Introduction

This document is submitted to meet the requirement of Improvement Programme Item Number 32 of Table S1.3 of the EPR Permit, which stipulates that '*the operator shall submit a written protocol referenced in condition 3.1.3 for the monitoring of soil and groundwater*'.

Impact Assessment

Part 2A of the Environmental Protection Act 1990 ("Part 2A") provides the legislative framework for the contaminated land regime in England, Wales and Scotland. It provides for contaminated land to be identified and dealt with in a risk-based manner. The Contaminated Land (Wales) Regulations 2006 (2006/2989) set out provisions for procedural matters under Part 2A. The 2006 regulations have been modified with the introduction of The Contaminated Land (Wales) (Amendment) Regulations 2012, which came into force on 6th April 2012. This includes an amendment to Regulation 3(c) to take account of the updated definition of "controlled waters" in Section 78A(9) of the Environmental Protection Act 1990.

Section 78A(2) of Part 2A of the EPA 1990 defines contaminated land as "land which appears to the local authority in whose area it is situated to be in such a condition, by reason of substances in, on or under the land, that:

- significant harm is being caused or there is a significant possibility of such harm being caused; or
- pollution of controlled waters is being, or is likely to be caused".

Contaminated Land Statutory Guidance published in April 2012 provides for a new four category test which is intended to clarify when land does or does not need to be remediated, where Category 1 is deemed as being high risk and Category 4 as being low risk.

"Significant harm" is defined in the Guidance on risk based criteria and must be the result of a significant "pollutant linkage". The presence of a pollutant linkage relies on the Source-Pathway-Receptor concept, where all three factors must be present and potentially or actually linked for a potential risk to exist. An initial assessment of pollutant linkage can be made qualitatively (i.e. through identifying these factors) and may be assessed using qualitative risk assessment models.

Regarding the protection of specific water resources, the main legislative directive within the UK and Europe pertinent to the protection of water quality is the EC Water Framework Directive (WFD) (2000/06/EC). The WFD establishes a legal framework for the provision of sufficient quantities of good quality water across Europe. It required EU member states to aim to achieve 'good ecological and chemical status' in all water bodies (both groundwater and surface water) by 2015. It came into force on 22 December 2000, and was incorporated into UK law (transposed) in 2003 via The Water Environment (Water Framework Directive) (England and Wales) Regulations 2003.

In September 2015, The Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015 were published. These Directions have been published as an associated document of The Water Environment (Water Framework Directive) (England and Wales) (Amendment) Regulations 2015 (SI 2015/1623). These Directions have replaced the River Basin

Districts Typology, Standards and Groundwater Threshold Values (Water Framework Directive) (England and Wales) Directions 2010 and the River Basin Districts Surface Water and Groundwater Classification (Water Framework Directive) (England and Wales) Direction 2009. The new Directions set out the environmental standards to be used for the second cycle of river basin plans. Along with the updated The Water Environment (Water Framework Directive) (England and Wales) (Amendment) Regulations 2015, they transpose Directive 2013/39/EC on environmental quality standards for priority substances.

Conceptual Site Model

The ground conditions at the site, as identified through historic site investigation process and current operations, have been summarised into a Conceptual Site Model (CSM), which defines the key sources, pathways and receptors that have been identified as being relevant to this site. The CSM considers the following factors:

- **SOURCES** – the identification of contaminants that represent potential pollution sources;
- **PATHWAYS** – the identification of the potential exposure pathways between the potential sources; and
- **RECEPTORS** – the identification of the potential receptors that could be sensitive to harm if exposed to these pollution sources.
- **POLLUTANT LINKAGE** – the identification of plausible pollutant linkages i.e. there must be a source, receptor and pathway and a feasible linkage between them.

The conceptual model is presented in accordance with the guidance outlined within CLR11.

Identification of Potential Sources

The potential sources of contamination include:

- Known, historic, contaminants in the groundwater (phenol, hydrocarbons and ammonia).
- Potential contamination of shallow soils from possible current activities such as:
    - Poor housekeeping operations or the occurrence of accidental spillages of binder raw materials such as phenol formaldehyde resin, ammonia solution, silane, silicone, oil emulsion, fuel.
    - Oil leaks (e.g. diesel-operated fork lift trucks, parked vehicles, storage of oils, fuels and maintenance chemicals).
    - Poor waste management practices or the occurrence of accidental spillages such as cupola exhaust dust.
    - Poor storage solutions of hazardous substances.
    - Poor condition of above ground storage tanks associated with the binder plant and below ground washwater pits.

Soil contamination as a result of historic activities is not considered to be a potential source of contamination as a result of the remedial works completed in the mid-late 1990s and early 2000s, following an intrusive investigation programme and implementation of the remedial action plan, which commenced in 1995. There are several remediation completion reports in existence following the remedial activities, which predominantly comprised the delineation, excavation and removal of contaminated groundmass and the subsequent backfill with clean material.

Identification of Potential Exposure Pathways

Exposure pathways are the potential routes and mechanisms that link potential on-site sources to the identified receptors. However, it should be stressed that these risks have to be considered only through plausible pathways.

The following potential exposure pathways have been identified at the site:

- Migration of potential contaminants to underlying shallow soils and shallow groundwater.
- Migration of contaminants via shallow groundwater flow to surface water resources.
- Migration of contaminants from shallow groundwater to surface water resources via permeable conduits.

Identification of Receptors

Based on the site's environmental setting, the following potential receptors have been identified:

- surface water resources (River Dee located approximately 500m away and three small boundary ditches along the site's southern, eastern and northern boundaries, which are connected and drain into the River Dee);
- shallow groundwater.

Potential Pollutant Linkages

In order for there to be a plausible pollutant linkage there must be a source, receptor and pathway and a feasible linkage between them (a so called pollutant linkage). Consequently, even where a contaminant is identified, if there is no pathway for the contamination to reach a receptor, or no receptor then there can be no significant risk and remedial actions are not required. Furthermore, even if there is a complete pollutant linkage, it is possible that the contaminant concentration that can pass along the linkage does not represent a significant risk to human health or the environment. Central to this risk assessment process is the development of a 'conceptual model'. This is a descriptive and/or pictorial representation of the area of potential contamination, the surrounding environment and the processes acting on the contaminants by which they can move and come into contact with receptors (e.g. by leaching and migration into groundwater).

Production of a conceptual model requires an assessment of risk to be made. Risk is a combination of the likelihood of an event occurring and the magnitude of its consequences. Therefore, in order to assess risk both the likelihood and the consequences of an event must be taken into account. This report adopts the methodology for risk evaluation presented in CIRIA report C552 'Contaminated

Land Risk Assessment – A Guide to Good Practice', 2001. The method is qualitative and involves the classification of the following:

- the magnitude of the potential severity or consequence of the risk occurring;
- the magnitude of the likelihood or probability of the risk occurring; and
- once the likelihood of an event occurring and its severity have been classified, a risk category can be assigned using *Table 1*:

Table 1: Risk Assessment Matrix

		Consequence / Risk			
		Severe	**Moderate**	**Mild**	**Minor**
Likelihood of Occurrence	**High Likelihood**	Very High	High	Moderate	Moderate/Low
	Likely	High	Moderate	Moderate/Low	Low
	Low Likelihood	Moderate	Moderate/Low	Low	Very Low
	Unlikely	Moderate/Low	Low	Very Low	Very Low

A conceptual model has been devised based on the current situation as detailed in a tabular format in *Table 2.*

Table 2. Conceptual Site Model				
Source	Pathway	Receptor	Potential Pollutant Linkage Likelihood & Potential Severity Mitigation / Assessment Control	Residual Risk
Potential contamination of shallow soils (phenol, formaldehyde silane, silicone, oil emulsion, fuel, cupola exhaust dust) from current activities (such as poor housekeeping, accidental spillages, leaks, poor waste management practices, poor storage solutions of hazardous substance, poor condition of above and underground storage tanks/pits). Known, historic, contaminants in the groundwater (phenol, hydrocarbons and ammonia).	Migration of contaminants to underlying shallow soils and shallow groundwater	**CWR01 Controlled Waters** (shallow groundwater – Alluvium surface water resources – boundary ditches, River Dee)	**Likelihood [Unlikely] & Severity [Moderate]** The installation operates under an Environmental Management System in accordance with ISO 14001 certification and is subject to independent audit (most recent in December 2016) and supplemented by internal audits (plant & Group level – most recent Group audit in April 2016) to ensure compliance. Under the EMS, measures are in place for the management of materials and for the prevention of accident releases including a procedure for recording and investigating pollution incidents/spillages, together with the implementation of corrective action to minimise re-occurrence. Storage and containment of potentially hazardous substances is undertaken in accordance with prevailing regulations. All above ground storage tanks (ASTs) are located within a bunded area and have high and low level alarms using level sensors. Bulk ASTs also have high-high level alarm switches. Non bulk storage of hazardous substances are stored in appropriate containers with secondary containment where required. ASTs and tank bund containment are included on site maintenance and inspection schedules. All materials and substances used are approved for use on site and records kept in accordance with the Control of Substances Hazardous to Health Regulations. A comprehensive database of material safety data sheets is available, which is regularly reviewed and updated. Records of consumption of raw materials are kept within the computerised purchasing and account system and principle raw materials used have written specifications to ensure the quality and quantity of the raw materials that are received from suppliers are verified and recorded. The installation operates generic spillage procedures including the use of chemical and oil spill kits. Spill kits are strategically located around the site and are audited and maintained by an external company.	**LOW**

Table 2. Conceptual Site Model				
Source	Pathway	Receptor	Potential Pollutant Linkage Likelihood & Potential Severity Mitigation / Assessment Control	Residual Risk
			Surface water is managed on site to ensure that only emissions of clean and uncontaminated rainwater are discharged to controlled waters. The four release points to surface waters are monitored twice annually in accordance with Permit requirements. Maintained hardcover areas reduce the likelihood of infiltration. The site does not hold a groundwater or surface water abstraction licence.	
	Migration of contaminants via shallow groundwater flow to surface water resources	**CWR02 Controlled Waters** (surface water resources - River Dee)	**Likelihood [Low] & Severity [Mild]** The site has been subject to a series of intrusive investigations and remedial actions from which, a groundwater monitoring plan was established. A series of groundwater monitoring and sampling exercises have taken place over the years together with a number of reviews of monitoring data. In 2007, the consultants, ERM, undertook further groundwater monitoring and completed a Controlled Waters Risk Assessment Review. The report concluded that the groundwater monitoring results indicated continued improvement of groundwater quality. The findings from the Controlled Waters Quantitative Risk Assessment, which included data since 2000, concluded that the River Dee was unlikely to be impacted by any measured concentrations of analytes within the groundwater. In line with Knauf Group policy, the Queensferry site has an ongoing programme of process optimisation to minimise consumption of raw materials, which ties in with the company's Sustainable and Environmental continuous improvement programme. As part of this programme, the harmonisation of phenol formaldehyde binder recipes has resulted in the removal or reduction in quantities of certain raw materials such as silicone and ammonia solution. Knauf Insulation introduced the Ecose binder, an alternative dextrose-based binder to the phenol formaldehyde resin binder. The current split of products is approximately 60% PF and 40% ecose binder for the installation, thus, scaling back in the use of more harmful chemical substances.	**LOW**

Table 2. Conceptual Site Model				
Source	Pathway	Receptor	Potential Pollutant Linkage Likelihood & Potential Severity Mitigation / Assessment Control	Residual Risk
	Migration of contaminants from shallow groundwater to surface water resources via permeable conduits	**CWR03 Controlled Waters** (surface water resources)	**Likelihood [Unlikely] & Severity [Moderate]** The site drainage system is included on a site maintenance and inspection schedule for cleaning annually by an external contractor. The site drainage system was subject to a detailed condition survey in 2013 undertaken by an external contractor with the completion of associated remedial works in 2013 and 2014. The wash water system is fully contained. The underground wash water & effluent pits are lined (multi layered coating) and are included on a site maintenance and inspection schedule to check the integrity of the lining of the pits annually. Planned preventative maintenance was undertaken on the mainline pit in September 2012 and August 2015. The site holds a consent from Welsh Water to discharge effluent water to sewer.	**LOW**
CWR = Controlled Water Risk				

Conclusion

The evolution of the Knauf Insulation Queensferry plant, process changes, controls and on-going improvement in environmental performance serves to limit environment impacts and with respect to residual impacts, all significant pollutant linkages have been eliminated or minimised.

This, together with the on-going commitment to continuous environmental improvement, underpinned by the long standing ISO 14001 environmental management system, the monitoring of soil and groundwater, as referenced in *Section 3.1.3* of the Environmental Permit has been undertaken on a systematic appraisal of the risk of contamination.

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