, including the absence of a confining layer of clay over part of the site and the presence of a number of mine shafts below the site which could act as potential direct pathways to groundwater below the site if there was a liquid release on site. Whilst two shafts had been identified as part of the basic desk study, the historic site records showed a much more extensive network of shafts.

Figure 1: Example of Historic Records



Often the information may also be anecdotal information from long service workers. For example, on the same site the presence and location of a culverted watercourse was critical to whether there was a potential pollutant linkage. Records on the location and condition of the culvert were limited however discussion with one of the site engineers revealed that the culvert had been repaired a number of years ago and this provided details on where the culvert was located and its design, allowing an assessment of whether it represented a viable pathway. It is therefore important to have experienced environmental personnel conducting the desk study and data collation who know what type of information to ask for and to obtain the relevant information held by an establishment.

Conceptual Site Model

The basis of the assessment of the potential for a Major Accident to the Environment (MATTE) from an establishment is the presence of potential pollutant linkages. The CDOIF guidance requires a risk assessment to be completed using a 'source-pathway-receptor' approach to identify potential pollutant linkages. This requires the identification of:

- the quantity, location and properties of environmentally hazardous materials present on site (sources);
- the routes (pathways) by which the sources might be able to reach surrounding environments; and
- the sensitivity of receiving environments or organisms (receptors).

All three components create a pollutant linkage and must be present or, may be present as a result of a major accident and a release, to create an environmental risk that may ultimately be defined as a Major Accident to the Environment (MATTE). Once all plausible 'source-pathway-receptor' relationships have been identified the CDOIF methodology can then be used to determine if potential pollutant linkages may give rise to a MATTE using prescribed criteria to assess the potential severity and duration of harm to a receptor.

Given the importance of these three components in the environmental risk assessment process and to the identification of MATTEs, experience shows it is critical that time is spent ensuring all potential linkages are identified and all available information is used to develop a conceptual model of the potential linkages.

The CDOIF Guideline provides a template MATTE Potential Summary Matrix (Table 1 of Appendix 5 of the Guideline) for identifying the potential pollutant linkages at the site. It has been our experience that this represents a good screening tool for allowing identification of the potential pollutant linkages that need to be taken through to the next stage of the assessment. However this summary matrix tends logically to be completed following completion of the other three tables in Appendix 5 i.e. Table 2 – Receptor Details, Table 3 – MATTE Scenarios and Table 4 – Dangerous Substances with Environmental Risk. The detail required to populate the other three tables (particularly details of the Dangerous Substances in terms of fate and transport in the environment and the receptor details) allows assessment of the potential for the pollutant linkages.

Figure 2: Example of MATTE Summary Matrix with Explanatory Notes

MATTE Summary Matrix																		
Row	DETR Table Ref	Receptor Type See Table 2 for receptor detail	**MATTE** threshold See Table 3 for description of identified **MATTE** scenarios	Substance / group of substances (see table 4 for description of substances or substance groups)														
				1	2	3	4	5	6	7	8	9	10	11	12	13		
Common Name				Substance 1	Susstance 2	Substance 3	Substance 4	Substance 5	Substance 6	Substance 7	Substance 8	Substance 9	Substance 10	Substance 11	Substance 13	Substance 13		
1	1	**Designated Land/Water Sites (Nationally important)** River (SSSI) Alluvial Wetland (SSSI) Estuary (SSSI)	>0.5ha or 10-50%	✓	✓	✓	✓	x	x	x	x	x	x	x	x	x		
2	2	**Designated Land/Water Sites (Internationally important)** River (SAC) Estuary (RAMSAR, SPA)	>0.5ha or 5-25% (5-25% LF/Pop)	✓	✓	✓	✓	x	x	x	x	x	x	x	x	x		
3	3	**Other designated Land** Wetlands Reserve Local Nature Reserve	10-100ha or 10-50%	✓	✓	✓	✓	x	x	x	x	x	x	x	x	x		
5	5	**Widespread Habitat -Non-designated Land** Nearby Agricultural Fields	>10ha	✓	✓	✓	✓	x	x	x	x	x	x	x	x	x		
10	7	**Soil or sediment (i.e. as receptor rather than purely a pathway)** Nearby fields & Reens	>10ha Contamination leading to environmental damage (as per ELD), or significantly affecting overlying water quality.	✓	✓	✓	✓	x	x	x	x	x	x	x	x	x		
15	12	**Fresh and estuarine water habitats** River Estuary	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	✓	✓	✓	✓	x	x	x	x	x	x	x	x	x		

Notes to Summary Matrix Table:

(i) Substances 5 to 8 discounted as the they solidify on release and therefore could not impact the identified receptors.
(ii) Receptors 4, 6, 7, 8, 11, 12, 13, 14 not present.
1 Substance 1 - Large quantity will volatilise following any loss. No pathway to River identified (see SPR Table). Main identified pathway to other receptors is leakage from the effluent pipeline.
2 Substance 2 - Upon release may solidify depending upon ambient temperature. No pathway to River identified (see SPR Table). Main identified pathway to other receptors is leakage from the effluent pipeline.
3 Substance 3 - Very toxic to aquatic organisms. Fumes released on loss. No pathway to River identified (see SPR Table). Main identified pathway to other receptors is leakage from the effluent pipeline.
6 Substance 4 - Moderate to rapid biodegradation. Moderate to acute toxicity to aquatic toxicity.
9 Substance 9 - Small Volume held in drums therefore no potential impact on identified receptors
10 Substance 10 - Stored in IBCs and therefore in credible scenario only a small volume (<1m3) would be released therefore no potential impact on identified receptors
11-13 Substance 11 and 12 - Not considered Dangerous to the Environment. Substance 13 - Solidifies on release and not considered Dangerous to the Environment.

Given the importance of the identification and assessment of pollutant linkages to the environmental risk assessment, ABB supplement the MATTE Potential Summary Matrix with a supporting Source–Pathway–Receptor Assessment table. This contains more details on the rationale for a particular pollutant linkage or also importantly why certain potential linkages have been discounted, as the template for Table 1 MATTE Potential Summary Matrix in the CDOIF Guideline does not allow for this. As a minimum notes should be added to Table 1 to explain why certain potential linkages have been discounted, to provide transparency in the assessment.

Figure 3: Example of Supplementary Source-Pathway-Receptor Assessment

	Source		Potential Pathway(s)	Receptor	Plausible SPR
	Substance	***MAH Scenario & Causes***			
1a	Raw Material (RM) or Final Product (FP) Storage: • Substance 1 • Substance 2 • Substance 3 • Substance 4	Release from tank in bund or Delivery Tanker during import. Causes i) Catastrophic Tank Failure ii) Major Tank leak iii) Minor Tank leak iv) Failure of hose during transfer to/from tanker	Vertical migration to groundwater within the sands and gravels via piles that support major buildings on-site (and penetrate to the Mercia Mudstone). Also some continuity between perched water and lower groundwater body does exist in some areas of the site; however this is not considered a significant potential pathway due to the very low vertical permeability. Then lateral migration of lower groundwater NW towards the River. However impact of the River considered unlikely due to the very slow groundwater movement (0.4-2.2 m/yr) towards the river.	River (SSSI, SAC)	No
1b	*NB. The following RM/FP not considered Dangerous to the Environment or held in such small volumes that whilst SPR linkage exists impacts to the environment are not considered significant:* • Substance 9 • Substance 10 • Substance 11 • Substance 12 *The following chemicals solidify on release and hence no SPR exists:* • Substance 13		Surface water flow in reens unlikely given distance from site to the River.		No
2a			Via surface water flow in reens but considered unlikely given distance from the Site to the SSSI (~900m) and limited flow within the reen system	Alluvial Wetland and Intertidal Mudflat (SSSI)	No
2b			Via leak in effluent pipeline which crosses the SSSI following entry into the site drainage and effluent system		Yes
2c			Vapour release following spill of Substance 1. Prevalent wind direction is from the west towards the SSSI to the east of the site.		Yes
3a			Via effluent pipeline following entry into the site drainage and effluent system	Estuary (SSSI, RAMSAR, SPA)	Yes
3b			No direct pathways. Surface water flow in reens unlikely given large distance from site to the Estuary. Groundwater flow in lower groundwater body below the site has been shown to be north-west towards the River.		No
4a			Via leak in effluent pipeline which crosses the Reserve following entry into the site drainage and effluent system Migration via surface water flow in reens unlikely given large distance from site to the Reserve. Groundwater flow in lower groundwater body below the site has been shown to be north-west towards the River Usk and not towards the Reserve.	Wetlands Reserve (Part of SSSI)	Yes
5a			Via surface water flow in reens but considered unlikely given distance from the Site to the SSSI (~900m) and limited flow within the reen system	Local Nature Reserve (SSSI)	No
5b			Via leak in effluent pipeline which crosses the SSSI following entry into the site drainage and effluent system		Yes
6a			Via surface water flow in reens	Agricultural Fields	Yes
6b			Perched water below site likely to drain to reens or more likely into drainage system and therefore potential pathways via leak in effluent pipeline crossing fields.		Yes
6c			Vapour release following spill of Substance 1 or hot Substance 1. Prevalent wind direction is from the west towards the fields to the east of the site.		Yes
7a			Via surface water flow in reens. No reens within the installation but are present at parts of the site perimeter. These drain into the main reens in the area (Julians and Lakes reen) which drain to either the Severn Estuary or River Usk. There may also be preferential flow in historical infilled reen below the site. Sediment traps are present at site boundaries within the on-site reens, preventing migration of sediments to off-site reens.	Fields & Reens	Yes
7b			Perched water below site likely to drain to reens or more likely into drainage system and therefore potential pathways via leak in effluent pipeline crossing fields.		Yes

Characterisation of Environmental Receptors

Identification and characterisation of the environmental receptors potentially at risk is in our experience critical to the environmental risk assessment. Understanding why environmental receptors are designated and their sensitivity is required to allow an assessment of the consequences of a release from an Establishment and whether it would be classified as a MATTE. Whilst the CDOIF Guideline is a screening methodology the proportionality element of the CDOIF Guideline is considered to make robust characterisation of receptors more important than under previous guidance.

The CDOIF Guideline defines the types of environmental receptors that should be considered. These are: Terrestrial habitats, Freshwater habitats, Marine habitats and Groundwater bodies. There are 15 types of receptors that are identified and the thresholds to be used when determining the potential for a MATTE to each of the receptors are provided. These have been developed with regard to the Major Accident EC reporting thresholds in the Seveso Directive and the DETR 1999 Guidance. There are some slight variations in the receptor groupings between the DETR 1999 Guidance and the CDOIF Guideline but this tends to result in only a minor variation when updating environmental risk assessment for existing COMAH Establishments but an update against the new groupings is advisable.

Key again is ensuring that as part of the desk study as much relevant information as possible is obtained. Links to sources of information on environmental receptors are provided for each receptor within the CDOIF Guideline. This includes information contained on the magic.gov.uk website, Natural England website, JNCC website or the Scottish Natural Heritage website, Wildlife Trust website etc. However, Establishments again will hold relevant information. This includes

understanding whether a smaller area within a larger receptor may be critical, any migratory species that could be affected at certain times of years and individual species that may be present.

Two of the Establishments worked on by ABB have been located close to estuaries which have been internationally and nationally designated sites based on their importance for wading birds and wildfowl, many of which are migratory species. Understanding why they are important and therefore how a release from an Establishment could impact the habitat is critical to allowing a proper assessment of whether the impact would constitute a MATTE. Experience has shown the value of using the right environmental expertise in the assessment.

Ensuring information is up to date is also considered critical. Safety reports are updated every 5 years which can mean designations may have changed or been updated, water quality classifications may have changed or new water abstractions may have occurred, so revisiting the receptor list is important.

Where ABB has utilised the CDOIF methodology to update existing COMAH environmental risk assessments, the receptor list was reviewed and verified. No significant changes were identified but verification of the existing receptor list and characterisation provided validity to the updated risk assessment and demonstrated adherence to the current good practice and designations.

Providing as much relevant detail as possible in Table 2 of Appendix 5 'Receptor Detail' has proved useful in providing a transparency to the risk assessment process.

Figure 4: Example of Receptor Detail

Receptor Detail					
Row	DETR Table Ref	Receptor Type	**MATTE** threshold	Receptor Name	Receptor Detail
1	1	Designated Land/Water Sites (Nationally important)	>0.5ha or 10-50%	River (SSSI)	The River east of the site (approx 329m SW of site)is a SSSI and SAC due to the fish & otter population
				Alluvial Wetland & Intertidal Mudflat (SSSI)	The nearest SSSI is the Alluvial Wetland & Intertidal Mudflat SSSI which is at it's closest to the site at P Corner (~900m). The designation is due to reens which are rich in plant species. It's site area is 760 ha. It constitutes lowland that lies alongside the Estuary and is drained by an ordered network of drainage ditches. They are an example of one of the most extensive areas of reclaimed wet pasture in Great Britain. The SSSI has 3 special features: Reen and Ditch Habitat; Insects and other Invertebrates; Shrill Carder Bee.
				Estuary (SSSI)	The Estuary is a SSSI, which is designated for a number of habitats and species. Important habitat for wading birds and migratory wildfowl. Habitats include intertidal mudflats and sandflats, sandbanks, Sabellaria Reefs, Saltmarsh, Shingle and rocky shore, coastal grazing marsh, ditches. Key species of international significance include European white fronted goose, bewick's swan, shelduck, dunlin and redshank. Also migratory fish species including salmon, sea trout, river and sea lamprey and twaite and allis shad
2	2	Designated Land/Water Sites (Internationally important)	>0.5ha or 5-25% (5-25% LF/Pop)	River (SAC)	TheRiver east of the site (approx 329m SW of site)is a SSSI and SAC due to the fish & otter population
				Estuary (RAMSAR, SPA)	As the Estuary is an important habitat for wading birds it is also desgnated under the RAMSAR International convention and as a Special Protection Area (SPA) under European Union Legislation
3	3	Other designated Land	10-100ha or 10-50%	Wetlands Reserve	The Wetlands Reserve is a partnership between NRW, the City Council and the RSPB. This reserve is mostly within the area of the Alluvial Wetland & Intertidal Mudflat SSSI. It covers an area of 438ha. The Reserve contains reed beds, saline lagoons, wet grassland and scrub and attract a wealth of wetland birds. The Reserve is also an excellent place to see orchids, butterflies, dragonflies and otters.
				Local Nature Reserve	31Ha of 36Ha nature reserve managed by local Wildlife Trust. This reserve is notable for its grasslands, crossed by a system of reens and grips (drainage features). Specific species present are Lesser Spearwort, Meadow Vetchling, Yellow-rattle, Sedge Warbler, Reed Bunting, Otter, Water Vole, Shrill Carder Bee
4	4	Scarce Habitat	2-20 ha or 10-50%	None	
5	5	Widespread Habitat -Non-designated Land	>10ha	Nearby agricultural fields	Nearest fields are owned by Establishment (approx 50Ha)

There is a requirement within the COMAH Guidance to identify receptors within 10km radius of an Establishment. In practical terms this can lead to a significant number of receptors being listed and included within the environmental risk assessment that aren't relevant. On one site ABB worked on, over 3000 listed buildings were identified within the 10km radius due to the urban nature of the surrounding environment. When consideration was given to the credible major accident scenarios and modelled likely aerial extent of any release (vapour cloud) it was concluded that only those present within 1km of the Establishment were relevant to the assessment. Professional judgement therefore needs to be given to selection of sensitive receptors otherwise the whole assessment would become unmanageable. It is important therefore to record the rationale for discounting any receptors within the 10km area.

The CDOIF Guideline does state that caution should be taken when completing the screening process to ensure that over simplification does not take place and that there will often be need for expert opinion and professional judgment. Experience of practical implementation of the methodology has borne out that this is an important point to take away from the guidance.

Multi-Disciplinary Team (Process Safety and Environmental Risk)

The CDOIF Guideline clearly sets out the competency requirements for those completing the environmental risk assessment. It states within the context of the guidance environmental specialists will be involved with the identification of potential MATTEs and in determining the thresholds that should apply to those receptors around the site. However, the skills of process safety specialists will be needed to evaluate the unmitigated risk frequencies to the identified receptors and to determine the mitigation and prevention measures already in place to reduce the risk.

ABB has utilised a multi-disciplinary team of in-house process safety experts and environmental specialists to complete all the environmental risk assessments undertaken in accordance with the CDOIF Guideline. Experience shows that whilst it is assessment of environmental risk, process safety experts provide the key input into characterising the major environmental hazards, providing the necessary frequency analysis for credible major hazard events and for the tolerability assessment within the CDOIF methodology, whilst also offering expertise in ALARP demonstration and cost benefit analysis.

The experts need to work closely together and with the Client to ensure a transparent and robust assessment is completed. Dialogue between experts is important as a number of iterations or amendments may be required as the assessment progresses. Our experience has shown that the use of a multi-disciplinary team that work closely together is key to delivering a robust environmental risk assessment.

MATTE Assessment

The CDOIF Guideline is intended to be a screening tool. However practical implementation at a number of Establishments demonstrates that the level of time, resource and effort required to complete the environmental risk assessment should not be underestimated.

This is particularly important on sites that have a wide ranging and large inventory of chemicals and/or where sites are located in sensitive environmental settings with a number of environmental receptors. In these cases the MATTE assessment of the individual pollutant linkages (assessment of the severity and duration classes) can be time consuming, and should not be underestimated. Consideration should also be given to the requirement to carry out the assessment in both the unmitigated and mitigated case, which again adds significant time and the time inputs required for the frequency assessment.

For example, on one chemical sector site, eleven chemicals were identified as Dangerous to the Environment and six receptor types were identified. Taking account of the credible major accident scenarios identified and pathways for the identified sources to reach the receptors resulted in over 100 potential individual pollutant linkages that required assessment. Only 22 of these pollutant linkages were identified as potential MATTEs, with the other approximate 80% classified as Sub-MATTE and discounted from further assessment. However, the time required to assess each of the potential linkages was significant and it is important to ensure there is a record to demonstrate why and how the particular MATTE classification has been reached.

Experience on the Establishments where the CDOIF methodology has been applied by ABB so far has only resulted in MATTE Consequence Levels Class A or Class B classifications, as shown in the example in Figure 5 below. Informal discussion with other companies that have utilised the CDOIF methodology suggests a similar experience has been encountered by others. Industry feedback on experience elsewhere would be interesting to understand the type of scenario that may lead to the more serious MATTE Consequence Levels Class C and D.

Figure 5: Example of CDOIF Tolerability Matrix

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

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

Comparable Outcomes Using Previous and Current Guidance

On those sites where ABB has applied the CDOIF Guideline to update existing COMAH environmental risk assessments, the assessments have validated previous findings, highlighting those major accident scenarios that represent the greatest environmental risk. However, what the CDOIF methodology has provided is the context of proportionality of the risk and a consistent transparent approach to the assessment. Cost benefit analysis and ALARP demonstration can also be applied to show that the risks are acceptable.

Whilst the assessment in the unmitigated and mitigated case can be cumbersome and often for Establishments that have a good knowledge of their environmental risks already may take a lot of time and effort to bring them only to a point that they already knew in terms of environmental risks, there is value in completing the assessment using the CDOIF Guideline to validate previous assessments using a common methodology.

Where ABB has applied the methodology this has provided sensible, measured outcomes which allow establishments to target the high risk areas with respect to resources and facility improvements.

Opportunity for Improvements to CDOIF Guideline

In ABB's experience, having utilised the CDOIF Guideline, the guidance itself could be simplified.

In our opinion the way the current Guidance is set out and written over complicates the process and feels disjointed. A section that clearly sets of the steps of the process and methodology would be extremely useful towards the front of the document. Section 6 of the CDOIF Guideline covers completing the risk assessment but this combined with an explanation of the MATTE assessment tables described in Section 4.2.2 of the CDOIF Guideline as an overall section explaining the overall process would be more helpful.

Some elements could be included in a glossary or an appendix, for example section 4.1.1 of the CDOIF Guideline 'Terms used in a risk assessment'. Inclusion in the main body of the document makes the guidance disjointed. Similarly the MATTE Thresholds in Section 3.2 of the Guideline could be included in an appendix rather than the main body of the text.

The risk frequency could be a separate section in a similar way to the cost benefit analysis.

The inclusion of a worked example in an appendix would help with explaining the methodology. There are two supplements to the Guideline, which contain two worked examples, which have been published subsequently to the original document. One is a worked example for a simpler 'Storage Terminal' and the other is an example of a 'Complex Site', in this case a refinery located near an estuary which is environmentally sensitive. These two examples do provide assistance with application of the Guideline to different sites. Users of the Guideline do, however, need to be made aware of the existence of these examples and the Frequently Asked Questions document that is available.

Conclusion

In ABB's opinion, based on our experience of implementing the CDOIF Guideline, the methodology provides a consistent transparent framework for conducting an initial environmental risk assessment for COMAH establishments. It also facilitates constructive discussion with the Competent Authority. The time and resource required to complete the assessment should not be underestimated. The use of a multi-disciplinary team of process safety and environmental experts to complete the assessment is critical to the completion of the methodology.

The inclusion of proportionality is welcomed. It allows Establishments to focus on those areas that represent the highest environmental risk whilst taking account of cost benefit analysis. Experience shows that the Competent Authority considers the application of the CDOIF methodology as a first phase in the environmental risk assessment process and that where the assessment highlights risks that are classified as Unacceptable or Tolerable if ALARP then further more detailed assessment, cost benefit analysis or implementation of further preventative measures will be required as a second phase.