Former Gasworks, Dock Road, Limerick

Baseline Report

In accordance with Article 22(2) of the Industrial Emissions Directive

March 2014

For Bord Gais

mouchel
building great relationships

Exchange Station
Mercury Court
Tithebarn Street
Liverpool
L2 2QP

T 0151 600 5500

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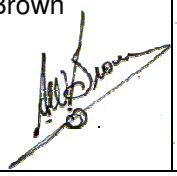
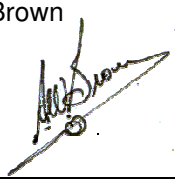
A	First Issue	Dave Watts 	Tony Brown 	Tony Brown 

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1021927/R/18	QRA Options Appraisal and Remedial Strategy Addendum Report
1021927/R/29	Preliminary Environmental Liabilities Risk Assessment (ELRA) report

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1021927/R/07	Environmental Impact Statement, Version C.
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1 Introduction

1.1 Terms of Reference

This report has been prepared on behalf of Bord Gais Eireann. as a baseline report for the proposed remediation of the former gasworks site, on Dock Road, Limerick, Ireland. The purpose of the report is to meet the requirements of Article 22(2) of the Industrial Emissions Directive (2010/75/EU). The scope of this report is further described in Section 1.4.

1.2 Background

Bord Gais Eireann propose to remediate the former gasworks site to enable future regeneration of site. The 1.4ha site is located in the City of Limerick approximately 100m south-east of the River Shannon. Bord Gais Eireann received planning permission in January 2013 for the remediation works. Three potential future uses for the site have been identified; commercial, residential (apartments) or public open space end uses. The planning submission included an Environmental Impact Statement, a Human Environment Assessment report, and a Natura Impact Statement, all of which are included within Appendix A for information.

In May 2012, Mouchel submitted an application for a Waste Licence to the Environmental Protection Agency (EPA) for the remedial works on behalf of Bord Gais Eireann. The reference number for the Waste Licence application is W0281-01.

This report forms part of a response to an EPA notification of information (dated 19th February 2014) required to comply with the amended Part IV of the Environmental Protection Agency Act 1992 as part of the implementation of the European Union (Industrial Emissions)(Licensing) Regulations 2013. Applications are required to provide the information prescribed in Regulation 9 of the EPA (Industrial Emissions)(Licensing) Regulations 2013. This report is prepared to comply with subparagraph (2)(n);

Provide, when requested by the Agency, in the case of an activity that involves the use, production or release of relevant hazardous substances (as defined in section 3 of the Act 1992) and having regard to the possibility of soil and groundwater contamination at the site of the installation., a baseline report in accordance with section 86B of the Act of 1992.

1.3 Requirement for Baseline Report

1.3.1 European Legislation

The Industrial Emissions Directive (2010/75/EU) or 'IED' entered into force within the European Union on 6 January 2011. The IED brings together the Integrated Pollution Prevention and Control Directive (2008/1/EC), the Waste Incineration Directive (2000/76/EC) and five other directives in a single Directive on industrial emissions.

For industrial activities regulated by the IED, such as the proposed remediation, Article 22(2) of Chapter II of the IED states that:

"Where the activity involves the use, production or release of relevant hazardous substances and having regard to the possibility of soil and groundwater contamination at the site of the installation, the operator shall prepare and submit to the competent authority a baseline report before starting operation of an installation or before a permit for an installation is updated for the first time after 7 January 2013. The baseline report shall contain the information necessary to determine the state of soil and groundwater contamination so as to make a quantified comparison with the state upon definitive cessation of activities provided for under paragraph 3.
The baseline report shall contain at least the following information:
(a) Information on the present use and, where available on past uses of the site;
(b) Where available, existing information on soil and groundwater measurements that reflect the state at the time the report is drawn up or, alternatively, new soil and groundwater measurements having regard to the possibility of soil and groundwater contamination by those hazardous substances to be used, produced or released by the installation concerned.
Where information produced pursuant to other national or Union law fulfils the requirements of this paragraph that information may be included in, or attached to, the submitted baseline report.
The Commission shall establish guidance on the content of the baseline report."

1.3.2 Irish Legislation

Article 22(2), as part of Chapter II of the IED, was transposed into Irish national law on 23 April 2013 by the European Union (Industrial Emissions) Regulations 2013 (S.I. No. 138 of 2013) and resulting amendments to the Environmental Protection Agency Act 1992. Section 86B of the Environmental Protection Agency Act 1992, as amended, states that:

"(1) Where an industrial emissions directive activity involves the use, production or release of relevant hazardous substances, and having regard to the possibility of soil and groundwater contamination at the site of an installation concerned, the Agency shall require an applicant under this Part for a licence or review of a licence or revised licence relating to the activity, including such a review by the Agency of its own volition, to furnish to the Agency a baseline report in accordance with regulations under section 89."

"(2) In relation to an installation, a baseline report shall contain the information necessary to determine the state of contamination of soil and groundwater at the time the report is drawn up in order that a quantified comparison may be made to the state of the site upon the permanent cessation (including cessation by abandonment) of the industrial emissions directive activity concerned and the applicant in preparing the baseline report shall include any information prescribed in regulations under section 89."
"(3) Notwithstanding the generality of subsection (2), a baseline report shall include at
least the following information-
(a) The current use and, where available, the past use of the site,
(b) Any available information
i. On soil or groundwater measurements that reflect the state of the site at the time that the baseline report is drawn up, or
ii. On new soil and groundwater measurements, having regard to the possibility of soil and groundwater contamination by the hazardous substances proposed to be used, produced or released by the installation concerned.
(4) Any information furnished to the Agency or to any other body under any enactment or rule of law or a law of the European Union, which complies with the requirements of subsection (2) or (3), may be furnished to the Agency in or with the baseline report.
(5) For the purposes of determining the information to be contained in a baseline report under this section the Agency shall have regard to, and shall for the purposes of subsection (2), make publicly available any guidance documents published by the Commission of the European Union in accordance with Article 22(2) of the Industrial Emissions Directive."

1.4 Objectives and Scope

This report has compiled the information available as of March 2014 related to soil and groundwater, which is required under Section 86(B) of the Environmental Protection Agency Act 1992, as amended. The current use and past use of the site are described in Section 2 of this report. Available information on soil and groundwater measurements for the site is included in Section 3 of this report, with supporting data attached as necessary. In accordance with Section 86(B)(4) of the EPA Act 1992, the information in Section 3 includes the results of soil and groundwater investigations completed during the course of the preparation of the Environmental Impact Statement and Licence Application for the site.

The possibility of soil and groundwater contamination by hazardous substances is addressed in Section 4 of this report, considering the potential sources of pollution on-site and other sources in the surrounding area.

2 Land Use

2.1 Current Use

The 1.4 ha site is located in the City of Limerick approximately 100 m south east of the River Shannon and immediately south east of the Dock Road. The national grid co-ordinates for the site are E156950 N156650. A location plan is included as Drawing- 1021927/TENDER/OD/001 Site Location.

The site, roughly rectangular in shape, is generally level at about 5 m MHD but rises to approximately 8 m MHD towards the south and east boundaries.

The site is surrounded by housing and light industry to the northeast and housing to the southeast and southwest. To the northwest some commercial properties are present and beyond this are the Graving Dock, Wet Dock and the River Shannon.

The site is currently derelict and access is managed by Bord Gais. The site includes a two-storey office block and other ancillary buildings including a former Generator Building, none of which are used on a permanent basis. The Bord Gais offices are also to be retained after the remediation works. The Generator Building and the Dock Road wall have Protected Status.

2.2 Past Use

The site history is summarised below:

- in the 1830's a limestone quarry was situated in the eastern part of the site, with a small gas works located to the north west;
- by 1872 the gas works occupied the majority of the site, with a small pond located at the edge of the remaining quarry;
- the quarry had been backfilled by 1938, and an electricity substation was located along the north east boundary;
- coal gas manufacture ceased in 1974 and the works became an oil gas plant until 1986 when natural gas was introduced; and
- demolition and site clearance took place between 1988 and 1995.

Full details of the site history and copies of historical maps are included in the following report; 1021927/R/07- Environmental Impact Statement, Mouchel 2013, which is included in Appendix A.

3 Soil & Groundwater Baseline Conditions

3.1 Soil

Published information indicates rockhead, to be close to the surface in places, with little or no drift cover. Where cover is present, it comprises made ground or recent alluvium associated with the River Shannon flood plain.

From the site investigations undertaken at the site, the general sequence of ground conditions comprised; Made ground underlain by limestone, with localised alluvium around the site boundary extending from the north west to the south west of the site.

Made ground over much of the site was predominantly granular in nature comprising sand, ash, limestone gravel with bricks and concrete. The made ground within the former quarry area was predominantly clay with brick and concrete fragments and large pockets of sand and layers of ashy material were recorded in the eastern section of the site and around the former quarry.

3.1.1 Soil Measurements

The following soil measurements are available for the Limerick Gasworks site, reflecting the state of the site at the time of this baseline report, prior to remediation works:

The site has been subject to five main phases of investigation; 1995 (O'Connor, Sutton, Cronin), 1996 (Arup), 2001 (Parkman), 2003 (Parkman) and 2009/2011 Site Characterisation (Mouchel). These investigations are reported in the following documents, which can be found within the Environmental Impact Statement Report included in Appendix A.

Summary Report on Limerick Site – O' Conner, Sutton, Cronin, August 1995;

Site Investigation Report: Volume 1 Report - Ove Arup, April 1996;

Site Investigation Report: Volume 2 Factual Site Investigation Data - Ove Arup, April 1996;

Desk Study Phase 1 Report – Parkman, April 2001 (report reference 25837/OR/01B);

Site Investigation Factual Report Volumes 1A and B – Parkman October 2001 (report reference 25827/OR/03B);

Site Investigation General Report Volume 2 – Parkman October 2001(report reference 25837/OR/04B); and

Ground Investigation into Boundary Conditions and Quarry Backfill – Parkman 2003 (report reference 25837/R/11A).

Limerick Gasworks Site Characterisation Factual Report (2009 and 2011) 1021927/R/02C November 2011- Mouchel

The investigations concur with the published geological maps with Made Ground (up to 10m deep in the former quarry area) overlying a thin layer of alluvial deposits (identified at the north-western boundary adjacent to the Dock Road) overlying limestone bedrock (which outcrops at the south- eastern boundary.

The recent characterisation exercise and subsequent risk assessment and options appraisal provide a comprehensive set of baseline data, with exploratory holes drilled on a 10m grid and chemical analysis undertaken on samples from each location at 1m intervals. The exploratory hole locations from the Characterisation are shown on Drawing 1021927/R02/OD/001 Characterisation Exploratory Hole Location Plan.

The assessment of the data is detailed in the following reports which are included in Appendix A.

1021927/R/03	QRA Options Appraisal and Remedial Strategy, Mouchel 2010
1021927/R/18	QRA Options Appraisal and Remedial Strategy Addendum Report, Mouchel 2012

Significant free phase product was identified within underground tanks and the former quarry. Assessment of the site has identified that groundwater beneath the site appears to have been impacted with dissolved phase phenols, PAHs (naphthalene in particular), cyanides, sulphate, ammonia, BTEX, TPH and heavy metals. In addition to the organic contaminants in soil and water, visual evidence of spent oxide was encountered in the central area of the site (former quarry area) with associated elevated cyanide levels and soil samples over the majority of the site contained high concentrations of sulphate, ammonia and metals, particularly lead with minor components of arsenic, chromium, nickel, copper and zinc.

3.2 Groundwater Measurements

Groundwater monitoring has been undertaken on a quarterly basis since the Characterisation investigation in 2009.

To date 17 monitoring visits have been undertaken, which comprise groundwater and free product level identification, along with taking water samples for chemical analysis. The following annual reports have been produced to date reflecting the state of the site at the time of this baseline report prior to remediation works;

1021927/R/14 Quarterly Groundwater Monitoring Visit 5 (year end 2010).

1034973/R/04 Quarterly Groundwater Monitoring Annual Report 2011

1034973/R/09 Quarterly Groundwater Monitoring Annual Report 2012

1049672/R/05 Quarterly Groundwater Monitoring Annual Report 2013

Copies of the reports are included in Appendix A.

4 Soil & Groundwater Contamination Hazards

Full details of the assessment of the soil and groundwater data, including the remediation options appraisal can be found in report; 1021927/R/03- QRA Options Appraisal and Remedial Strategy, Mouchel 2010, which is included in Appendix A.

4.1 Potential Pollutant Linkages

The Potential Pollutant Linkages with respect to human health are assessed to comprise:-

- Ingestion/ direct contact of soil for future site occupiers
- Inhalation/ ingestion/ direct contact of soil dust for future site occupiers and adjacent site occupiers, and
- Inhalation of soil gas/ volatiles for future site occupiers and adjacent site occupiers.

The potential pollutant linkages with respect to water are assessed to comprise:-

- Soil (including free phase hydrocarbons) leaching to groundwater impacting the River Shannon, and
- Groundwater (dissolved and free phase contaminants) impacting the River Shannon.

4.2 Human Health Detailed Quantitative Risk Assessment (DQRA)

Intrusive investigations have identified widespread contamination of the site, typically associated with by-products and waste products produced during the former use as a coal-gasification gasworks i.e. TPH, BTEX, PAHs (predominantly associated with coal tars) cyanides and heavy metals.

Qualitative assessment of the pollutant linkages for the site has identified potentially significant risks to future site users and adjacent premises. A Tier 1

quantitative risk assessment has been undertaken for onsite future residents (assuming apartments), public open space use and commercial workers and has identified potentially significant risks to site users via dermal contact and ingestion of shallow made ground contaminants across the site and inhalation of dust (and vapours for residential and commercial users), assuming that the free phase is not present (it is remediated/removed). If the site is however used for public open space, the users are potentially at risk via dermal contact, ingestion of shallow soils and inhalation of dust only, if there is no break layer introduced.

Remediation Target Values (RTV's) have been derived using generic assessment parameters, considered to be protective of human health, for each of the three potential future development options using the UK EA/ DEFRA's CLEA (Contaminated Land Exposure Assessment) and Dutch methodologies. In addition, a potential vapour pathway has been modelled whereby volatile organic contaminants in the soil and groundwater could represent a risk to future site occupiers and adjacent offsite occupiers and hence all free phase product within the soil and groundwater should be removed and surface soils remediated.

4.3 Groundwater/ Surface Water Quantitative Risk assessment

A Tier 3 Quantitative Risk Assessment has been undertaken using the UK EA's R & D Publication 20 to derive Remediation Target Values (RTV's) for contaminants in soils and groundwater that are protective of water resources at specified compliance points. In this case, the River Shannon, approximately 100m from the site, has been used. The risk assessment identifies that although a theoretical risk exists in respect to the River Shannon, this is unlikely to be realised due to the timescales required for contaminants to flow to the receptor and the presence of the wet dock and graving docks (with significant walls) impeding flow. It is also noted that cohesive alluvial deposits may be present in the vicinity of the river further impeding any groundwater flow directly into the river.

It is concluded that the limestone aquifer is not productive due to the brackish nature of the groundwater and the thin water bearing stratum (in the near surface weathered zone). There are also no abstractions within the vicinity of the site. Free phase liquids identified in the site investigation works should be removed as they are not modelled in the risk assessment.

4.4 Remediation Options Appraisal

A detailed appraisal of the available remediation options was undertaken. The preferred remediation options have been adopted to produce a remediation strategy using a two phase approach.

Phase 1 comprises the removal of free phase liquids, predominantly dense non-aqueous phase liquids (DNAPL) by Pump and Treat techniques. One such method comprises the installation of wells to intercept the DNAPL, generally spaced at 4-5m centres. Water is heated and pumped into some of the wells and extracted through others over a period of several weeks. The extracted mixture of water and DNAPL is separated with the DNAPL being collected in IBC's (intermediate bulk containers) or large tanks prior to removal from site for recycling or disposal (possibly incineration). Water is cleaned and reused. The whole system is closed and hence release of odours is minimal. It is estimated that a volume of approximately 200m^3 of DNAPL requires removal from site for recycling or disposal.

Phase 2 comprises the ex-situ stabilisation/ solidification of the uppermost 3m of made ground (or shallower where rock is encountered) to RTV's for surface soils are achieved and to remove the majority of underground structures and remnant free product from site. Sophisticated plant is available to allow thorough mixing of excavated materials with appropriate binders to ensure that the stabilised materials comply with specified leachate criteria. It is estimated that a volume of approximately 32,500m^3 of soil requires stabilisation/ solidification.

4.5 Remedial Works

The works have been designed to undertake the remediation of soil and groundwater at the site and to remove the potential sources of contamination present. The appointed contractor will be required to produce method statements for the two remediation phases, which will be required to prevent the creation of any further pathways during remediation. These temporary works will be operated under an Environmental Management System which will ensure adequate procedures and work practices are in place to prevent pollution of the environment.

On completion of remediation, a verification report will be produced, detailing the works undertaken. This report will form the basis of the Closure, Restoration & Aftercare Management Plan (CRAMP) for the site. This will ensure that any potentially polluting substances are removed from the site in a controlled

manner and that there will be no significant residual pollution of soil or groundwater.

A Preliminary Environmental Liabilities Risk Assessment (ELRA) report has been produced and submitted to the EPA (a copy of which is included in Appendix A) which details the potential risks associated with the remedial works and mitigation measures proposed. The report concludes that environmental risks associated with the works identified are considered to be manageable.

5 Conclusions

This report includes the results of soil and groundwater measurements available for the Limerick Gasworks site in advance of the planned remediation works. These measurements describe the baseline conditions at the existing derelict, brownfield site, as understood in March 2014.

The proposed remediation has been designed to remove the contamination sources at the site to ensure the protection of soil and groundwater.

Environmental risks associated with the works identified are considered to be manageable.