

APPLICATION FOR AN ENVIRONMENTAL PERMIT - THURROCK FLEXIBLE GENERATING FACILITY

Site Condition and IED Baseline Report

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- Appendix B Environmental Risk Assessment
- Appendix C Phase 1: Preliminary Risk Assessment
- Appendix D Phase 2: Site Investigation Report

1 INTRODUCTION

1.1 Background

- 1.1.1 This report forms part of an application by Thurrock Power Limited for an environmental permit to operate the Thurrock flexible generating facility (TFGF) to operate flexibly during times of peak electricity demand.
- 1.1.2 The installation will fall under Section 1.1, Part A(1)(a) of Part 2 of Schedule 1 to the Environmental Permitting (England and Wales) Regulations 2016, i.e. burning any fuel in an appliance with a rated thermal input of 50 or more megawatts, the appliances on site being treated as a single aggregated appliance. This Site Condition and Baseline Report (SCBR) supports the application for an environmental permit. The report has been prepared in accordance with the European Commission Guidance (Ref. 1) concerning baseline reports required under the IED and also the Environment Agency's H5 Horizontal Guidance.
- 1.1.3 The Industrial Emissions Directive (IED), Article 22, paragraphs 2 to 4, contains provisions for the definitive cessation of activities involving the use, production or release of Relevant Hazardous Substances (RHS) in order to prevent and tackle potential soil and groundwater contamination from such substances. A key tool in this respect is the establishment of a 'baseline report' where an activity involves the use, production or release of RHS and having regard to the possibility of soil and groundwater contamination. The report will form the basis for a comparison with the state of contamination upon definitive cessation of activities. Where information produced pursuant to other national law reflects the state at the time the report is drawn up, that information may be included in, or attached to, the baseline report.
- 1.1.4 This report is based on information and data available at the time of preparation of the report.

1.2 Key Objectives

- 1.2.1 The key objectives of this report are to:
- Establish the environmental setting of the site and determine its environmental sensitivity.
 - Identify activities that are currently undertaken at the site, including the identification of Relevant Hazardous Substances and preventative measures implemented to protect land and groundwater.
 - Establish the extent of historical contamination in the soil and groundwater in areas where current and/or future processes may include similar potentially contaminating substances.
 - To identify the Site Conditions at the site (baseline condition) such that they may be used as a point of reference to determine whether the site has been contaminated during the site's permitted operation in line with IED and Environmental Permitting Regulations requirements.
 - To provide conclusions on whether land quality has been impacted from historical activities.
- 1.2.2 The SCBR follows an eight-stage process, a summary of which is outlined below along with where it is addressed within this report:
- Stage 1 - Identify hazardous substances used, produced or released at the installation. This is addressed within Section 3 of this report,
 - Stage 2 - Identify relevant hazardous substances used, produced or released at the installation from the list of hazardous substances identified in Stage 1. This is addressed within Section 4 of this report,
 - Stage 3 – Undertake an assessment of site-specific pollution possibility for relevant hazardous substances. This is addressed within Section 5 of this report,

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- Stage 4 – Evaluation of Site History and potential for relevant hazardous substances to be present in soils and groundwater. This is addressed within Section 6 of this report,
 - Stage 5 – Evaluation of Environmental Setting to determine the fate of potential emissions of relevant hazardous substances This is addressed within Section 7 of this report,
 - Stage 6 – Site Characterisation that synthesises findings of Stage 5 and 6 on the basis of a Conceptual Site Model. This is addressed within Section 8 of this report,
 - Stage 7 – Site Investigation (including sampling strategy). This is addressed within Section 9 of this report,
 - Stage 8 – Production of Baseline Report. This is addressed within Section 10 of this report.

1.3 Description of Permitted Activities

- 1.3.1 Natural gas will be delivered to the TFGF via a new dedicated, underground gas supply connected to the National Grid National Transmission System (NTS). An onsite distribution system will connect each of the 96 engines to the gas supply.
- 1.3.2 The 96 reciprocating spark-ignition gas engines will be housed within purpose-built structures. They will be served by 48 exhaust stacks with one stack serving 2 engines.
- 1.3.3 The proposed facility will operate to provide additional energy security during periods of peak electricity consumption within the UK. The TFGF operation will have a total thermal input of up to 950 MW under normal operation (96 engines @ 9.896 MW_{th} input, LHV), ultimately providing up to 450 MW (net) of electricity, in high power mode, for export to the grid at times of peak demand. Therefore, the maximum combined capacity of the engines in this mode is approximately 1,037 MW_{th} (96 engines @ 10.8 MW, LHV)
- 1.3.4 Each engine will incorporate a generator set to produce electricity. Operation would not be continuous but would run as a flexible back up supply for up to 1,500 hours per engine per year as a 5-year rolling average and with no more than 2,250 hours per engine in any one year.

2 APPLICATION SITE CONDITION REPORT

2.1 Application Phase

2.1.1 This SCR, is prepared in accordance with the Environment Agency Horizontal Guidance Note H5, provides references to the various chapters of this report, where available information on the known current condition of the operational area is provided.

2.2 Site Condition Report Summary

1.0 Site Details	
Name of the applicant	Thurrock Power Limited
Activity address	Land southwest of Station Road, near Tilbury, Essex, RM18 8UL
National grid reference	TQ 66398 76793
Site area (ha)	Approximately 20 for the proposed wider Thurrock Site
Document reference and dates for Site Condition Report at permit application and surrender	Application 240130 R 794-ENV-EPC-20502 RN SCBR (this report)
Document references for site plans (including location and boundaries):	See Drawings section of this SCR: <ul style="list-style-type: none"> • Drawing 1 Site Layout Plan • Drawing 2 Site Drainage Plan • Drawing 3 Thurrock Development Zones • Drawing 4 Borehole Location Plan • Drawing 5 Site Location Plan • Drawing 6 Receptor Plan 2 km buffer • Drawing 7 – Receptor Plan 15 km buffer

2.0 Condition of the land at permit issue	
Environmental setting including: <ul style="list-style-type: none"> • Topography • Geology • Hydrogeology • Hydrology • Environmental Consents, Licences, Authorisations, Permits and Designations 	Details of the environmental setting are provided in Sections 7.1 to 7.5 of this SCR
Pollution history including: <ul style="list-style-type: none"> • Location, nature of incidents or direct discharges that may have affected soil or groundwater. • Historical land uses and associated contaminants 	Pollution history details are provided in Section 7.5 of this SCR
Evidence of historic contamination, for example, historical site investigation, assessment, remediation and verification reports (where available)	Details of historical contamination near to the site are provided in Sections 6.1 to 6.5 of this SCR
Baseline soil and groundwater reference data	Details of previous ground investigation are provided in Section 9 of this SCR
Supporting information	Supporting information used to identify the condition of land at permit issue include: <ul style="list-style-type: none"> • Appendix A – Groundsure Report

2.0 Condition of the land at permit issue

- Appendix B – Environmental Risk Assessment in Appendix C of the main application document
- Appendix C – Phase 1: Preliminary Risk Assessment
- Appendix D – Phase 2: Site Investigation Report

3.0 Permitted activities

Permitted activities	Section 1.1, Part A(1)(a) - burning fuel in an appliance with a rated thermal input of more than 50 megawatts
Non-permitted activities undertaken	N/A
Document references for: <ul style="list-style-type: none">• plan showing activity layout; and• environmental risk assessment.	<ul style="list-style-type: none">• Drawing 1 Site Layout Plan• Appendix B – Phase 1: Preliminary Risk Assessment

3 STAGE 1 – IDENTIFY WHICH HAZARDOUS SUBSTANCES ARE USED, PRODUCED OR RELEASED AT THE INSTALLATION AND PRODUCE A LIST OF THESE SUBSTANCES

3.1.1 The IED relates to contamination risk associated with “hazardous substances” used, produced and/or released by the facility. Hazardous substances are defined as substances or mixtures defined in Article 3 of Regulation (EC) No 1272/2008 of the European Parliament and of the Council of 16 December 2008 on Classification, Labelling and Packaging of substances and mixtures (the “CLP Regulations”). The determination of whether a substance is a hazardous substance is largely determined using the substance CAS Number and European Chemicals Agency (ECHA) database (Ref. 2).

3.1.2 Hazardous substances have been identified in the following raw materials that are used, residues created and releases from TFGF and are listed in Table 3-1 below.

Table 3-1: Raw Materials, Residuals and Released from TFGS

Material	Nature	Quantity used or produced annually (approx.)	Quantity stored	Method of storage	Hazardous
Raw Materials					
Natural Gas	Standard Composition	Up to 150,048,000 Nm ³	N/A – direct supply from grid. Natural gas will be fully contained within a sealed pipeline.	Not stored - direct supply from grid. Natural gas will be fully contained within a sealed pipeline.	Yes Highly flammable / explosive, Greenhouse gas (methane content)
Lubricating Oil	Highly refined mineral oil	Up to 130 tonnes per annum	42,000 litres	6 no. 7,000 litre tanks with secondary containment designed to industry standard with 110% containment.	Yes – Generally, not classified as dangerous however, accidental release into the environment can cause pollution.
Coolant	Ethylene Glycol (circa 37% v/v glycol water mixture)	Variable, usage limited to top-up as required.	None stored. Quantity limited to CCCW inventory = 151,350 litres of ethylene glycol water mixture in the cooling systems.	420 litres per engine system housed in CCCW system	Yes – Generally, not classified as dangerous however, accidental release into the environment can cause pollution.
Residues					
Waste Lubricating Oil	Highly refined mineral oil with contaminants including metals	Up to 130 tonnes per annum (estimated)	30,000 litres	6 no. 5,000 litre tanks with secondary containment designed to industry standard with 110% containment.	Yes – Generally, not classified as dangerous however, accidental release into the environment can cause pollution.
Waste from maintenance activities	Mainly solid waste packaging	unknown	Unknown	Segregated bins as appropriate	Yes – may be hazardous if contaminated with raw materials during maintenance / cleaning.

Material	Nature	Quantity used or produced annually (approx.)	Quantity stored	Method of storage	Hazardous
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Releases

Emissions to air	Products of the combustion of natural gas, primarily CO ₂ and water vapour plus oxides of nitrogen and carbon monoxide	1,195,200 m ³ (Normalised Volumetric Flow 8.3 m ³ /s x 96 engines x 1,500 average operational hours).	N/A - Not stored	N/A - Not stored	Yes – High levels of emissions from natural gas can reduce the amount of oxygen breathed from the air.
Surface water run-off	Rainwater run-off from roadways and clean areas such as building roofs.	Varies	Stored quality is variable	Contained within site attenuation pond prior to release to surface water drainage if not contaminated	No - not hazardous providing no contamination from an incident on site

4 STAGE 2 – IDENTIFYING THE RELEVANT HAZARDOUS SUBSTANCES

- 4.1.1 Stage 1 identified a number of hazardous substances that are stored and used on site as part of site operations. Stage 2 requires a review of the listed substances to determine which are relevant hazardous substances (RHS). Each of the substances identified within Stage 1 are reviewed below, considering their chemical and physical properties and how they are stored and used on site, to determine the potential pollution risk of each hazardous substance.
- 4.1.2 RHS in relation to IED are defined as:
those substances or mixtures defined within Article 3 of Regulations (EC) No1272/2008, which, as a result of their hazardousness, mobility, persistence and biodegradability (as well as other characteristics), are capable of contaminating soil or groundwater and are used, produced and/or released by the installation.
- 4.1.3 The following table provides a summary of the chemical and physical properties of the hazardous substances carried forward from the previous sub-section to inform the pollution risks. Those identified as a RHS are considered further in Stage 3.
- 4.1.4 Natural gas is lighter than air and therefore, should a leak occur, it will dissipate into the air. For this reason, it is considered incapable of having a discernible impact on the quality of soil or groundwater. Natural gas is not therefore considered to be a RHS and is not considered further in this report.
- 4.1.5 Flue gasses will be dispersed from the stacks at a height of 20 m and will be dissipate into the air. The stack height has been selective to give good dispersion and avoid grounding effects on site. For this reason, it is considered incapable of having discernible impact on soil or ground water.
- 4.1.6 As set out in the table all other materials carried forward from Stage 1 are considered RHSs.

Table 4-1: Summary of Potential Pollution Risk of Hazardous Substances

Substance	Chemical Characteristics /Risks	Physical State	Solubility	Toxicity	Mobility	Persistence	Soil and Groundwater Pollution Potential	RHS
Raw Materials								
Natural Gas	Flammable gas	Gas	0.0022% (as methane)	Non - toxic	High (upward)	Low	None	No
Lubricating Oil	A complex combination of hydrocarbons obtained from solvent extraction and dewaxing processes. Not classified as an environmental hazard.	Liquid	Non-soluble	Not considered to be ecologically toxic.	Low - will adsorb to soil particles and will not be mobile.	Contains components that may persist in the environment	Medium	Yes
Coolant	Ethylene Glycol (37%) Not classified as an environmental hazard.	Liquid	Soluble in water	Harmful to aquatic organisms	High – water soluble	Readily biodegradable	Medium	Yes
Residues								
Waste Lubricating Oil	As clean lubricating oil but may contain metals	Liquid	Non-soluble	May contain toxic components	Low - will adsorb to soil particles and will not be mobile.	Contains components that may persist in the environment	Medium	Yes
Waste from Maintenance Activities (Solid Waste)	Used components during maintenance / spillages e.g. oily rags and packaging	Solid	Non-soluble	May contain toxic components	Not mobile	May contain components that are persistent	Low	Yes

Releases

<p>Releases to Air (Flue Gas)</p>	<p>Carbon dioxide, oxygen, nitrogen, nitrogen oxides and carbon monoxide (flammable, gas under pressure, serious health hazard, acute toxicity).</p>	<p>Gas</p>	<p>Carbon dioxide: 2,000 mg/l Oxygen 39 mg/l Nitrogen solubility in water 20mg/l Nitrogen oxides Water 67 mg/l Carbon Monoxide – 30 mg/l</p>	<p>Carbon dioxide: acute toxicity. Oxygen: not toxic. Nitrogen: not toxic. Nitrogen oxides: acute toxicity. Carbon monoxide: acute toxicity.</p>	<p>High (upward)</p>	<p>Low</p>	<p>None</p>	<p>No – these components are all gaseous and will disperse upwards; therefore, unlikely to cause contamination of soils or groundwater.</p>
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5 STAGE 3 – ASSESSMENT OF THE SITE SPECIFIC POLLUTION POSSIBILITY

- 5.1.1 Each of the relevant hazardous substances identified in Stage 2 are to be considered in Stage 3 in the context of the site itself to determine whether circumstances exist which may result in the release of the substance in sufficient quantities to represent a pollution risk, either as a result of a singular emission or as a result of accumulation from multiple emissions.
- 5.1.2 Circumstances under which emissions may occur include:
- Planned emissions,
 - Accidents and / or incidents,
 - Routine operations.
- 5.1.3 The only planned emissions at the site is the emission of flue gases to atmosphere and discharge of clean surface water run-off to the surface water network. Surface water run-off is not identified as a hazardous substance and flue gases were discounted out as a RHS at stage 2.
- 5.1.4 An environmental management system (EMS) will be established on site and will cover those elements requiring environmental permitting. The EMS will be set up in accordance with the key requirements of ISO14001.
- 5.1.5 Management systems will be put in place to ensure that those operations which have the potential to give rise to significant environmental effects are controlled. These systems will not only cover normal running but will also address abnormal operation and start-up and shutdown of the TFGF.
- 5.1.6 Maintenance and inspection will also be a given and form part of operational site operating procedures. This includes periodic inspection / sampling of attenuation pond / drainage system water.
- 5.1.7 Planned maintenance routines will be established to ensure all key plant components which have the potential to affect the environmental performance of the facility remain in good working order.
- 5.1.8 Maintenance routines will draw on manufacturer's recommendations, modified as appropriate by operational experience during the lifetime of the TFGF. Maintenance will be carried out by contractors in accordance with the operator's maintenance requirements.
- 5.1.9 An Accident Management Plan (AMP) will be established prior to commencing operation of the proposed TFGF. The AMP will detail those actions required in the event of an emergency or accident/incident. This will include small incidents such as minor spills and leaks and complaints, as well as major incidents such as fire. In particular, a system for recording and allocating appropriate follow-up for accidents, incidents and non-conformances will be established prior to operation.

5.2 Lubricating Oil

- 5.2.1 Lubricating oils will be stored in double skinned tanks. All tanks will be positioned within bunded areas. The bunded areas are designed to contain any potential spillage and facilitate straightforward cleanup in the event of a spill and will contain 110% of the tank content.
- 5.2.2 Lubricating oil is delivered to site by road tanker or IBCs and is discharged to the individual tanks via a secure coupling. Deliveries are carried out on an impermeable surface and /or use a portable bund and under supervision of appropriately trained staff.
- 5.2.3 Oil is pumped to the individual engines via a closed system. Routine inspections and maintenance are carried out on the lubrication system to prevent or detect and repair any leaks.

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- 5.2.4 Spill containment kits are available in the delivery area. Relevant site staff are trained in the containment and clean-up of spills.
 - 5.2.5 Given these precautions, the risk of pollution to surface water and groundwater from lubricating oil is considered low.

5.3 Coolant

- 5.3.1 The coolant used in the CCCW systems contains approximately 37% Ethylene Glycol by volume. All the coolant is held within the CCCW systems with no spare stock held on site until the CCCW systems need replenishing, at which point the coolant is brought in specifically in 1,000l intermediate bulk containers.
- 5.3.2 The CCCW systems all operate entirely within bunded areas capable of containing at least 110% of the contents of the cooling water system.
- 5.3.3 Coolant leak detection is considered via pressure drop in cooling circuit used to indicate any faults in containment.
- 5.3.4 The CCCW systems are subject to routine maintenance and inspection to detect leaks and faults.
- 5.3.5 Spill kits are available and all relevant site staff are trained in the containment and clean-up of spills.
- 5.3.6 Since there is limited inventory, the glycol is contained within the closed loop cooling system, the risk of pollution is considered low.

5.4 Waste Lubricating Oil

- 5.4.1 Used lubricating oil is pumped into a waste oil tank via a closed system pending removal to a road tanker for off-site processing.
- 5.4.2 The road tanker will park on impermeable hardstanding and/or use a portable bund for collection of waste oil.
- 5.4.3 Routine inspections and maintenance are carried out on the lubrication system to prevent or detect and repair any leaks.
- 5.4.4 Spill containment kits are available in the delivery area. Relevant site staff are trained in the containment and clean-up of spills.
- 5.4.5 Given these precautions, the risk of pollution to surface water and groundwater from waste lubricating oil is considered low.

5.5 Waste from Maintenance Activities

- 5.5.1 Waste from maintenance activities may include oily rags, used PPE, spent filters, old scrap for replacement parts etc. General routine inspections and scheduled maintenance activities will generate these types of waste and can attribute to raw materials contamination. Proper handling and disposal of these waste are essential to reduce the risk of pollution caused by inappropriate discharging these items.
- 5.5.2 Solid waste and packaging from maintenance operations will be placed into appropriate closed bins for storage prior to collection from site for appropriate disposal. Site staff conduct inspections to ensure litter is identified and removed promptly.
- 5.5.3 These waste items are typically solid and the pollution risk to surface water and groundwater are considered very low.

5.6 Site Specific Pollution Possibility

5.6.1 All process areas will be situated on a hardstanding, and regular manual inspections will be conducted on the bunds associated with oil storage tanks to ensure their integrity and absence of contamination or leaks. Bunding for liquid storage tanks will contain 110% of the tank it contains. Bunds will be constructed to appropriate standards and lined with materials that are impervious to the content of the material they hold.

Table 5-1: Chemical Inventory and Assessment of Actual Pollution Risk

Substance	Nature	Approx. volume	Amount stored on site and management/control measures	Actual Pollution Risk ¹
Lubricating Oil	Liquid	6 no. 7,000 litre tanks	42,000 (max.) in double-skinned tanks located within a bunded area.	Low
Coolant	Liquid	420 litres per engine system	151,350 litres within the CCCW systems. All within a bunded area	Low
Waste Lubricating Oil	Liquid	6 no. 5,000 litre tanks	30,000 litres (max.) in double-skinned tanks located within a bunded area.	Low
Waste from Maintenance Activities	Solid	Variable	Records of maintenance and inspection will be kept to identify any pollution possibility	Very Low

6 STAGE 4 – PROVIDE A SITE HISTORY

- 6.1.1 The purpose of Stage 4 is to determine which of the RHS identified in Stage 3 have the potential to be present on site in the soil and groundwater already as a result of activities undertaken at the site to date and to determine whether they are coincident with potential future emission points.
- 6.1.2 This section should consider both the history of the site prior to development of the current facility and the operational history of the current facility.
- 6.1.3 Information from the Groundsure Report provided in Appendix A has informed the site history, previous site uses and uses of surrounding land.
- Appendix A
 - Appendix D – Phase 2: Site Investigation Report

6.2 General Site History

- 6.2.1 The historical land uses on and surrounding the TFGF site are listed in Table 6-1: Site History below.

Table 6-1: Site History

Dates	Surrounding Land Uses	On-Site
1863	West Tilbury Marshes located surrounding the site	West Tilbury Marshes located on site
1955	Railway established ~ 288 m W	
1967	Unspecified works located ~ 350 m SW	
1973 - 2010	Tilbury Power Station located ~ 500 m SW	
2024	Tilbury Power Station now decommissioned	

- 6.2.2 The site is situated in the West Tilbury Marshes region, and historically there has been minimal to no construction activity on or surrounding the proposed site.
- 6.2.3 The TFGF is to be situated on undeveloped land, classified as greenfield, with minimal risk of pollution.

6.3 Previous Ground Investigation

- 6.3.1 A Phase 2 Site Investigation was undertaken in September 2019 in Zone A (the main development site, where the TFGF will be located, as well as a battery storage facility and customer substation that do not form part of the permitted activities) and a report has been produced by TerraConsult Ltd. The report is included in Appendix C. Zone A is shown on drawing 3.
- 6.3.2 The investigation comprised:
- seven cable percussive boreholes to depths of up to 25 mbgl;
 - nine dynamic samples boreholes to depths of up to 5.45 mbgl;
 - ten Cone Penetration Tests;
 - piezometer installations within the Chalk aquifer in seven boreholes and subsequent groundwater monitoring; and
 - six standpipe installations within the Made Ground/Alluvium with subsequent groundwater and ground gas monitoring.

Ground Conditions

- 6.3.3 Topsoil was encountered within the majority of locations to depths of between 0.1 mbgl and 0.95 mbgl.
- 6.3.4 Made Ground was encountered within five locations to depths of between 0.5 mbgl and 1.82 mbgl. This comprised gravelly clay with gravel of brick and chalk.
- 6.3.5 Alluvium was encountered underlying the topsoil and Made Ground to depths of between 18.1 mbgl and 20.3 mbgl. It comprised predominantly very soft, silty clay, frequently peaty and an occasional layer of peat typically 1.5 m thick encountered at approximately 5.5 mbgl and 6 mbgl. Thinner shallower bands of peat were identified in five locations around 1 mbgl. Coarse sand and flint gravel were commonly encountered at depths of between 11.2 mbgl and 16.1 mbgl (RPS interpreted as the Taplow Gravel Member).
- 6.3.6 Chalk was encountered underlying the Alluvium recovered as chalk gravel and putty chalk, occasionally with pockets of flint gravel.
- 6.3.7 During the site investigation, groundwater was encountered in five cable percussive boreholes at depths of between 11.2 mbgl and 15 mbgl where the top of the sand and gravel was encountered and rose to depths of between 2.4 mbgl and 6.2 mbgl over a period of 20 minutes.

Groundwater Monitoring

- 6.3.8 Groundwater was monitored at depths of approximately 1 mbgl within the piezometers installed within the Chalk aquifer and at between 1.62 mbgl and 2.67 mbgl within shallower boreholes installed within the Made Ground/Alluvium.

Ground Gas Monitoring

- 6.3.9 Recorded methane, carbon dioxide and hydrogen sulphide concentrations were below detection levels on all monitoring occasions. Carbon dioxide concentrations ranged between 0.3 and 2.7 %.

Screening Assessment

- 6.3.10 Analysis of selected soil samples did not indicate any elevated concentrations of contaminants when compared with criteria for commercial end use.
- 6.3.11 Asbestos was not detected in any of the analysed soil samples.
- 6.3.12 Analysis of groundwater samples from the shallower boreholes did not indicate any elevated concentrations of contaminants when compared to the UK Drinking Water Standards.

6.4 Potential Historic Contaminants

- 6.4.1 There is no record of potential historic contamination within 250m of the site.

6.5 Operational History

- 6.5.1 The site has no operational history.

7 STAGE 5 – IDENTIFY THE SITE’S ENVIRONMENTAL SETTING

7.1 Site Setting and Sources of Desk Study Information

7.1.1 The information sources detailed below have been included within this section and are used to identify the condition of land.

- Groundsure Report – Appendix A
- Appendix C – Phase 1: Preliminary Risk Assessment
- British Geological Survey (BGS) Geology of Britain viewer¹
- Magic Map².

7.2 Ground Cover and Topography

7.2.1 The ground cover at the proposed site consists of marshland, classifying it as a greenfield site.

7.2.2 OS mapping indicates that the site is approximately 1.3 m AOD.

7.3 Geology and Hydrogeology

7.3.1 The superficial geological deposits underlying the site is Alluvium (clay, silt, sand and peat).

7.3.2 The permeability of the superficial deposits beneath the site is predominantly intergranular, exhibiting very low to moderate permeability.

7.3.3 The bedrock geology beneath the site is represented by the Lewes Nodular Chalk Formation.

7.3.4 The bedrock aquifer underlying the site is designated as Principal, described as highly intergranular and / or fracture permeability, usually providing a high level of water storage.

7.3.5 The superficial aquifer underlying the site is designated as Secondary Undifferentiated. The site is not located within a groundwater Source Protection Zone (SPZ).

7.4 Hydrology

7.4.1 There are a number of on-site and nearby surface and underground water bodies including:

- Two small inland surface rivers on-site that are not influenced by normal tidal action.
- Several small inland rivers (narrower than 5 m) which are not influenced by normal tidal action situated within 250 m of the site boundary.
- The River Thames is approximately 1.25 km south of the site.

7.5 Man-made Pathways

7.5.1 Drainage channels across the site can provide man-made pathway see Drawing 2 - Site Drainage Plan. There are no additional man-made pathways up to 500 m from the site that could serve as routes for the migration of hazardous substances.

¹ [BGS Geology Viewer - British Geological Survey](#)

² [Magic Map Application \(defra.gov.uk\)](#)

7.6 Environmental Consents, Licences, Authorisations, Permits and Designations for the Site and Surrounding Areas

Water Discharges and Abstraction Licences

7.6.1 There are no licenced discharges to controlled waters located within 2 km of the site.

7.6.2 There are six licensed groundwater or surface water abstractions located within 2 km of the site.

Table 7-1: Active Abstraction Licenses within 2 km

License Holder	Source	Use	Distance from site
C H Cole & Sons	Well 2 at Polwicks, West Tilbury	General farming & Domestic	800m NE
C H Cole & Sons	Well 2 at Polwicks, West Tilbury	Spray Irrigation	800m NE
C H Cole & Sons	Excav at Polwicks, West Tilbury	General Farming & Domestic	1,069m NE
C H Cole & Sons	Excav at Polwicks, West Tilbury	Spray Irrigation	1,069m NE
C H Cole & Sons	Well 1 at Polywicks, West Tilbury	Spray Irrigation	1,069m NE
C H Cole & Sons	Well 1 at Polywicks, West Tilbury	General Farming and Domestic	1,069m NE

Waste and Landfill Sites

7.6.3 There are five active or recent waste and landfill sites located within 500 m of the proposed site, details are provided in Table 7-1 below.

Table 7-2: Active or Recent Waste or Landfill Sites Within 500 m

Operator	Description	Licence Number	Location	Distance from Site
R W E nPower Plc	Industrial Waste Landfill (Factory curtilage)	EA/EPR/DP3498NX/A001	Tilbury B Power Station, Fort Road, Tilbury, Essex, RM18 8UJ	50 m S
Ingrebourne Valley Ltd	Waste Landfilling; >10 T/D With Capacity >25,000t Excluding Inert Waste	-	Tilbury Power Station, Fort Road, West Tilbury, Tilbury, Essex, RM18 8UJ	52 m S
R W E nPower Plc	A07: Industrial Waste Landfill (Factory curtilage)	EA/EPR/DP3898NN/T001	Tilbury B Power Station, Fort Road, Tilbury, Essex, RM18 8UJ	469 m E
R W E nPower plc	A07: Industrial Waste Landfill (Factory curtilage)	EA/EPR/LP3999NS/A001	Tilbury B Power Station, Fort Road, Tilbury, Essex, RM18 8UJ	471 m E
R W E nPower plc	A07: Industrial Waste Landfill (Factory curtilage)	EA/EPR/BP3399NM/A001	Tilbury B Power Station, Fort Road, Tilbury, Essex, RM18 8UJ	488 m SE

Statutory Designated / Sensitive Sites within 2 km

7.6.4 There are no statutory designated / sensitive sites located within 2 km from the proposed site.

Mining

7.6.5 There are no mining sites located within 500 m from the proposed site.

COMAH

7.6.6 There are no COMAH sites recorded within 500 m of the site.

Radon

7.6.7 The site is situated in an area where fewer than 1% of properties are estimated to be affected by Radon and no protective measures are deemed necessary.

8 STAGE 6 – SITE CHARACTERISATION

8.1 Introduction

- 8.1.1 RPS have developed a Conceptual Site Model (CSM) for the area to be occupied by TFGF.
- 8.1.2 The storage location of the identified potential contaminants is within the operational area housing the engines and CCCW system shown on Site Layout Plan.

8.2 Conceptual Site Model

Potential Contaminant Sources

On Site

- 8.2.1 The site is situated in the West Tilbury Marshes region, and historically there has been minimal to no construction activity on the proposed site.
- 8.2.2 TFGF is to be situated on undeveloped land, classified as greenfield, with none to minimal risk of pollution.
- 8.2.3 The principal release scenarios associated with RHS on site include:
- Accidental leakage of petroleum-based lubricating oils / waste oil and coolant during transfer, use and/or accidental damage to primary containment.
 - Accidental leakage / release of lubricating / waste oils and coolant because of either connection issued when refilling / emptying or due to failure of primary containment.
 - Accidental release of lubricating / waste oil and coolant, chemical into the onsite drainage system.

Off-site

- 8.2.4 Current and historical potential sources of contaminants of concern include the works associated with Tilbury Power Station to the south first established in 1973 and then decommissioned in 1991. The activities that were undertaken during this operational period could give rise of contamination off site.

Potential Pathways

- 8.2.5 Topsoil and subsoil horizons are likely to present across the proposed site owing to its agricultural use.
- 8.2.6 Drainage ditches across the site may act as pathways to spread contamination horizontally and vertically across Walton Common.
- 8.2.7 BSG indicates that superficial deposits comprise of Alluvium (clay, silt, sand and peat) are present underlying the site. The underlying bedrock, is of the Lewes Nodular Chalk Formation, Seaford Chalk Formation and Newhaven Chalk Formation.
- 8.2.8 Where superficial deposits are intergranular in nature any shallow groundwater and any mobile contaminants that may be present are not likely to be able to migrate due to low/moderate permeability. The bedrock which is suggested to be of high permeability allowing for the mobility of groundwater and mobile contaminants to deeper strata.

-
- 8.2.9 There is no concern of contaminants (if any present) beneath the site will migrate on or off-site via underlying superficial deposits. Due to the greenfield nature of the site, it is unlike to impact any controlled water receptors or on/off-site human health receptors via the dermal contact, ingestion and vapour inhalation pathways.
- 8.2.10 On completion of the proposed development, large areas of the site will be covered by buildings or hardstanding. In these areas the risks to future human health receptors via the pathways of dermal contact, ingestion and soil dust inhalation will be mitigated. In areas of managed soft landscaping, the pathways of dermal contact, ingestion and soil dust inhalation could still be active if contaminated soils are subject to disturbance.
- 8.2.11 The presence of buildings and hardstanding are also likely to reduce post-development surface water infiltration reducing the potential for the leaching of any mobile soil contaminants.

Associated Pollution Prevention Measures

- 8.2.12 General pollution prevention measures and mitigation measures associated with process and the RHS at the facility are described below:
- A combination of concrete bund / double skinned tanks are used in areas where potentially hazardous substances / materials are stored or used.
 - All storage vessels are situated on concrete bunded areas designed to contain 110% of the tank contents. The bunded area therefore will retain any accidental releases associated with the loss of primary containment, tank overflow, or issues associated with connection during filling / emptying. The effectiveness of these pollution prevention measures to contain any accidental releases of stored product is dependent on routine integrity monitoring and maintenance of bunds and tanks implemented by the site management and training protocols with regards to tank filling / emptying delivered to key personnel.
 - A drop in pressure in any CCCW system will trigger the automatic closure of a valve on the roof ensuring any leak from that system will be retained within a roof bund. The retained cooling system fluid will then be pumped to an appropriate vessel for off-site disposal or recovery.
 - The site will have an 'Accident Management Plan' that forms part of the site EMS which sets out hazard identification and risk assessment. In addition, it sets out steps to be taken by the operator to ensure that all preventative measures are in place to avoid an incident that does occur it can be mitigated in the most appropriate manner.
 - TFGF operates a formal inspection programme whereby tanks and bunds are visually inspected for any evidence of leaks / spills and general conditions on a regular basis.

Potential Receptors

- 8.2.13 Post development receptors include future site users and off-site human health receptors.
- 8.2.14 The Secondary Undifferentiated Aquifer present beneath the site is not considered to represent a particularly sensitive receptor in their own right. However, they may represent a pathway to surface water features.
- 8.2.15 The assessment does not consider the risk to construction workers during development of the site. These risks will be managed through appropriate H&S legislation including Health and Safety at works act and Construction Design and Management regulations.
- 8.2.16 An outline CSM has been developed on the basis of a desk study. The CSM is used to identify potential sources, pathways and receptors (i.e., potential pollutant linkages) onsite and offsite post development (see Thurrock Development Zones for proposed development map) and is summarised in the table below.

Table 8-1: Outline Conceptual Site Model

Potential Source	Contaminants of Concern	Via	Potential Pathways	Linkage Potentially Active?	Receptors	Qualitative Risk Rating	Notes
On site: Buildings and associated uses including storage of RHS and plant. Areas of land raising/in filling	Metals, inorganic compounds, hydrocarbons, VOCs, polychlorinated biphenyls (PCBs), pesticides, herbicides and asbestos	Soil	Direct contact/ingestion	✓ ✓	Construction workers Future site users	Low	Limited potential for significant contamination to be present. Risk of localised contamination increased in area of storage and operations. Post development risks minimised by buildings, hardstanding, containment and managed landscaping. Residual risk in areas of soft landscaping, if soils are exposed or disturbed.
			Inhalation of volatiles	✓ ✓	Construction workers Future site users	Low	Limited potential for significant volatile contaminants to be present in soils.
			Airborne migration of soil or dust	✓ ✓	Future site users Off-site users	Low	Limited potential for significant contamination to be present. Risk of localised contamination increased in area of storage and operations. Post development risks minimised by buildings, hardstanding, containment and managed landscaping.
			Leaching of mobile contaminants	✓	Secondary Undifferentiated Aquifer	Low	Potential for soil leaching and vertical and lateral migration of contaminants (if present) in shallow groundwater to impact controlled waters receptors.
			Direct contact/ingestion	* *	Future site users Off-site users	Low	Widespread very shallow groundwater unlikely to be present, with localised pockets of superficial deposits. There is a low potential of contamination in areas of operations.
			Inhalation of volatiles	✓ ✓	Future site users Off-site users	Low	Limited potential for significant volatile contamination in groundwater.
			Vertical and lateral migration in permeable strata	✓	Secondary Undifferentiated Aquifer	Low	
Off-site Potential contaminants	Metals, hydrocarbons, and solvents	Groundwater	Direct contact/ingestion	✓	Future site users	Low	Any contaminants of concern (if present) could be localised within shallow groundwater (if present)

Potential Source	Contaminants of Concern	Via	Potential Pathways	Linkage Potentially Active?	Receptors	Qualitative Risk Rating	Notes
associate with Tilbury Power station to the south of the site although now decommissioned.			Lateral migration and subsequent inhalation of volatiles	✓	Future site users	Low	Limited potential for significant volatile contamination in groundwater.
On and off-site: Made Ground, Areas of land raising/infilling.	Carbon dioxide and methane	Ground Gas	Inhalation of ground gas	✓	Future site users Off-site users	Low	There is the potential for ground gas originating from localised Made Ground and infilled ground on and off site. Significant areas of infilling that could represent a build-up of potentially explosive gases have not been identified historically on or off-site.
			Explosive risks	✓ ✗	Future site users Off-site users	Low	

Note The Qualitative Risk Rating does not consider the potential for the pathway to be active. In the event that a Moderate or High Qualitative Risk Rating is identified further assessment is recommended.

9 STAGE 7 – SITE INVESTIGATION

- 9.1.1 Stage 3 of the baseline assessment determines that hazardous substances are present on site, however as they have a low risk or very low of pollution and are to be effectively managed in accordance with the sites Environmental Management System it concluded that on a site specific basis there are no RHS for which site investigations would be required to obtain baseline data.
- 9.1.2 Whilst the conclusions of the Stage 3 assessment do not require data to be collected a Phase 2 Site Investigation site investigation has been completed as part of the development proposals for the site and a copy of this report is included within Phase 2: Site Investigation
- 9.1.3 The site investigation data includes analysis of hydrocarbons which would be relevant to the oil based RHSs. Ethylene glycol has not been tested in the analytical suite used to baseline the site. However, based on previous site uses it is not considered likely to have ethylene glycol contaminated the area to be occupied by the TFGF.

9.2 Summary of Works Undertaken

- 9.2.1 TerraConsult Ltd was commissioned by Statera Energy Limited to undertake a Phase 2 Site Investigation report for the TFGF. A summary of the works undertaken is included within Previous Ground Investigation
- 9.2.2 See Borehole Location Plan that covers the area of TFGF.

9.3 Laboratory Analysis

- 9.3.1 The scheduled analysis and number of samples tested is summarised in Table 9-1 below.

Table 9-1: Summary of Scheduled Chemical Testing

Analysis	No. of Soil Samples Tested
Metals	9
Speciated polycyclic aromatic hydrocarbons (PAHs)	9
Water Soluble Sulphate & Water Soluble Chloride	9
Phenols – Total (monohydric)	9
Mineral Oil, TPH C10-C40, TPH C10-C25	9
Benzene, toluene, ethylbenzene and xylenes (BTEX)	9
Asbestos screen	9
pH	9
Total Cyanide	9
Moisture Content & Stone Content	9
Analysis	No. of Water Samples Tested
Metals	3
General Inorganics	3
Speciated polycyclic aromatic hydrocarbons (PAHs)	3
Heavy Metals	3
Monoaromatics and Oxygenates	3
Mineral Oil, TPH C10-C40, TPH C10-C25	3

10 STAGE 8 – PRODUCE A BASELINE REPORT

- 10.1.1 Based on the hazardous substances identified in Stages 1-3 whilst there are a number of RHS that are associated with the TFGF due to the site-specific measures outlines in Stages 3 (Section 5) the pollution potential for all hazardous substances is low.
- 10.1.2 A ground investigation within the TFGF area has been conducted and provides sufficient data to baseline the site. The data is summarised in the sections below, with full details provided in Phase 2: Site Investigation
- 10.1.3 Baseline Conditions of Soil Results of soil analysis from samples taken from the ground investigation are used as the baseline conditions for the TFGF area and are described in Table 10-1, Table 10-2, Table 10-3, Table 10-4 and Table 10-5 below.

Table 10-1: Results of Laboratory Analysis for Metals

Determinand Metals	Minimum (mg/kg)	Maximum (mg/kg)
Arsenic	7.4	25
Cadmium	<0.2	<2.0
Chromium (III)	38	50
Copper	4.9	24
Lead	15	33
Mercury	<0.3	<0.3
Nickle	24	43
Selenium	<1.0	<1.0
Zinc	68	130

Table 10-2: Results of Laboratory Analysis for Polycyclic Aromatic Hydrocarbons

Determinand PAHs	Minimum (mg/kg)	Maximum (mg/kg)
Acenaphthene	<0.05	<0.05
Acenaphthylene	<0.05	<0.05
Anthracene	<0.05	<0.05
Benzo[a]anthracene	<0.05	<0.05
Benzo[a]pyrene	<0.05	<0.05
Benzo[b]fluoranthene	<0.05	<0.05
Benzo[ghi]perylene	<0.05	<0.05
Benzo[k]fluoranthene	<0.05	<0.05
Chrysene	<0.05	<0.05
Dibenzo[ah]anthracene	<0.05	<0.05
Fluoranthene	<0.05	<0.05
Fluorene	<0.05	<0.05
Indeno[123-cd]pyrene	<0.05	<0.05
Naphthalene	<0.05	<0.05
Phenanthrene	<0.05	<0.05
Pyrene	<0.05	<0.05
Total PAH	<0.09	<0.09

Table 10-3: Results of Laboratory Analysis for Petroleum Hydrocarbons

Determinand Petroleum Hydrocarbons	Minimum (mg/kg)	Maximum (mg/kg)
Mineral Oil (C10-C40)	<10	<10
TPH (C10-C40)	<10	<10
TPH (C10-C25)	<10	<10

Table 10-4: Results of Laboratory Analysis for BTEX and MTBE

Determinand BTEX and MTBE	Minimum (mg/kg)	Maximum (mg/kg)
Benzene	<0.001	<0.001
Toluene	<0.001	<0.001
Ethylbenzene	<0.001	<0.001
o-xylene	<0.001	<0.001
m-xylene	<0.001	<0.001
p-xylene	<0.001	<0.001

Table 10-5: Asbestos Screening

Determinand Asbestos	Screening Result
Asbestos	None detected

- 10.1.4 Analysis of selected soil samples did not indicate any elevated concentrations of contaminants when compared against their respective criteria for commercial end use.
- 10.1.5 Asbestos was not detected in any of the analysed soil samples.

Baseline Conditions of Groundwater

- 10.1.6 Results of groundwater analysis from samples taken from groundwater monitoring wells installed across the TFGF area that are used to baseline the groundwater conditions underlying the TFGF area are described in Table 10-6 below.

Table 10-6: Summary of Groundwater Analysis Results

Determinand	Minimum (ug/l)	Maximum (ug/l)
Arsenic	<0.15	140
Cadmium	<0.02	<0.02
Chromium	<0.2	0.2
Copper	<0.5	<0.5
Lead	<0.2	0.4
Mercury	<0.05	<0.05
Nickel	<0.5	9.2
Selenium	U/S	14
Zinc	<0.5	<0.5
Benzo(a)pyrene	<0.01	<0.01
Sum of PAHs (4no. congeners)	<0.01	<0.01
Total petroleum hydrocarbons	<140 (C5-C35)	<140 (C5-C35)

*U/S insufficient sample

10.1.7 Analysis of selected groundwater samples did not indicate any elevated concentrations of contaminants when compared to the UK Drinking Water Standards.

11 OPERATION SITE CONDITION REPORT

11.1 Operational Phase

11.1.1 During the operational phase of the facility the following information relevant to site condition within the permitted area will be recorded.

11.2 Site Condition Report Summary

4.0 Changes to the activity	
Have there been any changes to the activity boundary? If yes, provide a plan showing the changes to the activity boundary.	If yes, provide a plan showing the changes to the activity boundary.
Have there been any changes to the permitted activities? If yes, provide a description of the changes to the permitted activities	If yes, provide a description of the changes to the permitted activities
Have any 'dangerous substances' not identified in the Application Site Condition Report been used or produced as a result of the permitted activities? If yes, list them	If yes, list them
Checklist of supporting information	<ol style="list-style-type: none"> 1. Plan showing any changes to the boundary (where relevant) 2. Description of the changes to the permitted activities (where relevant) 3. List of 'dangerous substances' used/produced by the permitted activities that were not identified in the Application Site Condition Report (where relevant)

5.0 Measures taken to protect land	
Use records that you collected during the life of the permit to summarise whether pollution prevention measures worked. If you can't, you need to collect land and/or groundwater data to assess whether the land has deteriorated.	
Checklist of supporting information	<ol style="list-style-type: none"> 1. Inspection records and summary of findings of inspections for all pollution prevention measures 2. Records of maintenance, repair and replacement of pollution prevention measures

6.0 Pollution incidents that may have had an impact on land, and their remediation	
Summarise any pollution incidents that may have damaged the land. Describe how you investigated and remedied each one. If you can't, you need to collect land and /or groundwater reference data to assess whether the land has deteriorated while you've been there.	
Checklist of supporting information	<ol style="list-style-type: none"> 1. Records of pollution incidents that may have impacted on land, 2. Records of their investigation and remediation

7.0 Soil gas and water quality monitoring (where undertaken)	
Provide details of any soil gas and/or water monitoring you did. Include a summary of the findings. Say whether it shows that the land deteriorated as a result of the permitted activities. If it did, outline how you investigated and remedied this.	
Checklist of supporting information	<ol style="list-style-type: none"> 1. Description of soil gas and/or water monitoring undertaken 2. Monitoring results (including graphs)

12 SURRENDER SITE CONDITION REPORT

- 12.1.1 At permit surrender, the following sections of the SCR template (EPR H5) will be completed and submitted to the EA as part of the permit surrender application. Information that has been gathered over the lifetime of the Permit will be used to identify whether the land is in a satisfactory condition. If necessary, surrender reference data will be collected and remediation will be undertaken if required.

8.0 Decommissioning and removal of pollution risk

Describe how the site was decommissioned. Demonstrate that all sources of pollution risk have been removed. Describe whether the decommissioning had any impact on the land. Outline how you investigated and remedied this.

Checklist of supporting information	<ol style="list-style-type: none">1. Site closure plan2. List of potential sources of pollution risk3. Investigation and remediation reports (where relevant)
--------------------------------------------	-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

9.0 Reference data and remediation (where relevant)

Say whether you had to collect land and/or groundwater data. Or say that you didn't need to because the information from sections 3, 4, 5 and 6 of the Surrender Site Condition Report shows that the land has not deteriorated. If you did collect land and/or groundwater reference data, summarise what this entailed, and what your data found. Say whether the data shows that the condition of the land has deteriorated, or whether the land at the site is in a "satisfactory state". If it isn't, summarise what you did to remedy this. Confirm that the land is now in a "satisfactory state" at surrender.

Checklist of supporting information	<ol style="list-style-type: none">1. Land and/or groundwater data collected at application (if collected)2. Land and/or groundwater data collected at surrender (where needed)3. Assessment of satisfactory state4. Remediation and verification reports (where undertaken)
--------------------------------------------	----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

10.0 Statement of site condition

Using the information from sections 3 to 7, give a statement about the condition of the land at the site. This should confirm that:

1. the permitted activities have stopped,
 2. decommissioning is complete, and the pollution risk has been removed,
 3. the land is in a satisfactory condition
-

13 CONCLUSIONS

- 13.1.1 This site condition and baseline report has been produced in support of the application for an environmental permit for the Thurrock Gas-Fired Flexible Generating Facility.
- 13.1.2 The site is underlaid by geological deposits of Alluvium. Sources indicate that the bedrock geology is represented by the Lewes Nodular Chalk Formation and the bedrock aquifer designated as Principal.
- 13.1.3 The groundcover of the site comprises marshland, classifying the site as greenfield since 1863, possibly longer. No pollution incidents have occurred or have been noted at the site.
- 13.1.4 A number of RHS have been identified at the site. All will be stored in appropriate tanks, CCCW system or bunds on impermeable surfaces of the site. Spill kits and leak detection measures will be in place.
- 13.1.5 Of the RHSs identified in Section 5 of this report, the risk attributed to the storage and usage are considered low or very low risk. Whilst the overall conclusions would lead to there being no RHS for which baseline data is required ground investigation data for TFGF is available and has been provided to inform the baseline conditions of the site.
- 13.1.6 Consistent with the sites historical land uses, the baseline data does not show any indication of contamination.



Drawing 1 Site Layout Plan

Drawing 2 Site Drainage Plan

Drawing 3 Thurrock Development Zones

Drawing 4 Borehole Location Plan

Drawing 5 Site Location Plan

Drawing 6 Receptor Plan 2km Buffer

Drawing 7 Receptor Plan 15 km Buffer



Appendix A
GROUNDSURE REPORT



Appendix B
ENVIRONMENTAL RISK ASSESSMENT



Appendix C
PHASE 1: PRELIMINARY RISK ASSESSMENT



Appendix D
PHASE 2: SITE INVESTIGATION REPORT