

**Record of Determination of Contaminated Land**  
**25-71 Joss Street, Invergordon**  
**Part IIA of the Environmental Protection Act 1990**



**June 2006**



## Contents

1. Introduction.....	2
2. The Site .....	3
3. Description of Significant Pollutant Linkages .....	4
4. Summary of Evidence upon which the Determination is based .....	5
5. Summary of Relevant Assessment of the Evidence .....	7
6. Summary of Requirements of Statutory Guidance which have been Satisfied .....	9

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## 1. Introduction

Powers and duties with respect to land contamination were conferred on Local Authorities when the Contaminated Land Regime came into force with the Contaminated Land (Scotland) Regulations 2000. The legislative basis for the new regime is contained in Part IIA of the Environmental Protection Act 1990 (inserted by s57 of the Environment Act 1995). The Regulations were accompanied by a Scottish Executive Circular, 1/2000, which contained statutory guidance on the implementation of the Regime. The Regime has since been updated by The Contaminated Land (Scotland) Regulations 2005 (Scottish Statutory Instrument 2005 No.658).

The above legislation provides the following definition of contaminated land:

“Contaminated land” is any 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 –

- (a) significant harm is being caused or there is a significant possibility of such harm being caused;
- or
- (b) significant pollution of the water environment is being caused or there is a significant possibility of such pollution being caused

Highland Council in October 2001 published a *Contaminated Land Inspection Strategy*. On the basis of this strategy, sites within Highland were prioritised based on their previous and current use. Those sites perceived to be most at risk, and therefore prioritised for inspection are sites which include residential properties on areas previously used as gasworks, landfills and other high risk industrial land uses.

Once the Local Authority considers that a site is contaminated land, and wishes to identify it as such, a written record of this determination is required. Paragraph B52 of the Statutory Guidance sets out the following list of requirements for the written record:

- (a) description of the particular significant pollutant linkage, identifying all three components of pollutant, pathway and receptor;
- (b) summary of the evidence upon which the determination is based;
- (c) summary of the relevant assessment of this evidence;
- (d) summary of the way in which the authority considers that the requirements of the guidance in this Part and in Chapter A of the guidance have been satisfied.

The following sections provide the written record of determination for land at 25-71 Joss Street, Invergordon.

## 2. The Site

The former gasworks in Invergordon now comprises two blocks of mainly local authority owned flats totalling 24 in number, landscaped and car parking areas.

Site Address: 25-71 Joss Street

Invergordon

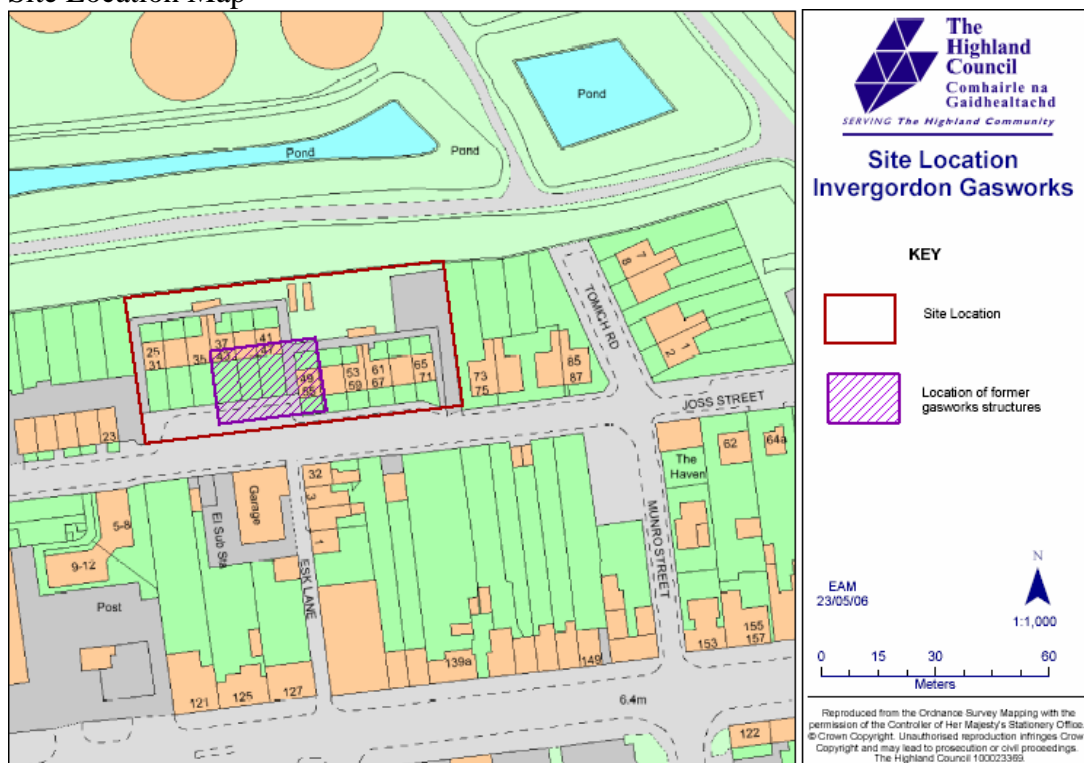
IV18 0AP

Area: 0.31ha (total site area); Area of Former Gasworks structures: 0.06ha

NGR: 270963, 868700

Current Use: Residential (without private gardens, but with landscaped areas)

### Site Location Map



The site has been subject to two phases of intrusive site investigation, in August 2003, and October/November 2004. A final Interpretative Report assessing the potential contamination status was produced in April 2005.

On the basis of the investigations, Highland Council considers that land at the former gasworks, Joss St comprises contaminated land as defined by Part IIA of the Environmental Protection Act 1990.

### 3. Description of Significant Pollutant Linkages

A pollutant linkage is defined in the Statutory Guidance as a linkage between a Contaminant and a Receptor, by means of a Pathway. It is considered that the following significant pollutant linkage is present at Joss Street:

<b>Contaminant</b>	<b>Pathway</b>	<b>Receptor</b>
Poly-cyclic Aromatic Hydrocarbons, in particular the risk driver at the site – Benzo (a) Pyrene	Ingestion of soil (indoor and outdoor) Dermal contact with soil (indoor and outdoor)	Residents at the site – the most vulnerable of which are assessed to be females in the 0-6 year age group.

It is considered that based on this linkage, the site should be identified as Contaminated Land due to **significant possibility of significant harm to human health.**

#### **4. Summary of Evidence upon which the Determination is based**

The former gasworks site at Joss Street, Invergordon has been subject to a number of investigations. The list below gives the full titles and authors of the factual reports held by the Highland Council in chronological order.

- The Highland Council Part IIA Contaminated Land Strategy Phase I Desk Study Joss Street, Invergordon. Highland Council, August 2003.
- The Highland Council Part IIA Contaminated Land Strategy Phase II Site Investigation Factual Report Joss Street, Invergordon. Highland Council, January 2004.
- Further Site Investigation Factual Report Joss Street, Invergordon. White Young Green, December 2004.
- Surface Soil Sampling undertaken by Highland Council on 1<sup>st</sup> December 2004, and analysed by Severn Trent Laboratories
- Groundwater monitoring undertaken by White Young Green on 8<sup>th</sup>-9<sup>th</sup> September 2005 and 7<sup>th</sup>-8<sup>th</sup> March 2006.
- Indoor air quality monitoring undertaken by BRE in September 2004, and a year long indoor air quality monitoring programme undertaken by BRE from January 2005 to February 2006 (final report in preparation, monthly factual reports are available).

##### **4.1 Summary of Evidence of Significant Possibility of Significant Harm to Human Health**

The gasworks at Joss Street, Invergordon first appears on historic OS maps in 1875. Evidence from a paper presented to the Institution of Gas Engineers Scottish Section in 1989 entitled *In Search of Old Gasworks* by James A Keith suggests that the gasworks at Invergordon was open from 1872 to 1921, and that it was acquired by the Town Council.

The Desk Study undertaken by Highland Council revealed a number of potential pollutant linkages, including the potential for the significant possibility of significant harm to human health via exposure to contaminants in soil present from the previous use of the site as a gasworks.

Exploratory investigation comprising the excavation and installation of monitoring wells in seven boreholes at the site was undertaken from 5<sup>th</sup>-7<sup>th</sup> August 2003. Soil samples were collected and analysed for a suite of contaminants normally associated with gasworks. Two boreholes recorded visual and olfactory evidence of contamination; one of these boreholes recorded a tarry/pitch layer with strong hydrocarbon odours from 0.5m to 1m below ground level. Soil concentrations of benzene at the site ranged up to 7.5mg/kg, and Benzo(a)Pyrene up to 12mg/kg (full

details of the contaminants encountered, including copies of the laboratory analysis certificates are included in the Phase II Report prepared by Highland Council).

On the basis of this investigation a further phase of site investigation work was commissioned, and the consultancy White young Green supervised the work. A total of 29 extra boreholes were drilled on and offsite, of these 20 were installed with groundwater monitoring standpipes. Three trial pits were also excavated. The intrusive works were carried out from 20<sup>th</sup> -27<sup>th</sup> October 2004. A total of 181 soil samples were collected and analysed at Severn Trent Laboratories. Further visual and olfactory evidence of contamination was encountered in the location of the former gasworks structures, including what was described as a layer of bitumen from 0.45m to 1m below ground level. Various concentrations of soil contaminants were encountered, including benzene up to 102mg/kg and Benzo(a)Pyrene up to 550mg/kg (full details of the contaminants encountered, including copies of laboratory analysis certificates are included in the White Young Green report).

Following this investigation, surface samples of soil were collected by Highland Council on 1<sup>st</sup> December 2004 and analysed for PAH only by Severn Trent Laboratories. Concentrations of Benzo(a)Pyrene in the soil ranged up to 9.8mg/kg.

DEFRA and the Environment Agency have published toxicological information on benzene and benzo(a)pyrene which are both considered to be carcinogens. A summary of the relevant risk assessment of these contaminants is given in Section 5.1 below.



## 5. Summary of Relevant Assessment of the Evidence

Two assessments of the site investigation information have been made, both by Land Quality Management Ltd (LQM). LQM are considered to be leading risk assessment consultants and provide contaminated land training to Local Authorities. Listed below are the LQM reports in chronological order.

- Human Health and Controlled Waters Risk Assessment for Residential Properties Located at Joss Street, Invergordon. Land Quality Management Ltd, July 2004.
- Interpretative Report and Risk Assessment for Second Phase of Intrusive Works at Joss Street. Land Quality Management, April 2005.

### 5.1 Summary of Assessment of Evidence of Significant Possibility of Significant Harm

The first LQM report relates to the Desk Study and Site Investigation information prepared by Highland Council. LQM undertook a Generic Quantitative Risk Assessment for the site, comparing the concentrations of the contaminants encountered in soil to the DEFRA produced Soil Guideline Values (SGV). For those contaminants for which there are SGV, there was no risk. However the contaminants for which there are SGV do not include many of the organic carcinogenic contaminants which are associated with gasworks.

LQM considered the various pathways which could expose contaminants to the residents at the site, and chose two contaminants as risk drivers to undertake Detailed Quantitative Risk Assessment. Benzene was selected to represent all risk from inhalation of volatiles as it is one of the most volatile hydrocarbons, and it is a known carcinogen. Benzo(a)Pyrene was chosen to represent the risk from PAH, particularly via dermal and ingestion routes as it is not particularly volatile, and is one of the most toxic PAH. Both these contaminants have toxicological data published by DEFRA. The approach to the risk assessment is consistent with the Contaminated Land Exposure Assessment (CLEA) published by the Environment Agency, and the subsequent CLEA Briefing Notes which update this model. The algorithms used within the CLEA model were used within the risk assessment for benzene and benzo(a)pyrene at the site. Parameters used in the model were those recommended by the Environment Agency, or were specific to the site. The toxicological parameters for benzene and benzo(a)pyrene were those published by DEFRA which are intended to be protective of human health.

LQM found that *“the DQRA has indicated that there is currently the potential for an unacceptable level of risk from the following exposure pathways from one or more of the contaminants of concern:*

- *Ingestion of soil and dust from contaminated soils*
- *Dermal contact with contaminated soils*
- *Inhalation of vapours and dust arising from contaminated soils*



- *Inhalation of vapours arising from dissolved contaminants within the groundwater”*

LQM recommended further investigation at the site, which was subsequently undertaken on behalf of Highland Council by White Young Green.

The second LQM report reviews the data supplied by WYG together with the original site investigation data, and a limited surface soil sampling exercise undertaken by Highland Council. Benzene and Benzo(a)Pyrene were again selected as risk drivers, and the risk assessment was reviewed based on the additional site information.

LQM again found that *“the DQRA has indicated that there is currently the potential for an unacceptable level of risk from the following exposure pathways from one or more of the contaminants of concern within the Site:*

- *Ingestion of soil and dust from contaminated soils*
- *Dermal contact with contaminated soils*
- *Inhalation of vapours and dust arising from contaminated soils*
- *Inhalation of vapours arising from dissolved contaminants within the groundwater”*

Highland Council considers that there is significant possibility of significant harm to residents via the pathways of ingestion (including inhalation of dust) and dermal contact with contaminated soils. In particular, Highland Council consider that the immediate area associated with the former gasworks structures should be identified as contaminated land, as levels of the risk driver contaminant of concern, Benzo(a)Pyrene far exceeded the site specific target level derived for the site by a magnitude of over 480 times. In addition, other PAH were also found to be elevated in this area, however their risk was not assessed, although it is considered that these PAH may also be carcinogenic and toxic. LQM state that *“the levels of individual PAHs observed within surface soils at the Site indicate that some of them may exceed any DQRA assessment criteria that may be derived. These included the following PAHs: benzo(a)anthracene; chrysene, benzo(b)fluroanthene; benzo (k)fluroanthene; benzo(ghi)perlene and indeno(123cd)pyrene.”*

## 6. Summary of Requirements of Statutory Guidance which have been Satisfied

In identifying that land at 25-71 Joss Street, Invergordon is contaminated land, as defined by Part IIA of the Environmental Protection Act 1990, Highland Council have taken into account the guidance contained within Chapter A and Chapter B of Annex 3 to Scottish Executive Circular 1/2000.

Chapter A of the Circular states that the first step for the local authority is to satisfy itself that *“a contaminant, a pathway (or pathways), and a receptor have been identified with respect to that land”*. Following on from this, the local authority must satisfy itself that both *“such a pollutant linkage exists in respect of a piece of land; and the pollutant linkage... presents a significant possibility of significant harm being caused to that receptor”*.

In this respect site receptors are the residents of the site properties. The source materials containing contaminants of concern are contained within a layer described in the investigations in association with the former gas works structures, ranging from 0.45 to 1M below the current site surface. The pathways which connect the source of contamination to the residents involve soil disturbance and migration of contaminants from activities such as installation and maintenance of services, grounds maintenance and gardening and soil movement from the effects of site flora and fauna. Direct contact during such activities or with contaminants coming to the surface as a result of such activities, provide the potential pathways for dust inhalation, soil ingestion and skin contact.

Chapter B, paragraph 45 of the statutory guidance states that the local authority should determine that land is contaminated land on the basis that there is a significant possibility of significant harm being caused where *“it has carried out a scientific and technical assessment of the risks arising from the pollutant linkage, according to relevant, appropriate, authoritative and scientifically based guidance on such risk assessments; that the assessments shows that there is a significant possibility of significant harm being caused; and that there are no suitable and sufficient risk management arrangements in place to prevent such harm”*.

Highland Council is satisfied that the statutory guidance has been followed. A detailed site investigation has been undertaken which found the presence of various contaminants associated with the previous use of the site as a gasworks.

A risk assessment was carried out to assess whether the presence of the contaminants could cause potential harm to human health. For this assessment the risk driver benzo(a)pyrene was selected. The risk assessment was carried out following guidance from DEFRA and the Environment Agency, and utilising the algorithms in the Contaminated Land Exposure Assessment model published by the Environment Agency. Toxicological information regarding the risk posed by benzo(a)pyrene to human health published by DEFRA was used in the risk assessment. The risk assessment found that concentrations of benzo(a)pyrene in soils throughout the site

exceed the level above which there is a risk to human health. In the area around the former gasworks structures, the magnitude of exceedence above which there is a risk to human health was over 480 times. As previously stated, benzo(a)pyrene was selected as a representative contaminant at the site, and other contaminants may be present which also pose a risk to health. Given the magnitude of exceedence, and the uncertainty regarding other contaminants at the site, Highland Council considers that the potential risk to human health is a significant risk.

Temporary management procedures to manage the risk have been implemented at the site. This has involved fencing off the landscaped areas of the site. Highland Council do not consider that this is a suitable long term measure, and remediation of the site is required in order to prevent the significant possibility of significant harm to human health.