Major Accident to the Environment Potential in the Whisky Industry

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The Scotch Whisky industry is one of Scotland's largest export industries, with over £4 billion worth of whisky sold in 2017. The industry employs over 10,000 people, with whisky produced at more than 120 distilleries – ranging in scale from thousands to millions of litres of production per year.

As ethanol is a flammable liquid, whisky distilleries, associated maturation and bottling sites that store over 6.3M litres of ethanol are classed as Lower Tier COMAH site and those with over 63.4M litres of ethanol are classed as Upper Tier. This categorisation means that the COMAH Competent Authority expects these sites to understand their risk of causing a Major Accident to the Environment (MATTE).

The industry has over 20 Upper Tier establishments in the UK, with most of these being large maturation warehouse complexes. There are almost 50 Lower Tier establishments, comprised of a mix of distilleries (with on-site warehouses), packaging and bottling facilities, and smaller warehouse complexes.

The Chemical and Downstream Oil Industries Forum (CDOIF) guidance is the preferred methodology for carrying out a MATTE assessment in the Whisky industry. This paper gives a brief overview of this methodology and discusses its application in the whisky industry.

Whisky industry sites contain several hazards to people and the environment beyond the obvious fire and explosion risk from ethanol. As an example, dust explosions are possible during the storage and grinding of malt and grain.

The cleaning of fermentation vessels is a vital part of the process, and hence large volumes of cleaning chemicals may be stored on-site, such as sodium hydroxide or sodium hypochlorite. A growing trend for larger sites in the industry is to utilise Anaerobic Digestion for water treatment, which adds hazards of biogas and high chemical oxygen demand (COD) substrate.

For more remote sites, fuel for steam and heating is often provided through fuel oil – in the author's experience, this is often a likely source of a MATTE, even in light of much smaller storage volumes compared to storage volumes of ethanol. This is typically due to the longer duration of effect that fuel oil can have compared to ethanol, however, serious ethanol leak or fire could cause a MATTE if the site is located near particularly sensitive receptors.

The paper will also discuss the implementation of recommendations from MATTE assessments, and SEPA from the perspective of a site operator. The co-author works for a whisky business that operates three COMAH sites, two lower-tier and one upper tier, and will explain their interpretation, and the follow-up process with the regulator.

Keywords: whisky, distilling, ethanol, COMAH, major accident, environment, risk assessment, MATTE, CDOIF.

Introduction

The production of whisky has been taking place in Scotland for centuries, and in 1824 the first licence for a distillery was granted to what is now the Glenlivet distillery (The Glenlivet, 2019). Since then the industry has expanded in size and acclaim, with more than 10,000 people directly employed by the industry, with 1.28 billion bottles of whisky sold every year. The majority of these sales are exported from the UK, with a value of £4.7 billion (The Scotch Whisky Association, 2019).

The Scotch Whisky Industry has had an exemplary record when it comes to Major Accidents, with the most recent occurring in Glasgow in 1960, where 19 firefighters died when tackling a blaze at a bonded warehouse (The Institution of Fire Engineers, 2012). In the USA, warehouse fires have been more prevalent, typically caused by lightning strikes on wooden warehouse buildings. These fires have often led to significant fish kills in local watercourses and reports of flows of burning bourbon down these small rivers (Courier Journal, 2012).

There are currently 70 Scotch Whisky processing sites that are covered by the Control of Major Accident Hazards (COMAH) regulations. There are 50 sites operating as Lower Tier establishments, and 20 operating as Upper Tier. These are shown on in Figures 1 and 2 below.

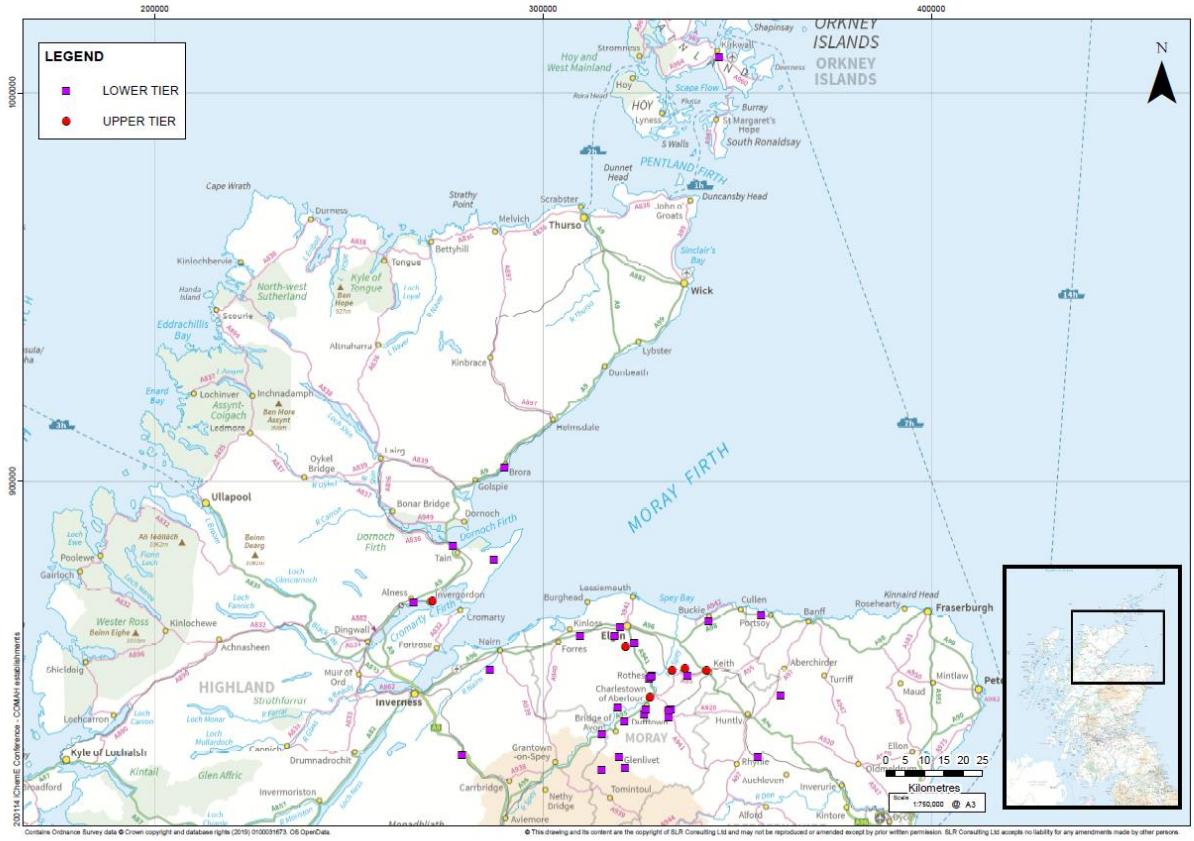

Figure 1: Whisky COMAH Sites in Norther Half of Scotland

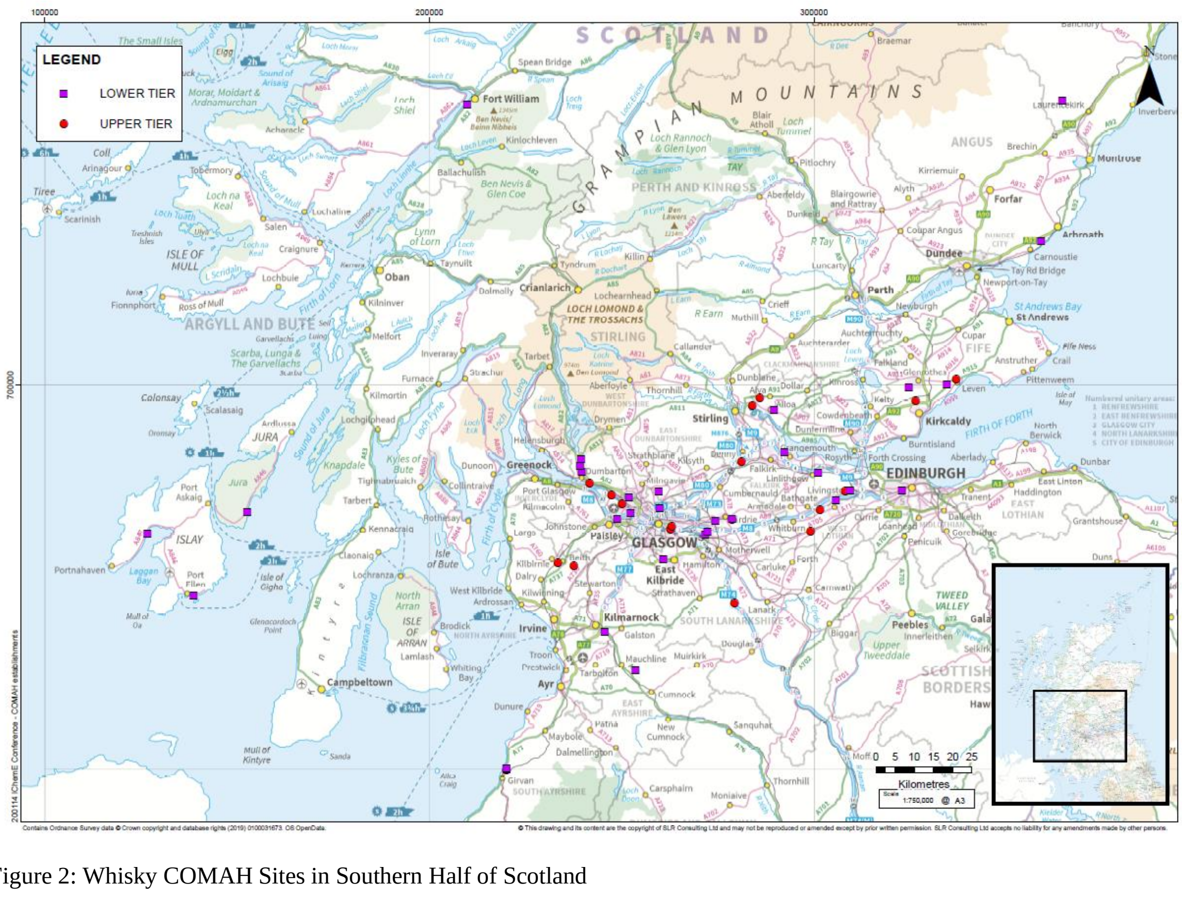

Figure 2: Whisky COMAH Sites in Southern Half of Scotland

The regulations are applied to whisky site on the amount of Class 2/3 flammable substance – this means that the total volume of whisky or spirit is counted, not the ethanol only, e.g. a one-litre bottle of whisky at 40 %abv is not considered to be only 400 ml of flammable substances, but the full litre. There a Lower Tier whisky site has >5,000 te of sprit and whisky, and an Upper Tier has >50,000 te.

Under COMAH, these sites must assess the risk to the environment from the possible major accidents that could occur on-site. As with COMAH sites in other sectors, the Scottish Environment Protection Agency (SEPA), has a preference for this risk tolerability to be assessed in line with the guidance given by the Chemical and Downstream Oil Industries Forum (CDOIF, 2013). This paper will give an overview of this process and some of the key learnings from the authors time carrying out these assessments. It will also give perspectives from an operator of multiple whisky sites that have gone through this process.

Environmental Hazards

While ethanol is the main hazardous substance stored on whisky sites, several other substances present a hazard to the environment. The substances, and the risk they present to the environment, will be introduced in the following section.

Ethanol

The process of producing whisky requires several processing steps which involve substances that pose a hazard to the environment. Through the initial steps, where grain, water and yeast are used to generate ethanol (with a strength of no more than 15-16 %abv), the main risk is the Chemical Oxygen Demand (COD) of the substance.

However, after the distillation process, the ethanol strength is raised, which then presents a toxicological risk to the environment, as well as having a high COD, this distilled ethanol is known as New Make Spirit (NMS). Depending on the production method the NMS can be in the region of 94 %abv from a grain whisky distillery and around 68 %abv from a malt whisky distillery. The ethanol content is then reduced, either through dilution or evaporation in the maturation process. This then gives a typical ethanol strength of 40 %abv for bottled mature whisky. This paper will use the broad term of “spirit” to refer to all of these different substances, for means of simplicity.

A range of tests on the effect ethanol has on ecological receptors has been carried out in Europe (CEFIC Ethyl Alcohol Group, 2004) and the USA (Ethanol HPV Challenge Consortium, 2001) which give a range of toxic concentrations depending on the species tested. This concentration can range from 10,000 mg/l for fish species, to <2,000 mg/l for aquatic invertebrates. Ethanol presents a very limited risk to groundwater as it has a half-life of between two and three days in aerobic conditions (Howard, 1991) so any contamination is expected to be very limited in time.

What must also be considered, is that many of the major accident scenarios involving spirit are warehouse or tank farm fires and explosions. These scenarios then need to consider the additional effects of the significant volumes of deoxygenated firewater that will flow to the downstream environmental receptors. In the author's experience, the age of the whisky processing sites means that there are limited tertiary containment systems on whisky sites to allow for the collection of firefighting runoff in these scenarios.

Liquid Fuel

A range of hydrocarbon fuels is used and stored on whisky sites, most prevalent being heating fuel or transportation diesel for site or fleet vehicles. Many whisky sites are remote, and therefore do not have a connection to the natural gas grid, which means that liquid fuels are used in boilers for the generation of process heating. The fuel used here can range from gas oil to heavy fuel oil, with storage tanks on-site often in the range of 5,000 and 50,000 litres.

The environmental effects of these fuels are well known with both toxic effects on aquatic life and microorganisms and, due to the lower aqueous solubility and lower density than water, the formation of surface sheen and/or layer of non-aqueous phase liquid (NAPL) on water bodies. This layer can lead to a reduction in dissolved oxygen and impact aquatic life. The more soluble mobile constituents within the fuels can also impact groundwater bodies via dissolution from NAPL where it can contaminate drinking water for a prolonged period.

Liquified Gas

The use of liquified or compressed gas, such as LPG and CNG is also fairly common in the whisky industry for heating and also for small site based vehicles. A fire or explosion involving these gases could lead to further fires on site but, by the nature of the fuel, would not lead to any losses to the surface water or groundwater environment.

As an aside, it is worth noting that some whisky manufacturing companies are moving from liquid fuels to liquified gas as a means of complying with the Medium Combustion Plant Directive. While not directly related to COMAH, this change from liquid fuels would also reduce the environmental risk of the site from a major accident.

Fusel Oil

For grain whisky distilleries, a by-product of the distillation process is fusel oil which is primarily isoamyl alcohol. Fusel oil is both toxic and immiscible in water and will have similar effects to a release of diesel. However, fusel oil is readily biodegradable and would have a half-life of between two and three days in aerobic conditions (National Center for Biotechnology Information, 2019).

Water Treatment

Depending on the size, types of site and local infrastructure, the water treatment infrastructure on a whisky site can vary widely. However, for large distilling sites, it is now increasingly common to have aerobic, and possible some anaerobic treatment for process effluent.

Activated sludge from aerobic treatment itself is hazardous if lost to the local environment, due to high solids content and COD. There also tend to be an elevated amount of copper salts within whisky effluent due to the use of copper vessels, which can contaminate drinking water. While the concentration of copper, will be elevated, the limit for copper concentration in drinking water is relatively high compared to other metal contaminants (Drinking Water Inspectorate, 2020), so this is unlikely to be an issue.

The substrate from anaerobic digestion has high COD, as well as low oxygen content (by design). This will lead to a reduction in the oxygen content of any water body that it is released into which can then harm any form of aerobic life form in that water body. Anaerobic digestion also introduces an additional fire and explosion risk from the biogas produced.

Demineralised water is also produced at maturation and bottling sites for dilution of spirit – this process typically requires acids and alkalis for the cleaning and regenerations of treatment equipment. In most cases, these are stored in relatively small amounts and do not present as a major accident hazard.

CIP Chemicals

A key step of the successful operation of whisky distilleries is ensuring process vessels are clean. While this promotes good heat transfer, it is primarily to prevent a build-up of micro-organisms that would be in competition with the yeast for carbohydrate – therefore reducing the amount of ethanol produced.

Sodium hydroxide solution is the most common substance used for cleaning in place (CIP) processes in distilleries, and storage volumes can be in the tens of cubic meters on site. Sodium hydroxide is a strong base, and a large release will cause a rise in pH which will cause immediate harm to environmental receptors, as well as the potential change to the pH of groundwater.

Types of Sites

As partly discussed above, there is a range of different whisky sites that each present an individual risk profile when it comes to environmental damage. The types of site that most people associate with the whisky industry is that of a remote single malt distillery. Depending on the fuels used, and the water treatment requirements these sites could contain all of the environmentally hazardous substances noted above and are relatively complex processing sites.

Most malt distilleries have relatively small amounts of spirit storage on-site with only relatively small vats and warehouses, as this is the case there are less than 40 Lower Tier sites of this types and six Upper Tier sites, even though this is the most common type of whisky site. Typically, malt whisky site that falls under COMAH also include large warehousing complexes (HSE, 2018).

Grain distilleries operate on a much larger scale than malt distilleries and produce larger volumes of ethanol at a higher strength. Note that grain NMS is 94 %abv compared to 68 %abv for malt NMS. Of the seven operating grain distilleries in Scotland, two of them are Upper Tier establishments, five are Lower Tier, and a single site being under the COMAH limits. The environmental hazards present on these sites are similar to that at a malt distillery, but with likely higher storage volumes of NMS. From the author's knowledge of the industry, four of these sites are operating anaerobic digestion plants, but none are operating using liquid fuels for process heating.

The most common type of site that falls into the Upper Tier threshold is large warehousing complexes. These large sites contain multiple maturation warehouses were whisky casks are filled, stored, and emptied. There are also tanker operations on site for the delivery of NMS or dispatch of mature spirit. The tankers and cask handling activities can present the most likely initiating event for a major accident as flammable spirit can be open to the atmosphere and potential ignition sources. These warehousing sites tend to have some liquid fuel storage for site and fleet vehicles as well as space heating. These sites can also have cooperages which commonly use open flames to char the inside of casks before filling.

Bottling and distribution is the final step in the process and often happen at specialist sites that blend the final product with the necessary bottling lines. These sites tend to have large storage tanks on-site for spirit of varying strength, and some have connected maturation warehouses. The bottling process in these facilities is relatively automated with specialist equipment, so a major accident stemming from the bottling hall is fairly unlikely. However, these sites also have frequent tankers transfers and cask handling activities where spirit is open to the atmosphere. They coild also have fuel for site vehicles and for space heating.

While these descriptions describe four distinct types of sites, there is a range of combinations of the four, for example, Grant’s Distillery in Girvan (Wm Grants and Sons, 2020) has both malt and grain distilleries and a large warehouse complex on the one site. As well as this, there are many examples of single malt distilleries with warehousing on site – with the expected cask handling activities.

Common Receptors

One of the key requirements of the CDOIF assessment is that it is specific to each site – to its hazardous substances, topography, site permeability and subsequent pathways and receptors. Not all of these can be covered in a single paper; however, for this overview, the sites will be split broadly into two groups. The first will be the sites within the Central Belt of Scotland that tend to be in industrial areas and the second being the rural sites in the rest of Scotland.

Central Belt Sites

While it may go against the marketing image of the whisky industry, a significant amount of scotch whisky is produced in fairly industrial settings of urban or suburban Central Belt of Scotland. These sites typically benefit from connection to the national gas grid which limits reliance on liquid fuels – although many still have small storage tanks for transport diesel.

These sites also tend to be more industrial in nature and are have more hardstanding coverage around the site. These low permeability surfaces are beneficial for environmental losses as they can limit losses to groundwater. In general, groundwater is less of a concern for these types of sites, firstly as only liquid fuels are prevalent enough to cause a MATTE and these should be limited on this type of site, and secondly, within the Central Belt, the number of groundwater drinking water abstractions are limited due to the impact of historical coal mining on water quality within the Central Belt, and the provision of reservoirs.

As will be described below, this increases the tolerability limits for effects on groundwater. What is worth noting, is that Scotland does not have Source Protections Zones for Groundwater with some local superficial aquifers (i.e Speyside) and all bedrock aquifers considered as having future resource potential so risks are required to be considered on a site by site basis for Scotch Whisky sites.

The tendency for impermeable surfaces on these sites leads any losses to be collected in a sites surface water drainage systems. Due to the age of many of these assets, there is limited implementation of tertiary containment of collection ponds where losses can be stopped from spreading to downstream receptors.

Surface water systems tend to be connected either to public foul water sewer systems which discharge to wastewater treatment plants (WWTP), or surface water sewers that flow to nearby watercourses. In the case of foul water sewers, it is also worth considering the activation of Combined Sewer Overflows (CSO) into surface water bodies due to high flow events. An example of a CSO is shown in Figure 3 below.

Figure 3: Example of CSO provided a pathway to a local watercourse

What also must be considered is the effect of and losses on downstream WWTP as large losses of ethanol, liquid fuels, fusel oil, and cleaning chemicals can destroy the biological processes within the WWTP. This would lead to raw sewage being released at the plant outfall until the biological systems are reseeded. Furthermore, in this scenario, the breakdown of the components in liquid fuels would be very limited, so for modelling purposed these should be treated as entirely being discharged at the WWTP outfall.

Watercourses in the Central Belt are in general of lower ecological and chemical status than rural ones, which makes it less likely that a MATTE could occur. It is also more likely that historical industrial uses of the river, such as mill dams mean that there are physical barriers to fish migrations and that these receptors are categorised as the lowest ecological status by default.

For ecological receptors, there are still a large number of designated sites such as Special Protection Areas (SPA), Sites of Special Scientific Interest (SSSI) and Ramsar sites around the central belt that must be considered. Aquatic ecology is the main area of concern, as significant losses are likely to lead to toxic conditions for fish and invertebrates living there. In particular, salmonids and lamprey are the main protected species to be conscious of when carrying out assessments.

Local watercourses also act as a pathway for hazardous substances to enter other downstream surface water receptors, typically the marine environment. The dilution level that any tidal estuary provides means that this receptor is not one that can be affected, and if so for only for a very short time. This effect would still apply for the fuel oils on site, as any oil sheen on the surface of the marine environment would be dispersed relatively quickly.

Terrestrial ecology tends to not be of the same level of concern, especially in this part of Scotland. While small populations of protected species like the Red Fox, Common Pipistrelle Bat, West European Hedgehog, and Kingfisher could be present near or within site buildings, they are extremely unlikely to be there in numbers to meet the CDOIF tolerability limits.

For these sites, cultural heritage receptors tend to be more likely to be nearby – and sites that are more likely to be damaged by the spread of fire, such as listed buildings. In general, a MATTE would only occur to this type receptor if there was a listed building on site, or directly beside the site and it could not be repaired within three years.

Rural Sites

In terms of the expectations of the general public, all scotch whisky is made in the small scale single malt distilleries in rural locations in the Highlands of Scotland. While this is not always the case, this is genuinely true for many whisky sites – even those that fall under COMAH. This understandably poses issues of environmental damage when it comes to Major Accident Hazards.

The main difference with sites in a rural location is the likely requirement for liquid fuels, from gas oil to heavy fuel oil. There is also a higher likelihood of there being permeable surfaces on these sites, which provides a pathway for loss to ground.

Groundwater impacts are of particular concern in the Speyside region, which is famous around the world for whisky production. The high permeability, higher yield and higher water quality of the sand and gravel aquifers in this region mean that groundwater abstraction points are abundant. This abstraction is not only to supply the distilleries themselves but also for local private water supplies for drinking water.

The CDOIF harm categories for this receptor type are particularly sensitive, which makes it increasingly likely that a MATTE could occur from fuel storage on these sites. Therefore, operators must ensure that their mitigation measures are robust and ideally that their storage tanks are compliant with guidance from the Construction Industry Research and Information Association (CIRIA).

Many of these rural sites are much further inland than those on the central belt, so any effects on surface water bodies would be over a longer length, with the respective increase in the CDOIF tolerability score. These rural waters are also more likely to be of better ecological and chemical status which makes also the potential for a MATTE more likely.

When it comes to aquatic and terrestrial ecological receptors, and the marine environment, there tends to be little difference between both types of sites. Although sites in remote parts of Scotland are more likely to impact low-population protected species such as Red Squirrel, Pine Martens and Eurasian Otter, it is still improbable that a Major Accident would lead to enough fatalities to cause a MATTE.

CDOIF Guidance

A broad introduction is given to the potential receptors in the section above, which split into the types of Land, Surface Water, Groundwater and Built Environment in the CDOIF guidance. There are also specific tolerability values depending on the designation of the receptor, e.g. an internationally important receptor such as a SSSI. The most relevant receptor types from the CDOIF guidance for a Whisky site are shown in Table 1 below. This table also gives examples of scenarios that could affect these receptors.

Table 1: Relevant Severity Harm Tolerability from CDOIF guidance

CDOIF Table 4.1 Row	Rector Type	Example Whisky Industry Scenario
1	Designated Land/Water Sites (Nationally Important)	Loss of NMS from a storage tank into SSSI watercourse.
2	Designated Land/Water Sites (Internationally Important)	Fire in maturation warehouse leading to loss to Ramsar coastal wetland.
3	Other Designated Land	Fire damaged to an area in an Area of Outstanding Natural Beauty
4	Scarce Habitat	Loss of ethanol affecting Biodiversity Action Plant (BAP) habitat.
5	Widespread Habitat - Non-designated land	Loss of diesel to ground where land has no designation.

CDOIF Table 4.1 Row	Rector Type	Example Whisky Industry Scenario
7	Groundwater Source of Drinking Water	Loss of gas oil into groundwater where there is a drinking water source
8	Groundwater - non-Drinking water source	Loss of heavy fuel oil into groundwater where there is no drinking water abstractions sources.
10	Built Environment	Explosion on site destroying a listed building on site.
13	Particular Species (Note - these criteria apply nationally - i.e. England, Wales, Scotland)	Ethanol loss to river causing death of salmon.
15	Fresh and estuarine water habitats	Ethanol loss to river causing ecological status to be lowered.

Once the level of harm for the receptors is found, the duration of harm needs to be found. The full range of different harm categories is shown in the CDOIF guidance, with Table 2 below showing the minimum duration that would lead to a MATTE.

Table 2: Relevant Duration of Harm Tolerability from CDOIF guidance

Receptor Type from Table 4.2 of CDOIF Guidance	Minimum Duration where MATTE could occur
Groundwater or surface water drinking water source (public or private)	Any
Groundwater (except drinking water sources): WFD Hazardous	>3 months
Groundwater (except drinking water sources): WFD Non-Hazardous	>1 year
Surface water (except drinking water sources - see above)	>1 year
Land	>3 years or >2 growing seasons for agricultural land

For the majority of scenarios for whisky sites, loss to Surface Water and related ecology are the main receptors Typically for ethanol losses, the effect duration will be less than one year due to quick half-life, and any fatalities to ecology would recover in the next breeding season. This would give a recovery time of less than one year, and therefore sub-MATTE effects. This would also apply for losses of water treatment substance and CIP chemicals.

This is not the case for liquid fuels used on site, so major accident scenarios involving loss of containment of these substances can easily cause a MATTE. First off, these substances effect surface water and groundwater, are more prevalent within the environment and contain Water Framework Directive (WFD) Hazardous components.

Liquid fuel losses can affect drinking water receptors, which, as shown in Table 2 above, does not have a minimum duration time for drinking water sources (from both ground and surface water). This could ea

Lessons from Assessments

From the author's experience, the most common environmental effects from Major Accident scenarios on whisky sites are from fires or loss of containment of ethanol, leading to toxic concentrations of ethanol within surface water bodies. However, as recovery time of one year is acceptable, for both the surface water body and aquatic ecology, these scenarios are typically sub-MATTE. It could be argued that these scenarios could be screened out prior to detailed modelling of the effects of spirit loss, but this may be difficult to argue with the sites SEPA inspector.

That leaves the liquid fuel oils on site being those that present the most risk – even for sites with tanks in the region of 10,000 litres of diesel. Depending on the specific pathways, it is easily possible for incidents involving this volume to cause a MATTE. This could be argued a slightly counterintuitive as these sites store millions of litres of spirit, which has the potential to lead to significant fires such as those seen in the US Bourbon industry.

This finding raises questions; first, is the CDOIF methodology applicable to the whisky industry? Stricter tolerabilities could be applied for recovery times; however, that would be seen as unfair compared to COMAH sites. Furthermore, having a lower time limit would add complexity with assessing the effects on ecological receptors – e.g. an incident in winter may be sub-MATTE, and one in spring may be a MATTE.

Secondly, does this also mean that sites without liquid fuels can be excluded from carrying out this in-depth assessment? This could be argued, but again it would be difficult to convince SEPA of this, as it would be for deviating from the CDOIF methodology. Finally, it also queries that if sites with relatively small liquid fuel tanks can cause a MATTE, does this mean non-COMAH sites with similar-sized tanks need more scrutiny? While SEPA would probably agree and do their best to provide this oversight here, they are limited in the resources they can devote to these lower-risk sites.

Overall, however, there are benefits from directing the focus of sites to the fuel oil storage systems, as the standards of the equipment can vary. The Oil Storage Regulations (Scotland) have been in place since 2006 and were updated in 2011, and SEPA expects that storage systems follow the relevant industry guidance on storage and containment (Walton, 2014). In the author's experience, the most common recommendations from working in the whisky sector have been to upgrade, or repair, tank and containment systems to meet this guidance, and the findings of these assessments have been a clear reminder of what they need to do to comply.

Industry Experience

Over the last three years, the author and colleagues have supported multiple sites around the Central Belt to assess their risk of a MATTE on three of their sites. This has included two Lower Tier establishments, a simple maturation warehouse and the grain distillery (which also has a single maturation warehouse on site), and an Upper Tier warehousing complex.

For the Lower Tier warehouse site, the only hazardous substances stored as maturing whisky in casks and, due to recovery times for receptors as explained above it was not possible to generate a MATTE. This did still, however, require the detailed process of modelling the losses and the pathways and receptors for the site.

For the other sites, there is diesel/gas oil storage so a more detailed investigation is justified to understand the effects on downstream receptors. The assessment for the Upper Tier warehousing complex was submitted in 2017 as part of the 5-yearly update to the safety report. Feedback from SEPA was not prompt, which meant the client had to wait to find what their inspector's area of focus would be. In this case, it was fuel storage, and it did prompt the client to review the safety systems around their tanks and alter the point at which their high level alarms activate.

Overall the client found the process is useful, as they now have access to data on ecology, archaeology, hydrology that they wouldn't normally which shows that even if the hazard is the same at multiple sites, the risk may be different due to the different receptors. The findings of the assessment have also allowed them to accurately score other environmental-based risk assessments on the site and be conscious that the different receptors mean each site needs to be treated differently, even for the same substance released.

The assessment process is costly, however, both financially and in employees' time. As company budgets for environmental compliance tend to be combined with health and safety, the money used for assessments could be used elsewhere. Savings could be made with the earlier screening of substances, such as ethanol in given situations, but prior advice would be required from SEPA before carrying out an assessment in this fashion.

SWA Guidance

The Scotch Whisky Association (SWA), is the main trade association representing the whisky sector in Scotland, and it has issued guidance on the completion of Environmental Risk assessments for COMAH sites (Scotch Whisky Association, 2016). This guidance is noted as supplementary for the CDOIF guidance itself, and also provides a spreadsheet for users to complete to support their assessment.

The guidance gives a good explanation of how sites should identify potential major accident scenarios, based on the specific hazardous substances likely to be present. It also gives relevant guidance on how to develop the Source-Pathway-Receptor models for potential major accidents and explains that only inherent control measures should be considered.

The guidance gives clear advice on finding the severity and duration of harm for ethanol losses, including to surface water and groundwater receptors. However, the guidance scores losses of oil to groundwater into different severity of harm categories based on only the volume lost. For example, a loss of <10,000 litres would be "Sub-MATTE" with a score of 1, and between 100,000 litres and 10M litres would be a "Major MATTE", with a score of 3.

This scoring does not consider the specific type of receptor, e.g. groundwater used for drinking water, or land that is designated as Nationally or Internationally important, or even if a credible pathway is present. Depending on the specific pathways and receptors, the area of effect of a diesel loss will vary – even for the same volume. It could be the case that a loss of 8,000 litres could effect a drinking water source leading to a MATTE, or a 30,000-litre loss could have limited effect on a non-drinking groundwater source and have sub-MATTE level of harm.

Ideally, this guidance should be updated to suggest that a Conceptual Site Model is generated to find the area of groundwater that could be affected by the leak, and the severity score based on this, and the specific receptors type used. This would avoid potential over, or under, reporting of damage to the relevant receptors.

Summary

A brief overview of the application of using the CDOIF methodology to assess the risk of a MATTE occurring at Scotch Whisky COMAH sites has been given. While the storage of ethanol, in various forms, is the hazardous substance with the highest storage volume, there can be a variety of other substances on these sites that could cause environmental damage. Liquid fuels such as diesel or heavy fuel oil are of particular concern, and in the authors experience is the only ones on a typical whisky site that could cause a MATTE.

An overview of the common receptors for these sites was given, split into rural and industrial locations. Surface water bodies, particularly local watercourses require focus for these sites, as well as the relevant aquatic and terrestrial ecology that would be affected by a major accident.

Groundwater may be ruled out as a receptor depending on the ground permeability on the site, but if a pathway exists, this receptor is of highest risk for a MATTE if liquid fuels are lost. While Source Protection Zones do not exist in Scotland, and drinking water abstractions are limited, nearby drinking water abstractions must be reviewed. Furthermore, contamination of groundwater in unproductive strata can still lead to a MATTE if the higher thresholds are reached.

From the author's experience of assessments in this sector, losses involving ethanol tend not to cause a MATTE. While these incidents are serious, ethanol is not prevalent in the environment. This leads to sub-MATTE levels of harm as the receptor should be able to recover within one year. This is not the case for liquid hydrocarbon fuels, and hence why there are of particular concern.

This paper has queried if it is appropriate for a COMAH site with large volumes of ethanol, and typically small fuel storage to have this focus. This is not likely to be practical, however, and is also applying different and stricter guidelines for this sector compared to others.

Experience from the industry on this point is not wholly negative, as when the client reviewed issues around diesel storage with SEPA, they made simple adjustments to the plant to reduce the environmental risk. They were also able to use the findings from the assessments on their multiple sites to give more accurate scoring to their other environmental risk assessment.

The process of these assessments is not simple and could be streamlined by screening out ethanol, and other substances that break down quickly in the environment, from consideration in these assessments. This would simplify the assessments overall and make them less costly for whisky sector sites to complete. This, however, would require agreement from SEPA as it is counter to the CDOIF methodology.

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