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ESB Networks Historic Cable Fluid Losses: Preliminary Site Assessment

Location 35: Blackrock – Ringsend 110 kV – March 2009

Prepared for

ESB Networks
Engineering Major Projects
One Dublin Airport Central
Dublin Airport
Cloghran
Co. Dublin

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EXECUTIVE SUMMARY

This report presents a preliminary assessment of the potential environmental impacts associated with the historic loss of cable fluid from a section of underground cable located adjacent to Merrion Road in Booterstown, Co. Dublin. ESB records indicate that 12,140 litres of cable fluid (linear alkyl benzenes) leaked into the ground from the subject section of cable over a period of six months between October 2008 and March 2009. The leak location is within approximately 50m of another leak location on the same section of cable (Location 48) where 27,177 litres of cable fluid is reported to have been lost to ground over a 4-year period between 2004 and 2007. The potential for the effects of these losses to have been cumulative has been considered herein.

The PSA was performed with reference to the EPA's 2013 publication "*Guidance on the Management of Contaminated Land and Groundwater at EPA Licensed Sites*". The EPA's guidance document outlines a staged and risk-based approach to contaminated land and groundwater assessment, with the PSA being the first stage in the process. By its nature the PSA stage is precautionary and conservative, aiming to identify those potential "pollutant linkages" where more detailed assessment is required.

Generally, more detailed assessment is only necessary where the assessed risk to a potential receptor is moderate, high or very high. However, in cases where the potential receptor is particularly sensitive, more detailed assessment may be recommended even if the assessed risk is low.

The findings of the PSA for the subject loss of cable fluid can be summarised as follows:

- The leak location is adjacent to the Merrion Road and close to the entrance to a private ground-level car park in Booterstown, Co. Dublin;
- South Dublin Bay, which is a designated Special Protection Area (SPA – site code 004024) and a Special Area of Conservation (SAC – site code 00210), lies approximately 100m north-east of the leak location. Booterstown Marsh, which is part of the South Dublin Bay SPA, lies approximately 200m south-east of the leak location;
- The topography in the vicinity of the leak location is flat; there is no discernible topographical gradient in the vicinity of the leak location;
- The closest streams to the leak location are Elm Park Stream and Booterstown Stream, which flow towards the north-east within culverts approximately 200m north-west and 200m south-east of the leak location, respectively. Both streams discharge to Dublin Bay. There is also an open drain between the car-park and the adjacent railway embankment approximately 100m north-east of the leak location, which discharges to Booterstown Marsh;

Based on available geological maps, the area of the leak location is underlain by estuarine silts and clays. The underlying bedrock is mapped as limestone (“Calp”). The area north-east of the leak location appears to have been reclaimed from a tidal wetland area during the late 18th or early 19th century;

- The groundwater body underlying area of interest is classified as a “locally important” aquifer from a productivity perspective. Its current WFD status is “good”, and the associated risk classification is “not at risk” of not achieving its WFD objectives. Vulnerability of the bedrock aquifer from a contamination standpoint is “high” in the area of interest, indicating that bedrock is relatively shallow and/or is overlain by permeable strata. Groundwater flow direction in the bedrock aquifer (and also in the overburden) can be expected to be generally towards the east or north-east and would discharge to Dublin Bay or potentially Booterstown Marsh;
- The key receptors potentially at risk of impact from the subject leak are considered to be Booterstown Marsh, Dublin Bay in the vicinity of the leak location and also in the area adjacent to the Elm Stream, Booterstown Stream and Booterstown Marsh discharge points, flora and fauna dependent on these water bodies, water quality in the bedrock aquifer underlying the area, and in the water mains in the vicinity of the leak location (if present).

A preliminary risk assessment was completed that considered the potential risk posed by the subject leak on the identified potential receptors. The findings of this preliminary risk assessment are summarised in the following table:

Receptor	Risk Category	Comment
<p>Booterstown Marsh (a SPA) South Dublin Bay (a SAC & SPA) Ecosystems dependent on these water bodies</p>	Moderate	<p>No preferential pathway linking the leak location to the open drain adjacent to the private car park has been identified.</p> <p>However, there is potential for cable fluid to have migrated along the cable trench to Elm Stream (ca. 200m north of leak location) and/or Booterstown Stream (ca. 200m south of leak location), both of which discharge to South Dublin Bay, and also to the vicinity of Booterstown Marsh.</p> <p>It is understood that ESB has received no reports of pollution of Booterstown Marsh or South Dublin Bay that could be linked to the subject loss of cable fluid.</p>
<p>Water mains/ Water supply (if close to the leak location)</p>	Low	<p>Whilst the potential for organic compounds to permeate water mains is known (in particular plastic water pipes and the joints of other types of water pipes), the potential for alkyl benzenes to permeate water mains was not established during the PSA.</p> <p>The risk category assumes that cable fluid may be present as residual LNAPL in the water main trench and that there is potential for it to permeate water pipes, but not to the extent that it will impact water quality in the pipes.</p>

Receptor	Risk Category	Comment
Bedrock aquifer	Low	<p>The bedrock is classified by the GSI as a “locally important” aquifer. Vulnerability rating is “high” close to the leak location. However, the water table in the estuarine clays is expected to be shallow, reducing the potential for downward migration of cable fluid to the bedrock aquifer.</p> <p>No preferential pathways potentially linking the leak location to the aquifer have been identified.</p>

Further investigation of the risk to Booterstown Marsh, Dublin Bay in the vicinity of the leak location and the Booterstown Marsh discharge, and their associated ecosystems, is considered necessary as a precaution to confirm the assessed level of risk. Further investigation of the risk to water mains and the bedrock aquifer is not considered necessary.

* * * * *

1 INTRODUCTION

1.1 Project Background

Geosyntec Consultants Ltd (Geosyntec) is pleased to present the Electricity Supply Board (ESB) this Preliminary Site Assessment (PSA), which relates to the potential environmental impacts associated with the historic loss of cable fluid from a section of fluid-filled cable located in Booterstown, Co. Dublin. The alignment of the subject section of cable and the approximate location of the historic loss of cable fluid is illustrated in ESB Drawing Number QD-354120-01-D460-001-049-000 (Figure 1).

The PSA was completed in accordance with Geosyntec proposal reference 190607 dated June 2019, which was authorised by the ESB on 1st July 2019. The PSA was led by Mr Graham Webb, who is an environmental engineer with over 25 years' relevant experience, and Mr Jim Wragg, who is a contaminant hydrogeologist with over 30 years' relevant experience.

ESB Networks operates and maintains a network of High Voltage (HV) underground cables of over 1,600 km across Ireland, of which approximately 205 km (175 km operational) are insulated by a cable fluid. The majority of these fluid-filled cables are located in urban settings across Dublin city and Cork city. The cable fluid acts as an electrical insulator and aids the conduction of heat away from the conductor allowing the cable to be operated more efficiently. The cables are vulnerable to third party interference or damage, and over time, cables can develop leaks due to defects developing in the cable sheath and in joints and terminations. When such leaks occur, there is potential for pollution to arise.

In the case of the section of fluid-filled cable that is the subject of this PSA, ESB records indicate that 12,140 litres of cable fluid leaked into the ground from the cable over a period of six months between October 2008 and March 2009.

1.2 Objective and Scope of Work

The primary objective of the PSA was to complete a preliminary assessment of the potential types, locations, extent and significance of environmental impacts associated with the subject historic cable fluid loss. The PSA was performed with reference to the EPA's 2013 publication "*Guidance on the Management of Contaminated Land and Groundwater at EPA Licensed Sites*". This PSA report is based on the EPA's guideline template report for PSAs, which is linked to the 2013 guidance.

The EPA's 2013 guidance document outlines a staged approach to contaminated land and groundwater assessment, with the PSA being the first stage in the process. During the PSA stage, the guidance requires the assessor to identify environmental "receptors" - including groundwater and surface water bodies and flora and fauna dependent on them as well as people - who are potentially at risk from the source of contamination, and to qualitatively assess the risk to each environmental receptor by considering the viability of each source-pathway-receptor "pollutant linkage". Those pollutant linkages where there is considered to be a moderate or high risk of impact from the source of contamination, or where the receptor

is particularly sensitive, are identified through this process. These pollutant linkages are then carried forward to the next stage of the process during which more detailed assessment can be completed. Given the above, the PSA stage of the process is precautionary and conservative in nature.

Generally, more detailed assessment is only necessary where the assessed risk to a potential receptor is moderate, high or very high. However, in cases where the potential receptor is particularly sensitive, more detailed assessment may be recommended even if the assessed risk is low.

The PSA for the subject loss of cable fluid was based on a desk study of publicly available information and information provided by the ESB, a walkover survey of the immediate vicinity of the cable within approximately 200 metres of the location of the historic loss of cable fluid, and a reconnaissance of the surrounding area.

Information for the desk study element of the PSA was obtained from the following sources:

- Ordnance Survey Ireland (OSI) website (www.osi.ie): historic maps, historic aerial images, recent “street-view” map;
- Environmental Protection Agency (EPA) websites (www.epa.ie and www.catchments.ie): locations of EPA-licensed facilities, locations of Natura 2000 sites and National Heritage Areas (NHAs), information on groundwater and surface water quality, including Water Framework Directive (WFD) classifications;
- Geological Survey of Ireland (GSI) website (www.gsi.ie): overburden and bedrock geology, information on groundwater resources and groundwater vulnerability;
- Office of Public Works (OPW) website (www.opw.ie): flood risk;
- National Waste Collection Permit Office (NWCPO) website (www.nwcpo.ie): register of companies holding waste facility permits or certificates of registration issued by local authorities;
- ESB records outlining the location of the cable fluid loss, the volume of fluid lost and the period over which the fluid loss occurred;
- Safety Data Sheets (SDSs) provided by the ESB for the cable fluids understood to have been used in the subject cable at the time of the cable fluid loss.

The walkover survey and reconnaissance of the area surrounding the subject section of cable was completed by Mr Graham Webb of Geosyntec on 26th July 2019.

During the walkover survey and reconnaissance, information on the following aspects were recorded:

- The environmental setting, with regard to local topography, surface water drainage and the proximity of local surface water courses;
- Land use, in particular the proximity of residential properties and other potentially sensitive land uses close to the subject section of cable;

- The proximity of the subject section of cable to other below-ground infrastructure, such as water mains, gas mains and sewers;
- Distressed vegetation, which may be indicative of subsurface contamination.

Central to the PSA was the development of a preliminary Conceptual Site Model, which presents potential source-pathway-receptor (SPR) linkages identified during the PSA, and a preliminary assessment of the risk posed to identified human or environmental receptors from residual cable fluid potentially remaining in the vicinity of the subject section of cable.

2 DETAILS OF LOSS EVENT

2.1 Introduction

In the case of the section of fluid-filled cable that is the subject of this PSA, ESB records indicate that 12,140 litres of cable fluid leaked into the ground from the cable over a period of six months between October 2008 and March 2009. The type of fluid understood to have been present in the cable is identified in ESB records as linear alkyl benzenes.

The leak location is within approximately 50m of another leak location on the same section of cable (Location 48) where 27,177 litres of cable fluid is reported to have been lost to ground over a 4-year period between 2004 and 2007. The potential for the effects of these losses to have been cumulative has been considered herein.

2.2 Properties of Cable Fluid

The properties of the linear alkyl benzenes understood to have been used in the subject section of cable over the period of the leak, based on information contained within the Safety Data Sheets provided by ESB, are as follows:

- Boiling point: 280°C
- Flash point: >135°C
- Flammability: Non flammable
- Explosive properties: Not explosive
- Vapour pressure: <0.02 kPa at 20°C
- Density: 0.86 g/cm³ at 20°C
- Solubility in water: Negligible
- Kinematic Viscosity: 4.2 mm²/s

In their 2010 publication "*Classification of Hazardous and Non-Hazardous Substances in Groundwater*", the EPA classifies all petroleum hydrocarbon compounds listed in the document, including linear alkyl benzenes, as hazardous in groundwater. However, this is on the basis that they are former List I substances and it is stated in the document that these

classifications are “under review”. Based on the methodology outlined in the above-mentioned publication (which is based on the persistence, toxicity and potential to bioaccumulate of the substance in the environment) and publicly-available information on its properties, Geosyntec has concluded that linear alkyl benzenes should be classified as non-hazardous in groundwater.

2.3 Fate & Transport of Cable Fluid

The fate and transport of cable fluid entering the subsurface during and following the subject leak can be expected to be controlled by the following factors:

- The blend of alkyl benzene compounds that make up the cable fluid are less dense than water;
- The cable fluid has a low water solubility (less than 1 mg/l);
- The compounds in the cable fluid are semi or non-volatile;
- The compounds present in the cable fluid can be expected to biodegrade but at rates that are controlled by the surface area of the fluid in the subsurface (i.e. in the form of a light non-aqueous phase liquid or LNAPL), its solubility where in contact with groundwater, the availability of electron acceptors and the presence of appropriate microbial populations.

Following creation of a breach in the cable structure, the conceptual model of the dispersion of the cable fluid into the subsurface at the subject location can be described as follows:

- As the cable fluid is less dense than water it will tend to migrate into the pore spaces in the sand bedding around the cable and downward under the force of gravity until it reaches either a water table or low permeability horizon, such as natural silt or clay at the base of the cable trench (if present);
- The cable fluid will tend to spread laterally whilst:
 - There is a driving head provided by leakage of further cable fluid;
 - There is a path of relatively low resistance, e.g. the sand bedding around the cable, potentially permeable fill material in other service trenches that the cable trench intersects, or permeable horizons in the overburden.

The migration potential of the cable fluid released to the subsurface as a result of the subject leak is discussed in more detail in Section 4.

3 SITE ENVIRONMENTAL SETTING

3.1 Proximity of Site to Designated Ecologically Sensitive Areas

The National Parks and Wildlife Service on-line mapping tool was consulted to check if the leak location lies close to ecologically sensitive areas. The coastal area of South Dublin Bay, which lies approximately 100m north-east of the leak location, is a Special Area of Conservation (SAC - 000210), and a Special Protection Area (SPA - 004024). Booterstown Marsh, which lies approximately 200m south-east of the leak location, forms part of the South Dublin Bay SPA.

3.2 Surrounding Land Use & Field Observations

The leak location is situated adjacent to Merrion Road in Booterstown, Co. Dublin (Figure 1). Adjacent and to the north-east of the leak location is a private ground-level car park, beyond which is the Dublin-Rosslare railway line and South Dublin Bay. Between the car park area and the railway embankment there is an open surface water drain that flows south-east and discharges to Booterstown Marsh. This drain lies approximately 100m north-east of the leak location.

Between the above-mentioned car park and Booterstown Marsh there is an area of disused ground, which is vegetated with a mix of grasses, small bushes and trees. To the north of the leak location is a vacant single-storey commercial building (possibly a former car sales business), beyond which is “Merrion House”, which is a three-storey office building.

Merrion Road, a four-lane arterial route, lies adjacent to the leak location to the south-west. Beyond Merrion Road is a terrace of residential houses that is set back from Merrion Road; the closest house is approximately 40m from the leak location. The extensive Elm Park development, which comprises a mix of multi-storey office buildings and residential apartment buildings, is located to the rear of this terrace of houses.

No evidence of stressed vegetation or die-back was observed in the vicinity of the leak location, along the cable route, or in the vicinity of the above-mentioned open drain at the time of the walk-over survey.

The earliest historic map available from the OSI’s website is dated 1837 – 1842. On this map, the leak location is situated on the north-eastern verge of Merrion Road. Immediately to the north-east is an area of low-lying land which is indicated to flood at high tide. The railway line is evident on this map approximately 100m north-east of the leak location, and separating the above-mentioned low-lying area from Dublin Bay. The terrace of houses referred to above on the south-west side of Merrion Road is evident on this map (labelled “Merrion Parade”).

The historic map dated 1888 – 1913 shows no further significant development in the vicinity of the leak location, apart from a tramline, which is shown running along the western side of the Rock Road. The low-lying area north-east of Merrion Road appears to have been drained, but not yet reclaimed.

The earliest aerial image available from OSI's website (other than 19th century historical maps) is dated 1995. This image shows the layout of the area close to the leak location similar to that observed today. The low-lying area north-east of the leak location has been infilled and the commercial buildings to the north are evident. The tramline along Merrion Road is no longer present.

Based on information from the EPA's and NWCPO's websites there are no facilities in the vicinity of the leak location that operate under an Industrial Emissions licence, an Integrated Pollution Control licence, a Waste licence or a Waste Facility Permit.

3.3 Topography & Surface Water

The leak location lies at an elevation of approximately 5 metres above Ordnance Datum within an area of relatively level ground.

Based on information on the EPA's website, the closest water courses to the leak location are Elm Park Stream and Booterstown Stream, which flow north-eastwards in culverts approximately 200m north and 200m south, respectively, of the leak location. Both these streams discharge into Dublin Bay (which is a SAC and a SPA). The status of these streams does not appear to have been assessed as part of WFD monitoring programmes.

In addition, and as outlined earlier, there is an open surface water drain running between the private car park and the railway embankment approximately 100m north-east of the leak location.

The leak location is not in an area that is indicated by the OPW as being at risk of fluvial flooding.

3.4 Geology & Hydrogeology

The bedrock geology underlying the leak location is mapped by the GSI as dark limestones and shale (known as 'Calp' limestone). Near-surface overburden deposits are indicated by the GSI to comprise estuarine silts and clays. Based on observations made during the walk-over survey and from a review of historic maps, there is believed to be an area of fill material underlying the area north-east of the leak location.

The groundwater body (GWB) underlying the leak location and the surrounding area is known as the Dublin GWB. This GWB covers an area of approximately 837 km² extending west from the Dublin coastline to the village of Kilmeage in Co. Kildare and extending from Malahide in north Co. Dublin to the southern limits of Dublin city. The GSI classifies the Dublin GWB as a "locally important aquifer". Such aquifers are generally moderately productive only in local zones. Groundwater flow direction in the bedrock aquifer (and also in the overburden) can be expected to be generally towards the east or north-east in the vicinity of the leak location.

The vulnerability of the bedrock aquifer in the vicinity of the leak location is classified by the GSI as “high” which suggests that bedrock is relatively shallow.

A search of the GSI’s online database indicates the presence of two wells approximately 1 km north-west of the leak location. One of these wells was shallow (12m) and there is no information available on its productivity. The other is 84m deep with moderate yield of 96 m³/day.

The EPA is responsible for classifying GWBs in Ireland in terms of water quality and their ability to meet objectives set out in the EU Water Framework Directive. Based on the most recent round of EPA monitoring (2010 – 2015), the status of the Dublin GWB was categorised as “good” and it was categorised as “not at risk” with regard to achieving WFD objectives.

4 CONCEPTUAL SITE MODEL

4.1 Introduction

For the purposes of this PSA, it has been assumed that the top of the fluid filled cable is buried at a depth of 0.9 – 1.1m below ground level within a backfilled trench that is around 1.2m deep. The trench backfill is assumed to comprise a 0.35 m deep sand layer (0.85m bgl) above which the trench is filled with selected excavated material.

For the purposes of the PSA, strata adjacent to and below the cable trench have been assumed to comprise either:

- Low permeability estuarine silts and clays; and/or,
- Granular fill materials associated with trench backfill for other underground services that intersect the route of the fluid filled cable; and/or,
- Granular fill materials associated with historical development and/or land raises in the vicinity of the cable route.

It has also been assumed that perched groundwater may periodically be present within the cable trench.

4.2 Source & Potential Migration Pathways

Based on the expected low permeability of overburden material in the vicinity of the leak location, cable fluid lost to ground in this case can be expected to have spread laterally within the permeable sand bedding within the cable trench. If the cable trench intersects more permeable material (e.g. lenses of natural sands or gravels, permeable fill material or another in-filled services trench) this could result in cable fluid migrating from the line of the cable trench and along a different route or routes.

We have developed a series of indicative estimates for the subject leak location under different ground condition scenarios, with regard to the extent of cable fluid migration. These estimates have assumed that the cable is installed within a 0.35m thick sand bedding and surround layer in a trench 1.1m wide cut into low permeability silt or clay soils, which can be expected at the subject location.

- In the case where (i) the sand bedding is dry, (ii) the cable fluid saturation reaches 40% residual saturation of the pore space in the sand bedding, and (iii) the cable fluid does not migrate into the overlying back-fill material, the theoretical length of trench impacted by LNAPL migration is 394m (1,277m if the two documented leaks in this section of cable are considered cumulatively). Given that the ground elevations along the line of the cable are relatively level, there appears to be potential for cable fluid to migrate along the sand bedding in both directions from the leak location (i.e. generally to the north-west and south-east);
- In the event that the base of the trench contains perched water then this would lower the LNAPL saturation in the sand layer surrounding the cable. This could result in LNAPL migration through the back-fill material above the sand bedding layer, but only if it is sufficiently permeable. The thickness of LNAPL-saturated soils will likely be less under this scenario than that outlined above, but the cable fluid may spread further. If a 40% residual cable fluid saturation is assumed in relatively permeable backfill material over a 0.2m thickness, this would lead to a theoretical length of trench impacted by cable fluid of 690m (2,234m if the two leaks in this section of cable are considered cumulatively);
- The third scenario considered herein is where the cable trench near the leak point passes through an area of granular material. Here a more radial spreading of the cable fluid could occur. If a 0.2m deep soil zone is impacted with a LNAPL saturation of 40% then the theoretical radius of cable fluid LNAPL impact away from the release would be 16 m (under this scenario of radial migration, the two areas of LNAPL from Location 35 and Location 48 would not overlap). Based on the local topography and expected shallow groundwater flow direction, there is potential for the migration of cable fluid under this scenario to be preferentially towards the north-east. This suggests that the cable fluid lost to ground has not migrated as far as the open drain located between the car park and the railway embankment, which is located approximately 100m from the leak location;
- The cable fluid may have some semi-volatile components (alkyl benzenes) and as such will generate a modest vapour pressure. However, given the absence of potential confined spaces in the vicinity of the leak location, this is not considered a viable exposure pathway;
- Cable fluid has the potential to migrate from the source to underneath confined spaced receptors (such as building cellars), either in LNAPL form or via migration in the dissolved phase in groundwater flow following dissolution from the LNAPL. Given the absence of buildings in the vicinity of the leak location, there is no need to assess this pathway in the subject case.

In addition to the above scenarios, the following potential migration pathways were considered as part of the PSA, but they were not carried forward to the preliminary risk assessment because the source-pathway-receptor (SPR) linkage was not considered viable:

- Soil and dust ingestion from near-surface soils;
- Dermal contact with near-surface soils;
- Inhalation of fugitive dust from near-surface soils; and
- Ingestion of soils via consumption of vegetables grown in near-surface soils.

4.3 Potential Receptors

With the above migration pathways in mind, Booterstown Marsh and Dublin Bay in the area of the leak location and also at the Booterstown Marsh discharge, local flora and fauna dependent on these water bodies, and the bedrock aquifer in the Carboniferous Limestone, appear to be the key environmental receptors potentially at risk of impact from the leak of cable fluid from this location.

The potential for cable fluid (or some of its constituent compounds) to permeate buried water mains close to the leak location (if present) and impact water quality in the water mains also needs to be considered.

Groundworks contractors performing future tasks in the vicinity of the leak location could also be considered potential receptors (via direct contact, inhalation and ingestion pathways). However, it has been assumed that the potential risks posed to future groundworks contractors would be adequately mitigated through effective health and safety planning and work control procedures at the time the works are being carried out. As a result, groundworks contractors have not been considered potential receptors in the preliminary risk assessment presented in the following section.

5 PRELIMINARY RISK ASSESSMENT

The key potential source-pathway-receptor (SPR) linkages associated with the subject loss of cable fluid are presented in this section, together with a preliminary assessment of the risk posed to the identified receptors. The preliminary risk assessment is based on the methodology outlined in CIRIA C552 (2001) "*Contaminated Land Risk Assessment – A Guide to Good Practice*". This methodology requires the classification of the magnitude of the **consequence** (severity) of a risk occurring, and the **probability** of a risk occurring. The risk assessment methodology is summarised in Tables 1 – 4 below.

The potential consequences of contamination risks occurring are classified in accordance with Table 1.

Table 1: Classification of Consequence

Classification	Definition of Consequence
Severe	<ul style="list-style-type: none"> • Short-term (acute) risk to human health likely to result in significant harm. • Short-term risk of pollution of sensitive water resource. • Catastrophic damage to buildings/property. • A short-term risk to a particular ecosystem, or organism forming part of such ecosystem.
Medium	<ul style="list-style-type: none"> • Chronic damage to human health. • Pollution of sensitive water resources. • A significant change in a particular ecosystem, or organism forming part of such ecosystem.
Mild	<ul style="list-style-type: none"> • Pollution of non-sensitive water resources. • Significant damage to crops, buildings, structures and services. • Damage to sensitive buildings/structures/services or the environment.
Minor	<ul style="list-style-type: none"> • Harm, although not necessarily significant harm, which may result in a financial loss, or expenditure to resolve. • Non-permanent health effects to human health (easily prevented by means such as personal protective clothing etc.) • Easily repairable effects of damage to buildings, structures and services.

The probability of contamination risks occurring are classified in accordance with Table 2.

Table 2: Classification of Probability

Classification	Definition of Probability
High Likelihood	Circumstances are such that an event appears very likely in the short-term or almost inevitable in the long-term; or there is already evidence that such an event has occurred.
Likely	Circumstances are such that such an event is not inevitable, but is possible in the short-term and is likely over the long-term.
Low Likelihood	Circumstances are such that it is by no means certain that an event would occur even over a longer period, and it is less likely in the short-term.
Unlikely	Circumstances are such that it is improbable that an event would occur even in the very long-term.

For each viable SPR linkage, the potential risks are evaluated, as presented in Table 3.

Definitions of the risk categories, together with the investigatory and remedial actions that may be necessary in each case are presented in Table 4.

Table 3: Risk Matrix

		Severe	Medium	Mild	Minor
Probability	High likelihood	Very high risk	High risk	Moderate risk	Low risk
	Likely	High risk	Moderate risk	Moderate risk	Low risk
	Low likelihood	Moderate risk	Moderate risk	Low risk	Very low risk
	Unlikely	Low risk	Low risk	Very low risk	Very low risk

Table 4: Definition of Risk Categories and Likely Actions Required

Risk Category	Definition and likely actions required
Very high	<p>There is a high probability that severe harm could arise to a designated receptor from an identified hazard OR there is evidence that severe harm to a designated receptor is currently happening.</p> <p>This risk, if realised, is likely to result in a substantial liability.</p> <p>Urgent investigation (if not undertaken already) and remediation are likely to be required.</p>
High	<p>Harm is likely to arise to a designated receptor from an identified hazard.</p> <p>Realisation of the risk is likely to present a substantial liability.</p> <p>Urgent investigation (if not undertaken already) is required and remedial works may be necessary in the short term and are likely over the longer term.</p>
Moderate	<p>It is possible that harm could arise to a designated receptor from an identified hazard. However, it is relatively unlikely that any such harm would be severe. If any harm were to occur, it is more likely that the harm would be relatively mild.</p> <p>Investigation (if not already undertaken) is normally required to clarify the risk and to determine the potential liability. Some remedial works may be required in the longer term.</p>
Low	<p>It is possible that harm could arise to a designated receptor from an identified hazard, but it is likely that this harm, if realised, would at worst be mild.</p>
Very low	<p>There is a low possibility that harm could arise to a receptor. In the event of such harm being realised, it is not likely to be severe.</p>

The key potential SPR linkages associated with the subject loss of cable fluid are presented in Table 5 below, together with a preliminary assessment of the risk posed to the identified receptors in each case, in line with the above methodology.

Table 5: Preliminary Risk Assessment for Location 35

Source	Potential Pathway	Receptor	Consequence	Probability	Risk Category	Comment
<p>Loss of cable fluid (linear alkyl benzenes) over a six-month period during the period October 2008 – March 2009 (estimated 12,140 litres).</p> <p>This followed on from an earlier loss of an estimated 27,177 litres of linear alkyl benzenes over the period 2004 – 2007 (Location 48).</p>	<p>Predominantly lateral migration of cable fluid from the leak location along the cable trench, and/or through granular lenses within the overburden or infill material, potentially followed by migration along other preferential pathways (e.g. other in-filled services trenches that intersect the cable trench, potentially the open drain adjacent to the railway embankment).</p>	<p>Boosterstown Marsh (a SPA); Dublin Bay (a SAC &, SPA); Ecosystems dependent on the above water bodies</p>	Medium	Likely	Moderate	<p>No preferential pathway linking the leak location to the open drain adjacent to the private car park has been identified.</p> <p>However, there is potential for cable fluid to have migrated along the cable trench to Elm Stream (ca. 200m north of leak location) and/or Boosterstown Stream (ca. 200m south of leak location), both of which discharge to South Dublin Bay, and also to the vicinity of Boosterstown Marsh.</p> <p>It is understood that ESB has received no reports of pollution of Boosterstown Marsh or South Dublin Bay that could be linked to the subject loss of cable fluid.</p>
	<p>Predominantly lateral migration of cable fluid from the leak location along the cable trench, and/or through granular lenses within the overburden, and subsequent migration into backfilled trenches containing water mains (if present). Permeation of constituents of the cable fluid through the walls or joints of the water mains.</p>	Water mains/ Water supply	Medium	Unlikely	Low	<p>Whilst the potential for organic compounds to permeate water mains is known (in particular plastic water pipes and the joints of other types of water pipes), the potential for alkyl benzenes to permeate water mains was not established during the PSA.</p> <p>The risk category assumes that cable fluid may be present as residual LNAPL in the water main trench and that there is potential for it to permeate water pipes. However, the low solubility of the alkyl benzenes and the expected low rate of permeation are such that they are unlikely to impact water quality in the pipes.</p>

Table 5: Preliminary Risk Assessment for Location 35

Source	Potential Pathway	Receptor	Consequence	Probability	Risk Category	Comment
(as above)	Vertical migration of cable fluid via permeable lenses in the overburden and/or via granular material in in-filled services trenches to groundwater in the bedrock aquifer, followed by dissolution of cable fluid and generation of a dissolved-phase plume of alkyl benzenes in the bedrock aquifer.	Bedrock aquifer	Mild	Low Likelihood	Low	The bedrock is classified as a “locally important” aquifer. Vulnerability rating is “high” close to the leak location. However, the water table in the estuarine clays is expected to be shallow, reducing the potential for downward migration of cable fluid to the bedrock aquifer. No preferential pathways potentially linking the leak location to the aquifer have been identified.

6 CONCLUSIONS

The following conclusions have been drawn based on the information reviewed and observations made during this PSA:

- The leak location is adjacent to the Merrion Road and close to the entrance to a private surface-level car park in Booterstown, Co. Dublin;
- South Dublin Bay, which is a designated SPA and a SAC, lies approximately 100m north-east of the leak location, and Booterstown Marsh which is part of the South Dublin Bay SPA lies approximately 200m south-east of the leak location;
- The topography in the vicinity of the leak location is flat;
- The closest streams to the leak location are Elm Park Stream and Booterstown Stream, which both flow north-east within culverts approximately 200m north-west and 200m south-east of the leak location, respectively. Both streams discharge to South Dublin Bay;
- The key receptors potentially at risk of impact from the subject leak are considered to be Booterstown Marsh (via the open drain adjacent to the railway embankment), South Dublin Bay close to the leak location and in the area adjacent to the Booterstown Marsh discharge, flora and fauna dependent on these water bodies, the bedrock aquifer underlying the area, and water mains in the vicinity of the leak location (if present);
- Following the preliminary risk assessment methodology outlined in CIRIA publication C552 (2001), the appropriate risk category for these potential receptors and the associated SPR linkages are considered to be:
 - Booterstown Marsh SPA - Moderate
 - Dublin Bay SAC/SPA - Moderate
 - Water mains - Low
 - Bedrock aquifer - Low

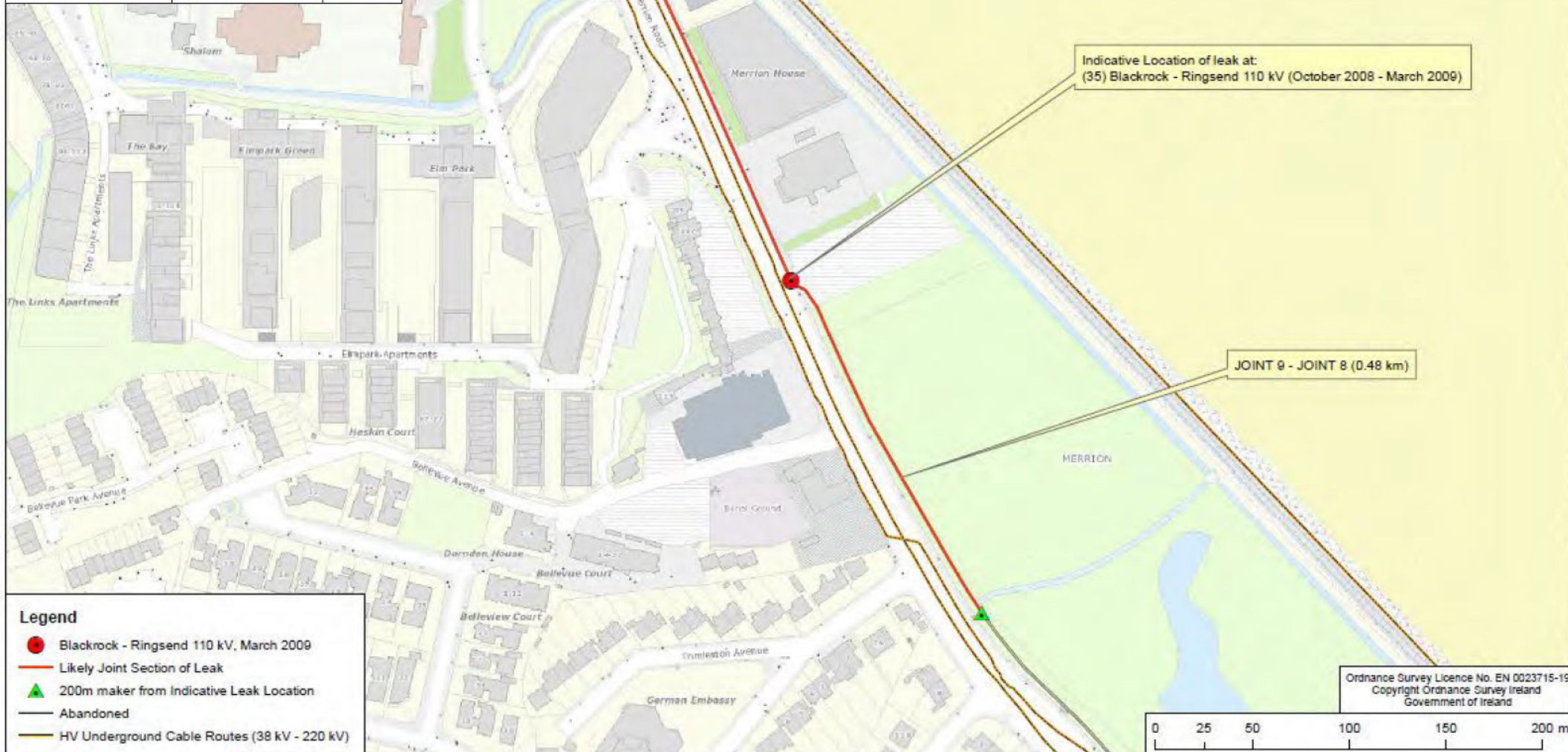
Further investigation of the risk to Booterstown Marsh, Dublin Bay in the vicinity of the leak location and the Booterstown Marsh discharge, and their associated ecosystems, is considered necessary as a precaution to confirm the assessed level of risk. Further investigation of the risk to water mains and the bedrock aquifer is not considered necessary.

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Figure 1 - Location No. 35

Booterstown, Dublin		GCU0257001	
Geosyntec consultants		ESB Networks	
Dublin, Ireland		July 2019	
		Figure 1	



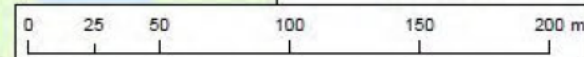
Legend

- Blackrock - Ringsend 110 kV, March 2009
- Likely Joint Section of Leak
- ▲ 200m maker from Indicative Leak Location
- Abandoned
- HV Underground Cable Routes (38 kV - 220 kV)

Indicative Location of leak at:
(35) Blackrock - Ringsend 110 kV (October 2008 - March 2009)

JOINT 9 - JOINT 8 (0.48 km)

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REV	DATE	REVISION DESCRIPTION	DRN	PRCD	SER
CLIENT APPROVAL		<input type="checkbox"/> PLANNING	<input type="checkbox"/> TRACKING	<input type="checkbox"/> CONSTRUCTION	<input type="checkbox"/> ABANDONED



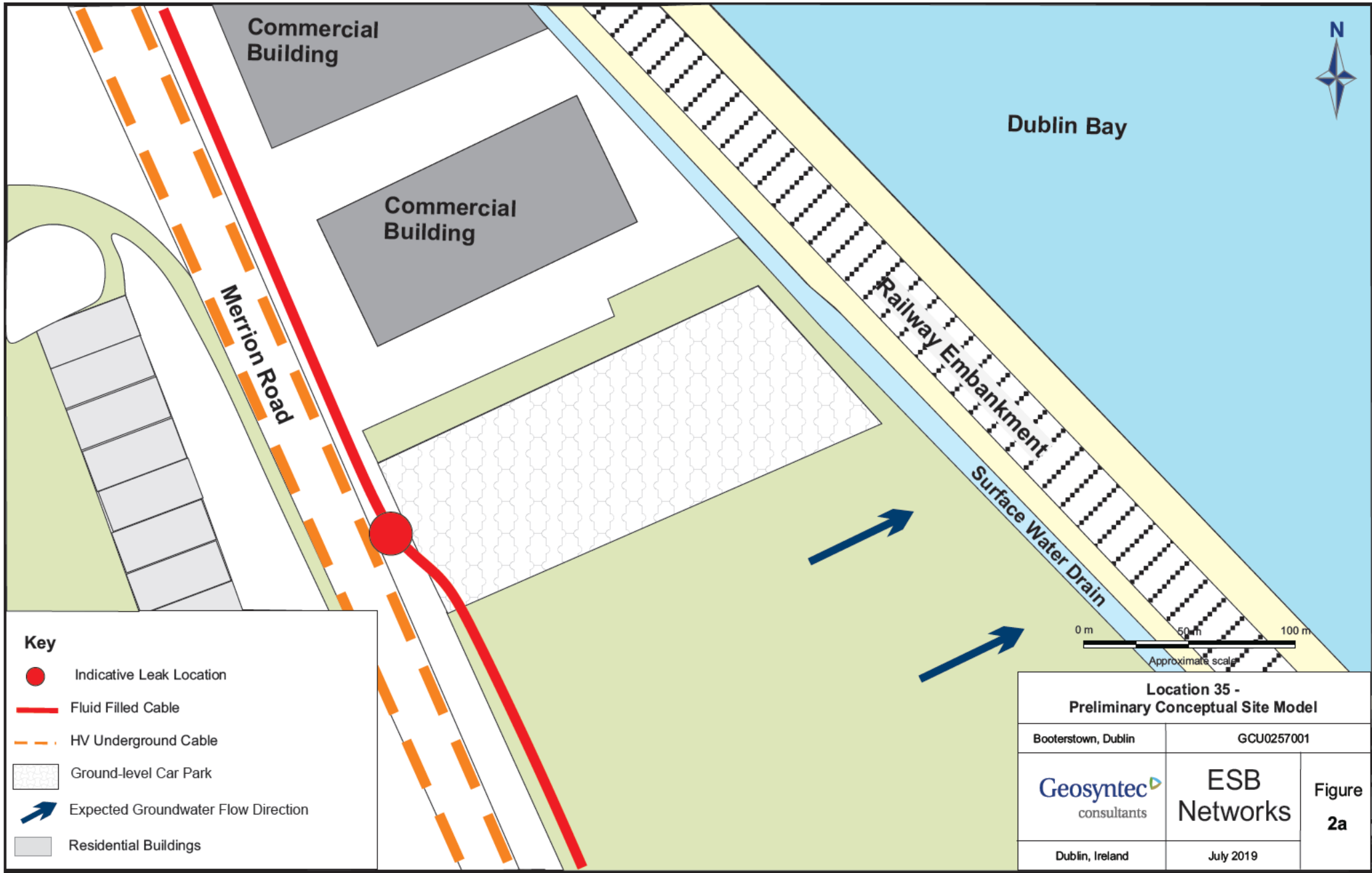
**Engineering and Major Projects,
One Dublin Airport Central,
Dublin Airport, Cloughran,
Co. Dublin, K67 XF72, Ireland.**
Tel: 011 703 8000 Web: www.esb.ie
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CLIENT:	ESB Networks
PROJECT:	P.R.A.
CONTRACT:	

PRODUCTION UNIT:	Civil & Environmental Engineering
DRAWING TITLE:	Indicative Cable Fluid Leakage Locations & Cable Sections (35) Blackrock - Ringsend 110 kV (October 2008 - March 2009)

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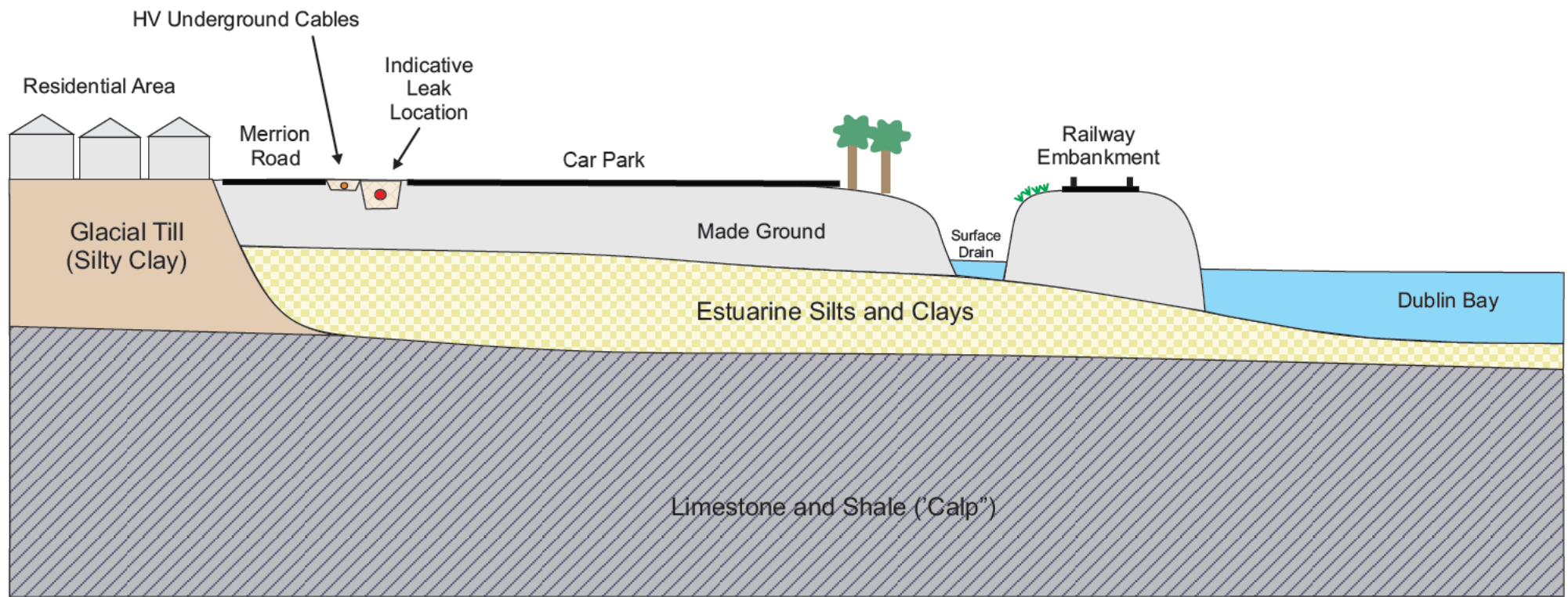
DRAWN:	T.O'Rourke	PRODUCED:	T.O'Rourke	CHECKED:	J. Fitzpatrick	APPROVED:	A.M. Casey	APPROVAL DATE:	24/07/2019
CLIENT REF:	00-00	REVISION:	2	NO. OF SHEETS:	1 of 1	SIZE:	A3	SCALE:	1:2,000
DRAWING NUMBER:		QD-354120-01-D460-001-049-000							



Key

- Indicative Leak Location
- Fluid Filled Cable
- HV Underground Cable
- Ground-level Car Park
- Expected Groundwater Flow Direction
- Residential Buildings

Location 35 - Preliminary Conceptual Site Model		
Boooterstown, Dublin	GCU0257001	
		Figure 2a
Dublin, Ireland	July 2019	



South-West

North-East

Location 35 - Preliminary Conceptual Site Model		
Boosterstown, Co. Dublin	GCU0257001	
Geosyntec consultants	ESB Networks	Figure 2b
Dublin, Ireland	July 2019	

Appendix A - Photolog

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Photograph 1 – View north from leak location



Photograph 2 – View north past Merrion House

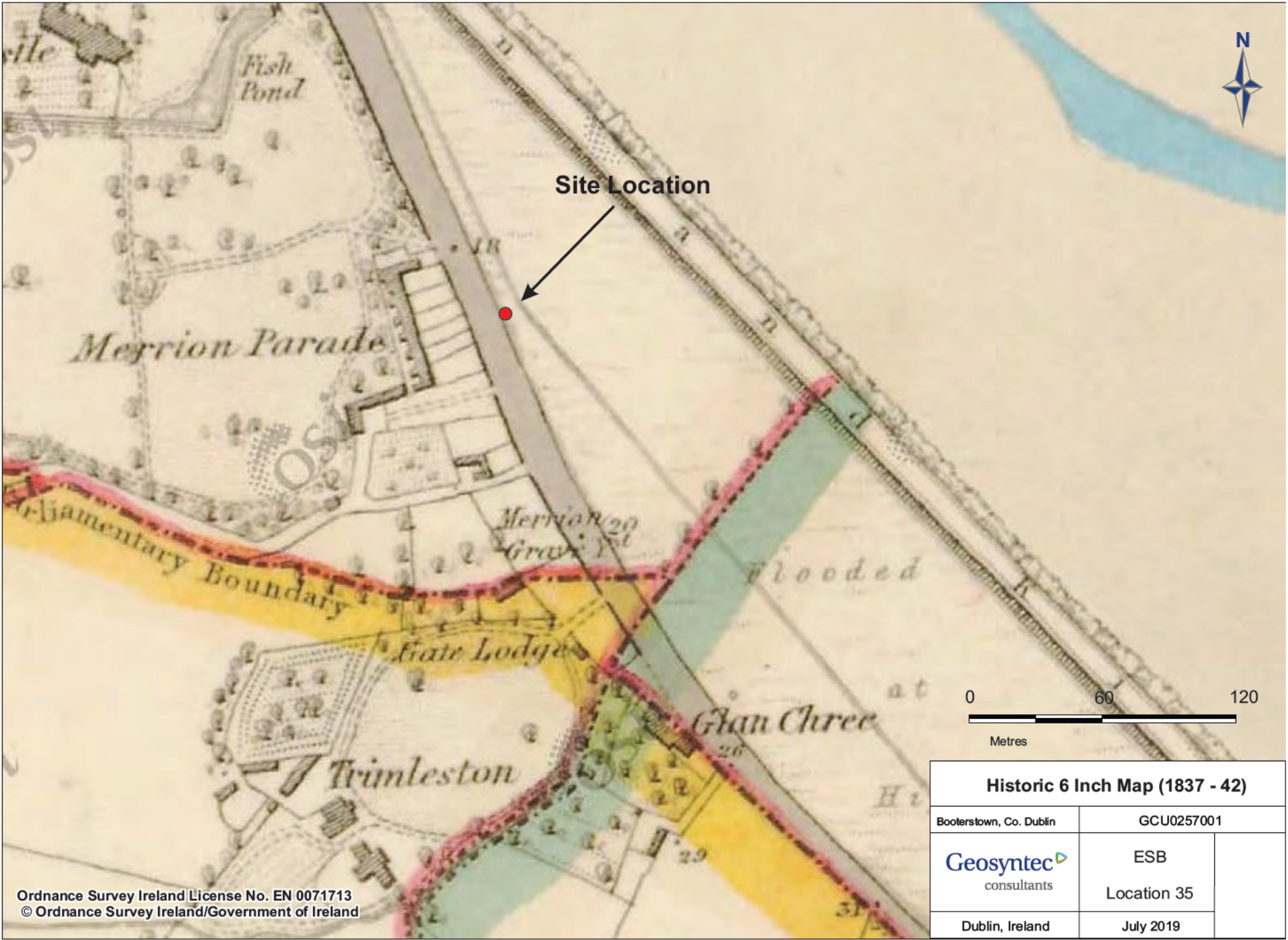


Photograph 3 – View south from leak location

Appendix B – Historical Maps and Aerial Images

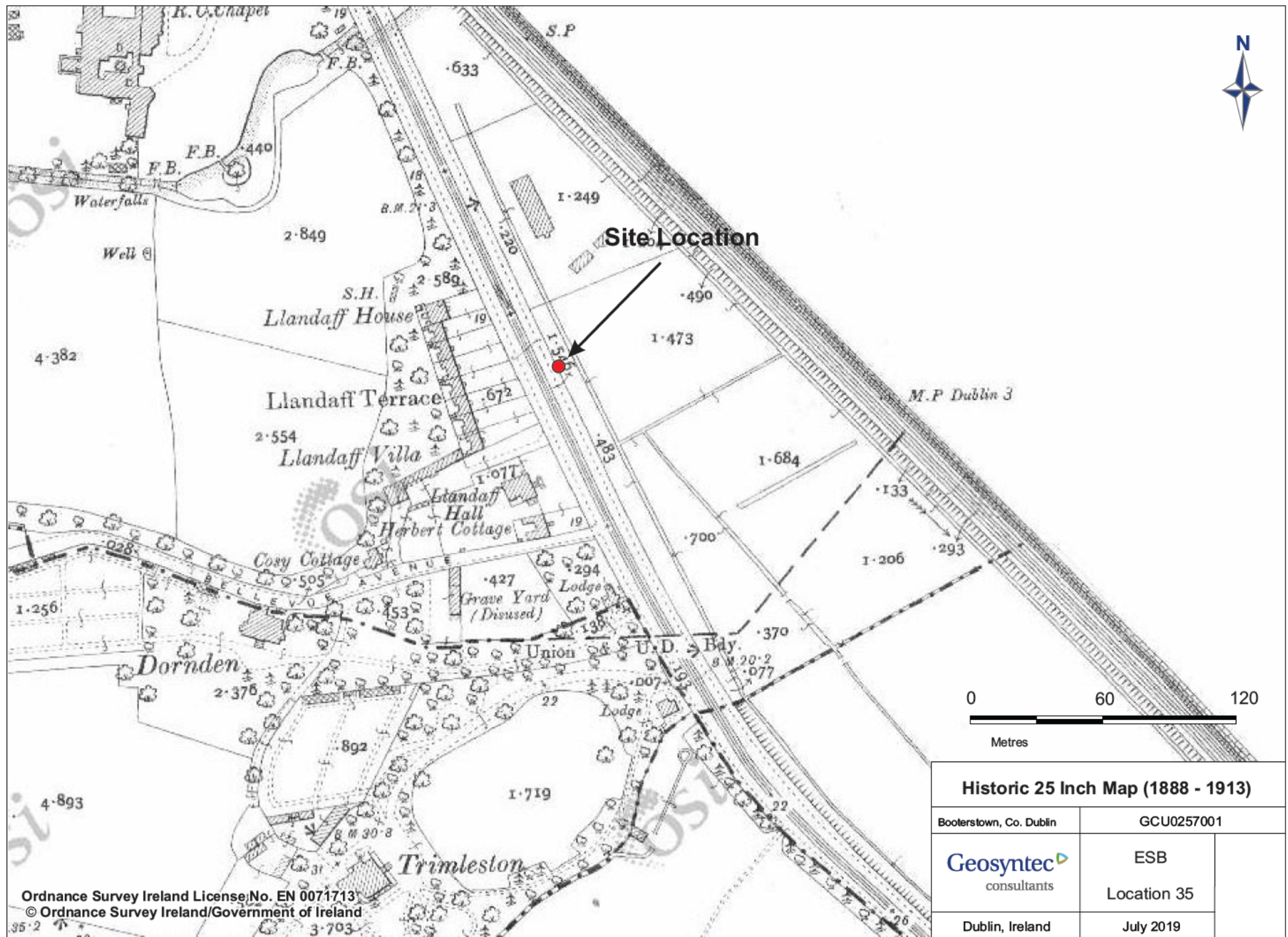
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Historic 6 Inch Map (1837 - 42)	
Boosterstown, Co. Dublin	GCU0257001
Geosyntec consultants	ESB
	Location 35
Dublin, Ireland	July 2019



Site Location



Historic 25 Inch Map (1888 - 1913)

Booterstown, Co. Dublin		GCU0257001	
	ESB		
	Location 35		
Dublin, Ireland		July 2019	

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Present Day Aerial Image	
Boooterstown, Co. Dublin	GCU0257001
Geosyntec consultants	ESB
	Location 35
Dublin, Ireland	July 2019

Appendix C - Safety Data Sheet for Cable Fluid

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C**

**Safety Data Sheet**

according to Regulation (EC) No 1907/2006

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Revision date: 08.05.2018

Product code: HURBV947130TGE

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SECTION 1: Identification of the substance/mixture and of the company/undertaking**1.1. Product identifier**

T 3788

CAS No: 67774-74-7

EC No: 267-051-0

1.2. Relevant identified uses of the substance or mixture and uses advised against**Use of the substance/mixture**

ES1 - Industrial use of intermediates.

Sector of uses [SU]:

SU3: Industrial uses: Uses of substances as such or in preparations at industrial sites

Environmental release categories [ERC]:

ERC 6a: Use of intermediate

Process categories [PROC]:

PROC 2: Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions

ES2 - Formulation & (re)packing of substances and mixtures - Industrial uses

Sector of uses [SU]:

SU3: Industrial uses: Uses of substances as such or in preparations at industrial sites

Environmental release categories [ERC]:

ERC 2: Formulation into mixture (mixtures)

Process categories [PROC]:

PROC 1: Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions

PROC 2: Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions

PROC 3: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition

PROC 4: Mixing or blending in batch processes

PROC 5: Mixing or blending in batch processes

PROC 8a: Transfer of substance or mixture (charging and discharging) at non-dedicated facilities

PROC 8b: Transfer of substance or mixture (charging and discharging) at dedicated facilities

PROC 9: Transfer of substance or mixture into small containers (dedicated filling line, including weighing)

PROC 15: Use as laboratory reagent.

ES03 - Use in cable oil - industrial use

Sector of uses [SU]:

SU3: Industrial uses: Uses of substances as such or in preparations at industrial sites

Environmental release categories [ERC]:

ERC 5: Use at industrial site leading to inclusion into/onto article

ERC 7: Use of functional fluid at industrial site

Process categories [PROC]:

PROC 13: Treatment of articles by dipping and pouring

Uses advised against

none

1.3. Details of the supplier of the safety data sheet

Company name: H&R ChemPharm (UK) Limited

Street: Dudley Road

Place: GB-DY4 8EH Tipton, West Midlands

Telephone: +441215220100

Telefax: +441215220116

e-mail: info.uk@hur.com

Responsible Department: Technical/Commercial Enquiries

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1.4. Emergency telephone number: +44(0)2078580111

SECTION 2: Hazards identification**2.1. Classification of the substance or mixture****Regulation (EC) No 1272/2008**

Hazard categories:

Aspiration hazard: Asp. Tox. 1

Hazard Statements:

May be fatal if swallowed and enters airways.

2.2 Label element**Regulation (EC) No. 1272/2008****Signal word:** Danger**Pictograms:****Hazard statements**

H304 May be fatal if swallowed and enters airways.

Precautionary statements

P301+P310 IF SWALLOWED: Immediately call a POISON CENTER/doctor.

P331 Do NOT induce vomiting.

P501 Dispose of contents/container to local/regional/national/international regulations.

2.3. Other hazards

This substance does not meet the PBT/vPvB criteria of REACH, Annex XIII.

SECTION 3: Composition/information on ingredients**3.1. Substances****Hazardous components**

CAS No	Chemical name	Quantity		
	EC No	Index No	REACH No	
	Classification according to Regulation (EC) No. 1272/2008 [CLP]			
67774-74-7	Benzene, C10-13-alkyl derivs.			100 %
	267-051-0			
	Asp. Tox. 1; H304			

Full text of H and EUH statements: see section 16.

SECTION 4: First aid measures**4.1. Description of first aid measures****General information**

In case of accident or unwellness, seek medical advice immediately (show directions for use or safety data sheet if possible).

After inhalation

In case of accident by inhalation: remove casualty to fresh air and keep at rest. In all cases of doubt, or when symptoms persist, seek medical advice.

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After contact with skin

After contact with skin, wash immediately with plenty of water and soap. Take off immediately all contaminated clothing. In case of skin irritation, consult a physician.

After contact with eyes

Rinse immediately carefully and thoroughly with eye-bath or water. In case of troubles or persistent symptoms, consult an ophthalmologist.

After ingestion

Do NOT induce vomiting. Rinse mouth thoroughly with water. Let water be drunken in little sips (dilution effect). Observe risk of aspiration if vomiting occurs. Never give anything by mouth to an unconscious person or a person with cramps. When in doubt or if symptoms are observed, get medical advice.

4.2. Most important symptoms and effects, both acute and delayed

If swallowed or in the event of vomiting, risk of entering the lungs.

4.3. Indication of any immediate medical attention and special treatment needed

Treat symptomatically.

SECTION 5: Firefighting measures**5.1. Extinguishing media****Suitable extinguishing media**

Sand. Foam. Carbon dioxide (CO₂). Extinguishing powder. In case of major fire and large quantities: Water spray jet. Water mist.

Unsuitable extinguishing media

Full water jet

5.2. Special hazards arising from the substance or mixture

Burning produces heavy smoke.

Can be released in case of fire: Carbon monoxide Carbon dioxide (CO₂) Sulphur dioxide (SO₂) Nitrogen oxides (NO_x)

5.3. Advice for firefighters

In case of fire and/or explosion do not breathe fumes. In case of fire: Wear self-contained breathing apparatus.

Additional information

Collect contaminated fire extinguishing water separately. Do not allow entering drains or surface water.

Co-ordinate fire-fighting measures to the fire surroundings.

SECTION 6: Accidental release measures**6.1. Personal precautions, protective equipment and emergency procedures**

Wear personal protection equipment (refer to section 8).

Ventilate affected area.

Special danger of slipping by leaking/spilling product.

6.2. Environmental precautions

Do not allow to enter into surface water or drains. Prevent spread over a wide area (e.g. by containment or oil barriers). Do not allow to enter into soil/subsoil.

6.3. Methods and material for containment and cleaning up

Absorb with liquid-binding material (e.g. sand, diatomaceous earth, acid- or universal binding agents).

Treat the recovered material as prescribed in the section on waste disposal.

Clean contaminated articles and floor according to the environmental legislation.

6.4. Reference to other sections

No information available.

SECTION 7: Handling and storage

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7.1. Precautions for safe handling**Advice on safe handling**

Wear suitable protective clothing. (See section 8.)
Avoid formation of oil dust.

Advice on protection against fire and explosion

Usual measures for fire prevention. Keep away from sources of ignition - No smoking.
Fire class B

Further information on handling

Do not breathe vapour/aerosol.
Avoid contact with eyes and skin.
Advices on general occupational hygiene: See section 8.

7.2. Conditions for safe storage, including any incompatibilities**Requirements for storage rooms and vessels**

Keep container tightly closed in a cool, well-ventilated place. Only use containers specifically approved for the substance/product.

Advice on storage compatibility

Do not store together with: Gas. Explosives. Radioactive substances. Infectious substances

Further information on storage conditions

Temperature control required. Protect from light. Keep container tightly closed. Do not allow contact with air.

7.3. Specific end use(s)

refer to chapter 1.

SECTION 8: Exposure controls/personal protection**8.1 Control parameter****DNEL/DMEL values**

CAS No	Substance	Exposure route	Effect	Value
67774-74-7	Benzene, C10-13-alkyl derivs.			
Worker DNEL, long-term		inhalation	systemic	7 mg/m ³
Worker DNEL, long-term		inhalation	local	7 mg/m ³
Worker DNEL, long-term		dermal	systemic	9,6 mg/kg bw/day
Consumer DNEL, long-term		inhalation	systemic	1,8 mg/m ³
Consumer DNEL, long-term		inhalation	local	1,8 mg/m ³
Consumer DNEL, long-term		dermal	systemic	4,8 mg/kg bw/day
Consumer DNEL, long-term		oral	systemic	0,5 mg/kg bw/day

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PNEC values

CAS No	Substance	Value
Environmental compartment		
67774-74-7	Benzene, C10-13-alkyl derivs.	
Freshwater		0,001 mg/l
Freshwater (intermittent releases)		0 mg/l
Marine water		0 mg/l
Freshwater sediment		1,65 mg/kg
Marine sediment		0,165 mg/kg
Micro-organisms in sewage treatment plants (STP)		14,2 mg/l
Soil		0,329 mg/kg

Additional advice on limit values

Air limit values::

Possibility of exposure to Aerosol

Limit value = 5 mg/ m³ - Source: ACGIH**8.2. Exposure controls****Appropriate engineering controls**

Provide adequate ventilation.

Protective and hygiene measures

Clean skin thoroughly after working.

Do not put any product-impregnated cleaning rags into your trouser pockets.

When using do not eat, drink or smoke.

Eye/face protection

Safety goggles with side protection. In case of increased risk add protective face shield. DIN EN 166

Hand protection

Use safety gloves of following materials: NBR (nitrile) / neopren / viton (permeationslevel 5 - 6), Cat. II according to norm EN 347/EN 388.

The quality of the protective gloves resistant to chemicals must be chosen as a function of the specific working place concentration and quantity of hazardous substances.

For special purposes, it is recommended to check the resistance to chemicals of the protective gloves mentioned above together with the supplier of these gloves.

Skin protection

Oil-resistant and hardly inflammable protective clothing.

Respiratory protection

With correct and proper use, and under normal conditions, breathing protection is not required.

Respiratory protection necessary at:

-aerosol or mist formation

-exceeding exposure limit values

Suitable respiratory protection apparatus: Respiratory equipment in case of nebulosity or aerosol: Use a mask with a filter type A2, A2/P2 or ABEK.

The filter class must be suitable for the maximum contaminant concentration (gas/vapour/aerosol/particulates) that may arise when handling the product. If the concentration is exceeded, self-contained breathing apparatus must be used.

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Environmental exposure controls

No information available.

SECTION 9 Physical and chemical properties**9.1. Information on basic physical and chemical properties**

Physical state: Liquid
Colour: colourless
Odour: characteristic

Test method

pH-Value: No information available.

Changes in the physical state

Melting point: -39 °C
Initial boiling point and boiling range: >260 °C
Sublimation point: No information available.
Softening point: No information available.
Pour point: > -60 °C ASTM D 97-66
Flash point: >130 °C ASTM D 93
Sustaining combustion: No data available

Flammability

Solid: No information available.
Gas: No information available.

Explosive properties

none

Lower explosion limits: No information available.
Upper explosion limits: No information available.
Ignition temperature: No information available.

Auto-ignition temperature

Solid: No information available.
Gas: No information available.

Decomposition temperature: No information available.

Oxidizing properties

none

Vapour pressure: 0,013 hPa ASTM D 323
(at 25 °C)Vapour pressure: No information available.
(at 50 °C)Density: 0,85-0,88 g/cm³ ASTM D 1298

Bulk density: No information available.

Water solubility: Immiscible

Solubility in other solvents

No information available.

Partition coefficient: No information available.

Viscosity / dynamic: No information available.

Viscosity / kinematic: 4,0-4,5 mm²/s ASTM D 445
(at 40 °C)

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Flow time: No information available.
Vapour density: No information available.
Evaporation rate: No information available.
Solvent separation test: No information available.
Solvent content: No information available.

9.2. Other information

Solid content: No information available.

SECTION 10 Stability and reactivity**10.1. Reactivity**

No information available.

10.2. Chemical stability

Stable at ambient temperature.

10.3. Possibility of hazardous reactions

No hazardous reactions known.

10.4. Conditions to avoid

No information available.

10.5. Incompatible materials

Oxidising agent, strong

10.6. Hazardous decomposition products

No hazardous decomposition products known.

SECTION 11: Toxicological information**11.1. Information on toxicological effects****Toxicokinetics, metabolism and distribution**

No information available.

Acute toxicity

Based on available data, the classification criteria are not met.

CAS No	Chemical name				
	Exposure route	Dose	Species	Source	Method
67774-74-7	Benzene, C10-13-alkyl derivs.				
	oral	LD50 > 5000 mg/kg	Rat	ECHA Dossier	EEC Directive 67/548
	dermal	LD50 > 2000 mg/kg	Rat	ECHA Dossier	OECD Guideline 402

Irritation and corrosivity

Based on available data, the classification criteria are not met.

Sensitising effects

Based on available data, the classification criteria are not met.
May cause sensitisation especially in sensitive humans.

Carcinogenic/mutagenic/toxic effects for reproduction

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Based on available data, the classification criteria are not met.

Reproductive toxicity:

Method: OECD Guideline 416 (Two-Generation Reproduction Toxicity Study)

Species: Rat

Result: NOEL = 50 mg/kg (P0), 50 mg/kg (F1), 50 mg/kg (F2); Literature information: ECHA Dossier

Developmental toxicity/teratogenicity: Method: OECD Guideline 414 (Prenatal Developmental Toxicity Study);

Species: Rat; Result: NOAEL = 125 mg/kg (embryotoxicity); Literature information: ECHA Dossier; Reproductive toxicity:

STOT-single exposure

Based on available data, the classification criteria are not met.

STOT-repeated exposure

Based on available data, the classification criteria are not met.

Acute hazard

May be fatal if swallowed and enters airway (Benzene, C10-13 alkyl deriv.)

Practical experience**Other observations**

Frequent contact especially if dried out may cause skin and eye irritations.

SECTION 12: Ecological information**12.1. Toxicity**

If this product contains phenol, dodecyl, branched (EC No. 310-154-3), this product is not to be classified as dangerous for the environment. Raw materials containing this substance have not been classified by our suppliers as hazardous to the environment on the basis of test data, expert judgement or analogy assessments.

CAS No	Chemical name						
	Aquatic toxicity	Dose	[h] [d]	Species	Source	Method	
67774-74-7	Benzene, C10-13-alkyl derivs.						
	Acute algae toxicity	ErC50 mg/l	>0,1*	72 h	Desmodesmus subspicatus	ECHA Dossier	*The substance is not soluble in water. - OECD Guideline 201
	Acute crustacea toxicity	EC50 mg/l	> 0,041*	48 h	Daphnia magna	ECHA Dossier	*The substance is not soluble in water. - EU Method C.2
	Fish toxicity	NOEC 8* mg/l	>0,0577	21 d	Danio rerio	ECHA Dossier	*The substance is not soluble in water. - OECD Guideline 203
	Crustacea toxicity	NOEC mg/l	>0,007*	21 d	Daphnia magna	ECHA Dossier	*The substance is not soluble in water.

12.2. Persistence and degradability

The product is slightly soluble in water. It can be largely eliminated from the water by abiotic processes, e.g. mechanical separation.

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CAS No	Chemical name	Method	Value	d	Source
67774-74-7	Benzene, C10-13-alkyl derivs.	Evaluation			
	OECD Guideline 301 F	64%	28	ECHA Dossier	
	Easily biodegradable (concerning to the criteria of the OECD)				

12.3. Bioaccumulative potential

No indication of bioaccumulation potential.

Partition coefficient n-octanol/water

CAS No	Chemical name	Log Pow
67774-74-7	Benzene, C10-13-alkyl derivs.	6,4

BCF

CAS No	Chemical name	BCF	Species	Source
67774-74-7	Benzene, C10-13-alkyl derivs.	35		Environmental Toxicology

12.4. Mobility in soil

No information available.

12.5. Results of PBT and vPvB assessment

This substance does not meet the PBT/vPvB criteria of REACH, Annex XIII.

12.6. Other adverse effects

No information available.

SECTION 13 Disposal**13.1. Waste treatment methods****Advice on disposal**

Dispose of waste according to applicable legislation. Consult the appropriate local waste disposal expert about waste disposal. Non-contaminated packages may be recycled. The allocation of waste identity numbers/waste descriptions must be carried out according to the EEC, specific to the industry and process.

Waste disposal number of contaminated packaging

150110 WASTE PACKAGING; ABSORBENTS, WIPING CLOTHS, FILTER MATERIALS AND PROTECTIVE CLOTHING NOT OTHERWISE SPECIFIED; packaging (including separately collected municipal packaging waste); packaging containing residues of or contaminated by hazardous substances; hazardous waste

Contaminated packaging

Handle contaminated packages in the same way as the substance itself.

SECTION 14: Transport information**Land transport (ADR/RID)**

14.1. UN number:	No dangerous good in sense of this transport regulation.
14.2. UN proper shipping name:	No dangerous good in sense of this transport regulation.
14.3. Transport hazard class(es):	No dangerous good in sense of this transport regulation.
14.4. Packing group:	No dangerous good in sense of this transport regulation.

Inland waterways transport (ADN)

14.1. UN number:	No dangerous good in sense of this transport regulation.
14.2. UN proper shipping name:	No dangerous good in sense of this transport regulation.
14.3. Transport hazard class(es):	No dangerous good in sense of this transport regulation.

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14.4. Packing group:	No dangerous good in sense of this transport regulation.
Marine transport (IMDG)	
14.1. UN number:	No dangerous good in sense of this transport regulation.
14.2. UN proper shipping name:	No dangerous good in sense of this transport regulation.
14.3. Transport hazard class(es):	No dangerous good in sense of this transport regulation.
14.4. Packing group:	No dangerous good in sense of this transport regulation.
Air transport (ICAO-TI/IATA-DGR)	
14.1. UN number:	No dangerous good in sense of this transport regulation.
14.2. UN proper shipping name:	No dangerous good in sense of this transport regulation.
14.3. Transport hazard class(es):	No dangerous good in sense of this transport regulation.
14.4. Packing group:	No dangerous good in sense of this transport regulation.
14.5. Environmental hazards	
ENVIRONMENTALLY HAZARDOUS:	no
14.6. Special precautions for user	
Information for safe handling see chapter 7	
Information for personal protective equipment see chapter 8	
14.7. Transport in bulk according to Annex II of Marpol and the IBC Code	
not relevant	

SECTION 15: Regulatory information**15.1. Safety, health and environmental regulations/legislation specific for the substance or mixture****EU regulatory information**

2010/75/EU (VOC):	No information available
2004/42/EC (VOC):	No information available.
Information according to 2012/18/EU (SEVESO III):	Not subject to 2012/18/EU (SEVESO III)

Additional information

Observe in addition any national regulations!

National regulatory information

Employment restrictions:	Observe restrictions to employment for juvenils according to the 'juvenile work protection guideline' (94/33/EC).
Water contaminating class (D):	1 - slightly water contaminating

Additional information

none

15.2 Chemical Safety Assessment
not applicable.**15.2. Chemical safety assessment**

For this substance a chemical safety assessment has been carried out.

SECTION 16: Other information**Changes**

Rev. : 1,0 - 08.05.2018

Abbreviations and acronyms

ADR: Accord européen sur le transport des marchandises dangereuses par Route

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CAS Chemical Abstracts Service
DNEL: Derived No Effect Level
IARC: INTERNATIONAL AGENCY FOR RESEARCH ON CANCER
IMDG: International Maritime Code for Dangerous Goods
IATA: International Air Transport Association
IATA-DGR: Dangerous Goods Regulations by the "International Air Transport Association" (IATA)
ICAO: International Civil Aviation Organization
ICAO-TI: Technical Instructions by the "International Civil Aviation Organization" (ICAO)
GHS: Globally Harmonized System of Classification and Labelling of Chemicals
GefStoffV: Gefahrstoffverordnung (Ordinance on Hazardous Substances, Germany)
LOAEL: Lowest observed adverse effect level
LOAEC: Lowest observed adverse effect concentration
LC50: Lethal concentration, 50 percent
LD50: Lethal dose, 50 percent
NOAEL: No observed adverse effect level
NOAEC: No observed adverse effect level
NTP: National Toxicology Program
N/A: not applicable
OSHA: Occupational Safety and Health Administration
PNEC: predicted no effect concentration
PBT: Persistent bioaccumulative toxic
RID: Règlement international concernant le transport des marchandises dangereuses par chemin de fer (Regulations Concerning the International Transport of Dangerous Goods by Rail)
SARA: Superfund Amendments and Reauthorization Act
SVHC: substance of very high concern
TRGS Technische Regeln fuerGefahrstoffe
TSCA: Toxic Substances Control Act
VOC: Volatile Organic Compounds
VwVwS: Verwaltungsvorschrift wassergefaehrdender Stoffe
WGK: Wassergefaehrdungsklasse

Relevant H and EUH statements (number and full text)

H304 May be fatal if swallowed and enters airways.

Further Information

Classification according to Regulation (EC) No 1272/2008 [CLP] - Classification procedure:

Health hazards: Calculation method. ; H304: On basis of test data.

Environmental hazards: Calculation method.

Physical hazards: On basis of test data.

The above information describes exclusively the safety requirements of the product and is based on our present-day knowledge. The information is intended to give you advice about the safe handling of the product named in this safety data sheet, for storage, processing, transport and disposal. The information cannot be transferred to other products. In the case of mixing the product with other products or in the case of processing, the information on this safety data sheet is not necessarily valid for the new made-up material.

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Identified uses

No	Short title	LCS	SU	PC	PROC	ERC	AC	TF	Specifica ion
1	Industrial use of intermediates.	-	0	-	2	6a	-	-	
2	Formulation & (re)packing of substances and mixtures - Industrial uses	F	0	-	1, 3, 4, 5, 8a, 8b, 9, 15	2	-	-	

LCS: Life cycle stages

PC: Product categories

ERC: Environmental release categories

TF: Technical functions

SU: Sectors of use

PROC: Process categories

AC: Article categories

Material Safety Data Sheet**1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND COMPANY/UNDERTAKING**

Material Name : Shell Diala Cable Oil
Uses : Insulating oil.
Product Code : 001D8369

Manufacturer/Supplier : Shell UK Oil Products Limited
 PO BOX 3
 Ellesmere Port
 CH65 4HB
 United Kingdom

Telephone : +44 (0) 151-350-4000
Fax : +44 (0) 151-350-4000
Email Contact for MSDS : If you have any enquiries about the content of this MSDS please email lubricantSDS@shell.com

Emergency Telephone Number : +44-(0) 151-350-4595

2. HAZARDS IDENTIFICATION

EC Classification : Harmful.

Health Hazards : Repeated exposure may cause skin dryness or cracking.
 Harmful: may cause lung damage if swallowed.

Signs and Symptoms : If material enters lungs, signs and symptoms may include coughing, choking, wheezing, difficulty in breathing, chest congestion, shortness of breath, and/or fever. The onset of respiratory symptoms may be delayed for several hours after exposure. Defatting dermatitis signs and symptoms may include a burning sensation and/or a dried/cracked appearance. Ingestion may result in nausea, vomiting and/or diarrhoea.

Safety Hazards : Not classified as flammable but will burn.
Environmental Hazards : Not classified as dangerous for the environment.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Preparation Description : Alkyl benzene.

Hazardous Components

Chemical Identity	CAS	EINECS	Symbol(s)	R-phrases(s)	Conc.
Benzene, C10-C13 alkyl derivatives	67774-74-7	267-051-0	Xn	R65; R66	90.00 - 100.00 %

Additional Information : Refer to chapter 16 for full text of EC R-phrases.

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4. FIRST AID MEASURES

- Inhalation** : No treatment necessary under normal conditions of use. If symptoms persist, obtain medical advice.
- Skin Contact** : Remove contaminated clothing. Flush exposed area with water and follow by washing with soap if available. If persistent irritation occurs, obtain medical attention.
- Eye Contact** : Flush eye with copious quantities of water. If persistent irritation occurs, obtain medical attention.
- Ingestion** : If swallowed, do not induce vomiting; transport to nearest medical facility for additional treatment. If vomiting occurs spontaneously, keep head below hips to prevent aspiration. If any of the following delayed signs and symptoms appear within the next 6 hours, transport to the nearest medical facility: fever greater than 101° F (37° C), shortness of breath, chest congestion or continued coughing or wheezing.
- Advice to Physician** : Treat symptomatically. Potential for chemical pneumonitis. Consider: gastric lavage with protected airway, administration of activated charcoal. Call a doctor or poison control center for guidance.

5. FIRE FIGHTING MEASURES

Clear fire area of all non-emergency personnel.

- Specific Hazards** : Hazardous combustion products may include: A complex mixture of airborne solid and liquid particulates and gases (smoke). Carbon monoxide. Unidentified organic and inorganic compounds.
- Suitable Extinguishing Media** : Foam, water spray or fog. Dry chemical powder, carbon dioxide, sand or earth may be used for small fires only.
- Unsuitable Extinguishing Media** : Do not use water in a jet.
- Protective Equipment for Firefighters** : Proper protective equipment including breathing apparatus must be worn when approaching a fire in a confined space.

6. ACCIDENTAL RELEASE MEASURES

Avoid contact with spilled or released material. For guidance on selection of personal protective equipment see Chapter 8 of this Material Safety Data Sheet. See Chapter 13 for information on disposal. Observe the relevant local and international regulations.

- Protective measures** : Avoid contact with skin and eyes. Use appropriate containment to avoid environmental contamination. Prevent from spreading or entering drains, ditches or rivers by using sand, earth, or other appropriate barriers.
- Clean Up Methods** : Slippery when spilt. Avoid accidents, clean up immediately. Prevent from spreading by making a barrier with sand, earth or other containment material. Reclaim liquid directly or in an absorbent. Soak up residue with an absorbent such as clay, sand or other suitable material and dispose of properly.
- Additional Advice** : Local authorities should be advised if significant spillages

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cannot be contained.

7. HANDLING AND STORAGE

- General Precautions** : Use local exhaust ventilation if there is risk of inhalation of vapours, mists or aerosols. Properly dispose of any contaminated rags or cleaning materials in order to prevent fires. Use the information in this data sheet as input to a risk assessment of local circumstances to help determine appropriate controls for safe handling, storage and disposal of this material.
- Handling** : Avoid prolonged or repeated contact with skin. Avoid inhaling vapour and/or mists. When handling product in drums, safety footwear should be worn and proper handling equipment should be used.
- Storage** : Keep container tightly closed and in a cool, well-ventilated place. Use properly labelled and closeable containers. Storage Temperature: 0 - 50°C / 32 - 122°F
The storage of this product may be subject to the Control of Pollution (Oil Storage) (England) Regulations. Further guidance maybe obtained from the local environmental agency office.
- Recommended Materials** : For containers or container linings, use mild steel or high density polyethylene.
- Unsuitable Materials** : PVC.
- Additional Information** : Polyethylene containers should not be exposed to high temperatures because of possible risk of distortion. Exposure to this product should be reduced as low as reasonably practicable. Reference should be made to the Health and Safety Executive's publication "COSHH Essentials".

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

If the American Conference of Governmental Industrial Hygienists (ACGIH) value is provided on this document, it is provided for information only.

Occupational Exposure Limits

- Exposure Controls** : The level of protection and types of controls necessary will vary depending upon potential exposure conditions. Select controls based on a risk assessment of local circumstances.
Appropriate measures include: Adequate ventilation to control airborne concentrations. Where material is heated, sprayed or mist formed, there is greater potential for airborne concentrations to be generated.
- Personal Protective Equipment** : Personal protective equipment (PPE) should meet recommended national standards. Check with PPE suppliers.
- Respiratory Protection** : No respiratory protection is ordinarily required under normal conditions of use. In accordance with good industrial hygiene practices, precautions should be taken to avoid breathing of material. If engineering controls do not maintain airborne

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- concentrations to a level which is adequate to protect worker health, select respiratory protection equipment suitable for the specific conditions of use and meeting relevant legislation. Check with respiratory protective equipment suppliers. Where air-filtering respirators are suitable, select an appropriate combination of mask and filter. Select a filter suitable for combined particulate/organic gases and vapours [boiling point >65 °C (149 °F)] meeting EN141.
- Hand Protection** : Where hand contact with the product may occur the use of gloves approved to relevant standards (e.g. Europe: EN374, US: F739) made from the following materials may provide suitable chemical protection: PVC, neoprene or nitrile rubber gloves. Suitability and durability of a glove is dependent on usage, e.g. frequency and duration of contact, chemical resistance of glove material, glove thickness, dexterity. Always seek advice from glove suppliers. Contaminated gloves should be replaced. Personal hygiene is a key element of effective hand care. Gloves must only be worn on clean hands. After using gloves, hands should be washed and dried thoroughly. Application of a non-perfumed moisturizer is recommended.
- Eye Protection** : Wear safety glasses or full face shield if splashes are likely to occur. Approved to EU Standard EN166.
- Protective Clothing** : Skin protection not ordinarily required beyond standard issue work clothes. It is good practice to wear chemical resistant gloves.
- Monitoring Methods** : Monitoring of the concentration of substances in the breathing zone of workers or in the general workplace may be required to confirm compliance with an OEL and adequacy of exposure controls. For some substances biological monitoring may also be appropriate.
- Environmental Exposure Controls** : Minimise release to the environment. An environmental assessment must be made to ensure compliance with local environmental legislation.

9. PHYSICAL AND CHEMICAL PROPERTIES

- Appearance : Colourless. Liquid at room temperature.
- Odour : Slight hydrocarbon.
- pH : Not applicable.
- Initial Boiling Point and Boiling Range : > 280 °C / 536 °F estimated value(s)
- Pour point : < -60 °C / -76 °F Data not available
- Flash point : Typical 140 °C / 284 °F (PMCC / ASTM D93)
- Upper / lower Flammability or Explosion limits : Typical 1 - 10 %(V)
- Auto-ignition temperature : > 320 °C / 608 °F
- Vapour pressure : < 0.5 Pa at 20 °C / 68 °F (estimated value(s))
- Density : Typical 857 kg/m³ at 20 °C / 68 °F
- Water solubility : Negligible.
- n-octanol/water partition coefficient (log Pow) : > 6 (based on information on similar products)
- Kinematic viscosity : Typical 4.2 mm²/s at 40 °C / 104 °F
- Vapour density (air=1) : > 1 (estimated value(s))
- Evaporation rate (nBuAc=1) : Data not available

Material Safety Data Sheet**10. STABILITY AND REACTIVITY**

Stability	: Stable.
Conditions to Avoid	: Extremes of temperature and direct sunlight.
Materials to Avoid	: Strong oxidising agents.
Hazardous Decomposition Products	: Hazardous decomposition products are not expected to form during normal storage.

11. TOXICOLOGICAL INFORMATION

Basis for Assessment	: Information given is based on data on the components and the toxicology of similar products.
Acute Oral Toxicity	: Expected to be of low toxicity: LD50 > 5000 mg/kg , Rat Aspiration into the lungs when swallowed or vomited may cause chemical pneumonitis which can be fatal.
Acute Dermal Toxicity	: Expected to be of low toxicity: LD50 > 5000 mg/kg , Rabbit
Acute Inhalation Toxicity	: Not considered to be an inhalation hazard under normal conditions of use.
Skin Irritation	: Expected to be slightly irritating. Repeated exposure may cause skin dryness or cracking.
Eye Irritation	: Expected to be slightly irritating.
Respiratory Irritation	: Inhalation of vapours or mists may cause irritation.
Sensitisation	: Not expected to be a skin sensitiser.
Repeated Dose Toxicity	: Not expected to be a hazard.
Mutagenicity	: Not considered a mutagenic hazard.
Carcinogenicity	: Components are not known to be associated with carcinogenic effects.
Reproductive and Developmental Toxicity	: Not expected to be a hazard.
Additional Information	: Used oils may contain harmful impurities that have accumulated during use. The concentration of such impurities will depend on use and they may present risks to health and the environment on disposal. ALL used oil should be handled with caution and skin contact avoided as far as possible.

12. ECOLOGICAL INFORMATION

Ecotoxicological data have not been determined specifically for this product. Information given is based on a knowledge of the components and the ecotoxicology of similar products.

Acute Toxicity	: Poorly soluble mixture. May cause physical fouling of aquatic organisms. Expected to be practically non toxic: LL/EL/IL50 > 100 mg/l (to aquatic organisms) (LL/EL50 expressed as the nominal amount of product required to prepare aqueous test extract).
Mobility	: Liquid under most environmental conditions. Floats on water. If it enters soil, it will adsorb to soil particles and will not be mobile.
Persistence/degradability	: Expected to be inherently biodegradable.
Bioaccumulation	: Has the potential to bioaccumulate.
Other Adverse Effects	: Product is a mixture of non-volatile components, which are not

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expected to be released to air in any significant quantities. Not expected to have ozone depletion potential, photochemical ozone creation potential or global warming potential.

13. DISPOSAL CONSIDERATIONS

- Material Disposal** : Recover or recycle if possible. It is the responsibility of the waste generator to determine the toxicity and physical properties of the material generated to determine the proper waste classification and disposal methods in compliance with applicable regulations. Do not dispose into the environment, in drains or in water courses.
- Container Disposal** : Dispose in accordance with prevailing regulations, preferably to a recognised collector or contractor. The competence of the collector or contractor should be established beforehand.
- Local Legislation** : Disposal should be in accordance with applicable regional, national, and local laws and regulations.
EU Waste Disposal Code (EWC): 13 03 08 synthetic insulating and heat transmission oils. Classification of waste is always the responsibility of the end user.
Hazardous Waste (England and Wales) Regulations 2005.

14. TRANSPORT INFORMATION**ADR**

This material is not classified as dangerous under ADR regulations.

RID

This material is not classified as dangerous under RID regulations.

ADNR

This material is not classified as dangerous under ADNR regulations.

IMDG

This material is not classified as dangerous under IMDG regulations.

IATA (Country variations may apply)

This material is not classified as dangerous under IATA regulations.

15. REGULATORY INFORMATION

The regulatory information is not intended to be comprehensive. Other regulations may apply to this material.

- EC Classification : Harmful.
EC Symbols : Xn Harmful.
EC Risk Phrases : R65 Harmful: may cause lung damage if swallowed.
R66 Repeated exposure may cause skin dryness or cracking.
EC Safety Phrases : S62 If swallowed, do not induce vomiting: seek medical advice immediately and show this container or label.

Material Safety Data Sheet**Chemical Inventory Status**

EINECS	:	All components listed or polymer exempt.
TSCA	:	All components listed.
Classification triggering components	:	Contains alkyl benzene derivatives.
Other Information	:	Environmental Protection Act 1990 (as amended). Health and Safety at Work Act 1974. Consumers Protection Act 1987. Control of Pollution Act 1974. Environmental Act 1995. Factories Act 1961. Carriage of Dangerous Goods by Road and Rail (Classification, Packaging and Labelling) Regulations. Chemicals (Hazard Information and Packaging for Supply) Regulations 2002. Control of Substances Hazardous to Health Regulations 1994 (as amended). Road Traffic (Carriage of Dangerous Substances in Packages) Regulations. Merchant Shipping (Dangerous Goods and Marine Pollutants) Regulations. Road Traffic (Carriage of Dangerous Substances in Road Tankers in Tank Containers) Regulations. Road Traffic (Training of Drivers of Vehicles Carrying Dangerous Goods) Regulations. Reporting of Injuries, Diseases and Dangerous Occurrences Regulations. Health and Safety (First Aid) Regulations 1981. Personal Protective Equipment (EC Directive) Regulations 1992. Personal Protective Equipment at Work Regulations 1992.

16. OTHER INFORMATION

R-phrases(s)

R65	Harmful: may cause lung damage if swallowed.
R66	Repeated exposure may cause skin dryness or cracking.

MSDS Version Number	:	1.0
MSDS Effective Date	:	16.09.2010
MSDS Revisions	:	A vertical bar () in the left margin indicates an amendment from the previous version.
MSDS Regulation	:	Regulation 1907/2006/EC
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