Island Gas Limited

Albury Wellsite

Production Operations Incorporating Hydrogen Production

Environmental Permit Application

Waste Management Plan

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1. INTRODUCTION

Island Gas Limited (IGas) is a leading onshore oil and gas exploration and production business, holding a portfolio of exploration and production assets focused on three regions: the North West, East Midlands and the Weald Basin in Southern England. The business has more than thirty years' experience of successfully and safely extracting and producing hydrocarbons onshore in the UK.

IGas is engaged in the exploration and production of petroleum onshore United Kingdom and holds 100% interest in Development Licence DL004 within which it holds Operator status and proposes to commence hydrogen production using gas produced from the pre-existing Albury 1 well (ALB-1).

The purpose of this document is to outline the proposed operations and the associated waste management arrangements at the Albury Wellsite during any workover and production operations (inclusive of hydrogen production). IGas are proposing to add a single installation activity to its current Albury permit (EPR/EB3100FC).

IGas is the holder of a number of Environmental Permits issued by the Environment Agency in accordance with EPR2016. The current activities permitted to be undertaken by IGas at the Albury Wellsite are presented in Table 1.1.

Permit Number	Reference	Description
EPR/EB3100FC	A1	The incineration of hazardous waste in a waste incineration plant or waste co-incineration plant with a capacity exceeding 10 tonnes per day.
	A2	A mining waste operation for the management of extractive waste including gas from prospecting for mineral resources, not involving a waste facility.
	SR2018 No1	Operation of one or more medium combustion plants.
EPR/SB3796DT	SR2014 No4	To operate a standard facility described in standard rules SR2014 No4: accumulation and disposal of radioactive waste from NORM industrial activity of the production of oil and gas.

Table 1.1: Current Permitted Activities

As the development continues to progress, an additional permitted activity has been identified. As a result, IGas have prepared an application to vary the environmental permit EPR/EB3100FC with the purpose of gaining permission to produce hydrogen using a process known as Steam-Methane Reformation (SMR).

2. SCOPE

This Waste Management Plan is applicable to the Albury Wellsite and all operations permitted therein. It is applicable to IGas, its contractors and subcontractors and can be used in support of applications to the Environment Agency under EPR2016.

This Waste Management Plan will supersede all previous Waste Management Plans relating to the Albury Wellsite once both approved by the Environment Agency upon commencement of the hydrogen production operations. This Waste Management Plan is the principle document for the management of all mining waste activities permitted at the Albury Wellsite under applicable environmental legislation.

3. DEFINITIONS

ALB-1:	Albury 1 Well
ALB-2:	Albury 2 Well
DL:	Development Licence
DNO:	Distribution Network Operator
EPR2016:	Environmental Permitting (England and Wales) Regulations 2016, as amended.
IGas:	Island Gas Limited
Km:	Kilometre
M:	Metre
MCP:	Medium Combustion Plant
MCPSG:	Medium Combustion Plant & Specified Generator
Mm:	Millimetre
MW:	Megawatt
NORM:	Naturally Occurring Radioactive Material
PEDL:	Petroleum Exploration and Development Licence
SNCI:	Sites of Nature Conservation Importance
SG:	Specified Generator
SMR:	Steam-Methane Reformation
UK:	United Kingdom
WR11:	Notice of Intention to Drill for Minerals Form

Table 3.1: Definitions

4. ENVIRONMENTAL LEGISLATION AND APPLICABILITY

The Albury Wellsite is the subject of several activities which, under current environmental legislation, requires an environmental permit. The Environment Agency regulate all permitted activities under the Environmental Permitting (England and Wales) Regulations 2016, as amended (EPR2016). Under EPR2016, Operators are required to submit environmental permit applications to the Environment Agency to seek approval to undertake such activities.

Onshore oil and gas developments are the subject of the environmental permitting regulations, as such a number of environmental permits have already been obtained. This Waste Management Plan provides an update on the proposed operations to be conducted at the Albury Wellsite and provide an explanation as to which additional permitted activities will be required/applied for.

4.1 Environmental Permitting (England and Wales) Regulations 2016

The Environment Agency regulate all permitted activities under EPR2016 and require 'Operators' to submit environmental permit applications to seek approval to undertake such activities. IGas has assessed the activities associated with the proposed operations and considers certain activities to fall within the scope of EPR2016 and therefore require the necessary environmental permits.

4.1.1 Industrial Emissions Activity

Schedule 1, Part 2 of EPR2016 details a number of activities that are classified as an Industrial Emissions Activity including 'Energy Activities' (Chapter 1), Chemical Industry (Chapter 4) and 'Waste Management' (Chapter 5). Energy Activities include the storage of crude oil, Chemical Industry includes hydrogen production, whilst Waste Management includes the incineration of waste.

4.1.1.1 Oil Storage

This activity is cited under EPR2016, Schedule 1, Part 2, Chapter 1, Section 1.2, Part A(1) (e)(i).

'The loading, unloading, handling or storage of, or the physical, chemical or thermal treatment of crude oil.'

The current and future proposed operations do not have the potential to involve the handling and storage of crude oil within the site, as such the permit will not be varied to facilitate oil storage.

4.1.1.2 Production of an Inorganic Chemical

This activity is cited under EPR2016, Schedule 1, Part 2, Chapter 4, Section 4.2, Part A(1), (a)(i).

'Producing inorganic chemicals such as gases (for example, hydrogen).'

It is proposed that the natural gas (methane) produced from the Albury Wellsite will be used for the production of hydrogen by means of Steam Methane Reformation. Based on conversations with the Environment Agency it is considered that this activity will require an application to permit this particular activity.

4.1.1.3 Incineration of Natural Gas

This activity is cited under EPR2016, Schedule 1, Part 2, Chapter 5, Section 5.1, Part A(1) (a).

'The incineration of hazardous waste in a waste incineration plant or waste co-incineration plant with a capacity exceeding 10 tonnes per day.'

The proposed operations will not involve the incineration of natural gas exceeding 10 tonnes per day. Activity A1 of environmental permit EPR/EB3100FC is not being varied as there will be no changes to the incineration operations. However, the activity is being retained, and is not being surrendered at this time.

4.1.2 A Mining Waste Activity

Schedule 20 of EPR2016 defines a mining waste operation as being the management of extractive waste, whether or not it involves a waste facility. An environmental permit is required to authorise a mining waste operation.

The Albury operations will continue to involve the management of extractive waste not including a waste facility. Activity A2 of environmental permit EPR/EB3100FC is not being varied as the type, volume and management of extractive waste will remain the same. For clarity the Albury Wellsite produces natural gas as a product and is not a waste, therefore the use of SMR technology for natural gas is not a waste management technique, but as part of the Operators decision to produce Hydrogen as part of the Company's business plan.

4.1.3 Water Discharge Activity

Schedule 21 of EPR2016 relates to water discharge activities, including the discharge or entry to inland freshwaters, coastal waters or relevant territorial waters of any trade effluent. For clarity the discharge of clean surface run-off water is considered a trade effluent for the purpose of onshore oil and gas permit applications.

Surface run-off water at the Albury Wellsite is collected within the containment ditches for subsequent removal via road tanker and disposed at an Environment Agency licenced waste facility. No discharges will take place at the Albury Wellsite during the operations, therefore a water discharge activity will not be applied for.

4.1.4 A Groundwater Activity

Under Schedule 22 of EPR2016, an activity that could involve the discharge of pollutants into groundwater must be notified to the Environment Agency, together with the nature of these pollutants. The Environment Agency will then determine whether the groundwater activity needs to be permitted. For clarity, no activities involving the discharge of pollutants to groundwater will take place and therefore a groundwater activity permit will not be applied for.

4.1.5 A Radioactive Substances Activity

Schedule 23 of EPR2016 provides for the control of Naturally Occurring Radioactive Material (NORM). Schedule 23 defines the production of oil and gas as a NORM industrial activity and therefore any accumulation of radioactive waste, which exceeds concentrations set out in Table 1 of Schedule 23 of EPR2016. IGas have previously obtained a SR2014 No.4 permit (EPR/SB3796DT) which remains relevant to the proposed activities and therefore no application is being made to undertake further radioactive substances activities.

4.1.6 Medium Combustion Plant and Specified Generators

Schedule 25a of EPR2016 considers activities which involve the operation of Medium Combustion Plants (MCP), specifically MCPs with a rated thermal input equal to or greater than 1 megawatt but less than 50 megawatts. Such plants are required to operate within the set Emission Limit Values as cited by EPR2016, as amended.

Schedule 25b of EPR2016 considers activities which involve the operation of combustion plants which is used for the purpose of generating electricity, but does not consider mobile units unless they are connected to an electricity transmission system or distribution system or fulfilling the role of a static generator. These Specified Generators (SG) fall in scope of this Schedule if they have a rated thermal input equal to or greater than 1 megawatt but less than 50 megawatts.

Operators of MCP and SG (MCPSG) that are in scope will require an environmental permit under schedule 25A and 25B of EPR2016, as amended. A permit to operate both is determined by the capacity, emissions and operating hours of the plant.

The Albury Wellsite currently holds a SR2018 No.1 permit for the operation of the existing medium combustion plant. Through discussions with the Environment Agency is has since been identified that the current permit is not suitable to the existing MCPSG due to the NOx emission limit (95mg/m^3) being unachievable for the existing plant. As such, following consultation with the Environment Agency, IGas is now applying for a bespoke permit to facilitate the MCPSG operations, specifically to operate within a NOx limit of 190mg/m^3. The Environment Agency Screening Tool has confirmed that the activity is considered a 'simple bespoke'. The current SR2018 No.1 permit will be surrendered by IGas upon completion of the bespoke permit determination.

4.2 Water Resources Act 1991 (as amended by the Water Act 2003)

Under Section 199 of the Water Resources Act 1991 (as amended by the Water Act 2003), a notice of the intention to construct or extend a boring for the purpose of searching for or extracting minerals must be submitted to the Environment Agency using form WR11. The WR11 requires that a method statement, including drilling and casing designs, together with storage and use of chemicals and drilling muds, accompanies the WR11 application form. No additional wells are currently being planned and therefore it is not foreseeable that the Albury Wellsite will be the subject of a WR11 application at this stage.

5. CRITERIA FOR DETERMINING THE CLASSIFICATION OF WASTE FACILITIES

In addition to the management of extractive waste, the wellsite may require environmental permits that also cover the deposit or accumulation of extractive waste in a waste facility. The definition of a waste facility is based on the wellsite having a designated area for the accumulation or deposit of waste subject to certain timescales, depending on the nature and source of the waste.

Article 3 (15) of the Mining Waste Directive defines a waste facility as:

'*any area designated for the accumulation or deposit of extractive waste whether in a solid or liquid state or in solution or suspension, for the following time periods:*

- *No time-period for Category A waste facilities and waste characterised as hazardous in the waste management plan;*
- *A period of more than six months for facilities for hazardous waste generated unexpectedly;*
- *A period of more than one year for facilities for non-hazardous non-inert waste; and*
- *A period of more than three years for facilities for unpolluted soil, non-hazardous prospecting waste, waste, resulting from extraction, treatment and storage of peat and inert waste.'*

The wellsite will not involve the accumulation or deposit of extractive waste exceeding the timescales specified above. All extractive wastes stored at the wellsite will:

a) Be limited to non-hazardous substances; and
b) Be of a short duration, significantly less than 1 year.

Details of the extractive waste streams are provided within Section 8 of this Waste Management Plan.

5.1 Criteria for Determining a Category A Waste Facility

Where the proposed activities include a waste facility, the Operator is required to include an assessment as to whether the proposed facility will be classified as Category A or not.

Where a mining waste facility is to be considered, a review of the mining waste facility against criteria specified within Annex III of the Mining Waste Directive must be undertaken to determine whether or not the mining waste facility should be classified as a Category A Mining Waste Facility. The criteria for the determination of which is as follows:

a) A failure or incorrect operation e.g. the collapse of a heap or the busting of a dam, could give rise to a major accident, on the basis of a risk assessment taking into account factors such as the present or future size, the location and the environmental impact of the water facility;
b) It contains waste classified as hazardous under Directive 91/689/EEC above a certain threshold: or
c) It contains substances or preparations classified as dangerous under Directives 67/548/EEC or 1999/45/EC above a certain threshold.

Section 5 above provides justification detailing why the operations are not considered a waste facility. The criteria for determining a Category A Waste Facility does not apply to this Waste Management Plan.

6. EXTRACTIVE AND NON EXTRACTIVE WASTE MANAGEMENT

A waste is defined in Article 3(1) of the Mining Waste Directive by reference to Article 3(1) of the Waste Framework Directive 2008/98/EC. The definition is; 'waste' shall mean any substance or object in the categories set out in Annex I which the holder discards or intends or is required to discard. The wastes are defined in Article 3 of the Directive as inert, non-hazardous or hazardous and are as follows:

Hazardous Waste: The Waste Framework Directive (2008/98/EC) (WFD) sets out what waste is and how it should be managed. The WFD defines some wastes to be hazardous waste. A hazardous waste is defined as a waste that has one or more of the fifteen specified hazardous properties listed in Annex III to the WFD. The application of this is determined by the List of Wastes Decision (2000/532/EC).

Non-hazardous Waste: A waste which is neither classed as inert or hazardous.

Inert Waste: Inert Waste is waste which does not undergo any significant physical, chemical or biological transformations. Inert waste will not dissolve, burn or otherwise physically or chemically react, biodegrade or adversely affect other matter with which it comes into contact in a way likely to give rise to environmental pollution or harm human health. The total leachability and pollutant content of the waste and the ecotoxicity of the leachate must be insignificant and in particular not endanger the quality of surface water and/or groundwater.

Whilst the UK has withdrawn from the European Union, the Waste (Circular Economy) (Amendment) Regulations 2020 which transposes (transfers requirements into UK law) six amending EU Directives in the field of waste including Directive 2008/98/EC ("the Waste Framework Directive"). The definitions provided above are still considered applicable.

6.1 Operator Waste Objectives

IGas's policy on waste duty of care, waste segregation, waste handling and waste transfer are set out within the management system documentation.

Persons responsible for the waste management at the wellsite is the Site Supervisor Adviser. They will:

- Promote awareness of the Waste Management Plan;
- Monitor and report on waste generation;
- Monitor and enforce waste segregation;
- Monitor the effectiveness of the Waste Management Plan;
- Form a good working relationship with the waste management contractor; and
- Encourage suggestions for better waste management onsite.

6.2 Waste Prevention and Minimisation

Article 4 of the Waste Framework Directive provides a Waste Hierarchy and is described below in order of priority for waste prevention. An assessment of the potential waste arising from the Albury operations has been undertaken. The potential waste, together with its classification, anticipated quantities, prevention, minimisation, treatment and disposal is provided in Section 7.

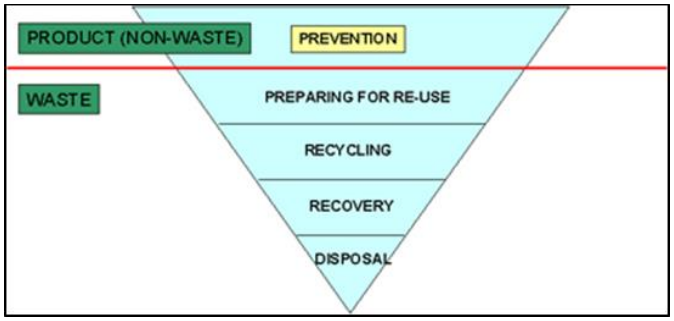

Figure 6.1 Hierarchy of Waste Management

6.2.1 Waste Prevention

Every effort will be made to eliminate the waste produced at source. Control measures will include:

- Calculating quantities of required products;
- Avoiding packaged material where practicable;
- Ordering correct quantities;
- Avoiding damage by handling and storing correctly; and
- Using fewer materials in designs and manufacturing.

6.2.2 Preparing for Re-Use

Only dispose of waste which cannot economically or practically be re-used or recycled. Checking, cleaning, repairing and refurbishing of items and spare parts for subsequent re-use.

6.2.3 Recycle

Waste is to be segregated onsite to allow for recycling offsite. Additionally, materials that are recycled shall be procured for use onsite where practicable and where specification permits. Turning wastes into a substance or product including composting subject to quality protocols.

6.2.4 Other Recovery

Other recovery includes anaerobic digestion, incineration with energy recovery, gasification and pyrolysis which produce energy (fuels, heat and power) and materials from waste.

6.2.5 Disposal

Waste that cannot be reused or recycled practicably shall be disposed of responsibly and in compliance with IGas's duty of care obligations. All waste shall be removed from site by a licensed waste carrier to a licensed waste facility.

6.3 Waste Supervision and Carriers

IGas will undertake the management of waste generated at the wellsite during hydrocarbon production. During operations, the management of waste generated at the wellsite will be delegated to the Wellsite Supervisor, appointed by IGas to exercise overall control of the wellsite operations, in accordance with the Borehole Sites and Operations Regulations 1995 and the Waste (England and Wales) Regulations 2011.

The management of waste onsite will include:

- Management of waste in accordance with the waste hierarchy, as set out in the Waste (England and Wales) Regulations 2011;
- Monitoring of all waste storage units such as skips and storage tanks;
- Liaison with third party waste advisors with respect to sampling and analysis of waste;
- Compiling all waste transfer notes; and
- Managing the collection and offsite disposal of all waste streams.

IGas will appoint competent waste dealers and carriers, responsible for the transportation of all waste streams to the relevant Environment Agency permitted waste treatment facility. Waste dealers and carriers will hold relevant certificates issued by the Environment Agency, which shall be inspected prior to being appointed.

7. WASTE GENERATING ACTIVITIES

The following section describes the various extractive wastes arising from the operations, their classification and anticipated quantities. Non-extractive wastes, which are not subject to environmental permits under the Mining Waste Directive, are listed in Section 8 of this Waste Management Plan.

A summary of the waste generating activities associated with the operations being conducted at the Albury Wellsite is detailed as follows:

- Well Workovers;
- Production; and
- Well Suspension and Abandonment.

This Waste Management Plan, sets out the classification of waste streams associated with the proposed Albury development across all phases of operations included current and proposed. Waste management arrangements for each waste stream are detailed within Section 8 of this Waste Management Plan.

7.1 Intermittent Well Workovers

Throughout the lifetime of oil and gas wells Operators are required to conduct workover operations with the aim of restoring, prolonging or enhancing production. Such workovers include the replacement of production tubing, and well logging. Coil tubing, wireline, snubbing or slickline equipment may all be used at one time or another. Workovers in this context are considered 'mechanical' well maintenance, performed on an as needs basis with no input of chemicals into the well or the formation.

IGas may also perform workovers whereby chemicals are pumped downhole to prevent/remove blockages within the well such as hydrate build up whereby methanol would be used. For clarity, no chemicals shall enter or come into contact with the formation and shall remain strictly within the well casing, isolated from the formation. There are no plans to undertake 'chemical' well maintenance such as acidisation.

The extractive wastes generated during the workover include:

- Well Suspension Brine;

7.2 Production

The extractive wastes generated during both the current and proposed production operations includes:

- Formation Water (with the potential for NORM).

For clarity natural gas is not an extractive waste owed to the fact it is a product purposely sought by IGas and not associated gas to oil.

7.2.1 Current Production Operations

The main activity taking place at the Albury Wellsite is the production of natural gas from the ALB-1 well. The natural gas produced is currently being used to generate electricity for use at the wellsite with surplus being exported to the grid. This production activity shall continue as it is until the necessary equipment has been installed and commissioned to enable hydrogen production.

For clarity, the current MCPSG permit is not suitable for current activities. On the advice from the Environment Agency, IGas are applying for a simple bespoke permit to operate the currently existing MCPSG. The MCPSG is currently being used to provide electricity to the site, enabling it to become independent from the national grid. This activity is already being undertaken currently as it is an existing plant, which falls under the definition of Tranche B however to ensure the activity is regulated under the correct permit full details of the MCPSG and the impact on the environment is being provided.

A Gas Management Plan has been produced providing a more in depth description of the MCPSG.

7.2.2 Proposed Production Operations

IGas will continue to produce natural gas from the ALB-1 well in accordance with environmental permit EPR/EB3100FC. The natural gas, once at surface shall continue to be treated by means of separation from any produced fluids before being the subject of chemical scrubbing, including the removal of sulphur compounds, to ensure the natural gas is in optimum condition prior to being used as a fuel (for either a fuel for MCPSG or feedstock SMR).

IGas is seeking permission to produce hydrogen from the natural gas by using SMR technology, specifically the use of a single BayoTech SMR H2-1000 Generator. A modular unit confined to 3x 40ft container with a production capacity of up to 1,000kg of hydrogen per day, with produced hydrogen being compressed and loaded into dedicated transportation trailers and ready for collection on an as needs basis.

The purpose of the natural gas (methane) is twofold, both energy and feedstock. Within the SMR plant, methane will be separated, with a small fraction being used to generate heat within a furnace to heat water and produce steam. This, along with the remaining volume of methane shall be co-mingled in the presence of catalysts in a series of reactors, where the following chemical reactions take place.

Steam-Methane Reforming Reaction

Methane (CH_4)	+	Steam (H_2O)	+	Heat	=	Carbon Monoxide (CO)	+	Hydrogen ($3H_2$)

Water-Gas Shift Reaction

Carbon Monoxide CO	+	Steam H_2O	=	Carbon Dioxide CO_2	+	Hydrogen H_2	+	Heat

The Gas Management Plan provided in support of the application provides further information on the hydrogen production process.

The hydrogen is then compressed and stored within purpose-built transportation trailers (gas cylinders) pending collection by a dedicated licenced haulier for delivery to the receiving facility.

This technology, which has been in use since the 1920's, has recently been developed further to facilitate hydrogen production on a much smaller scale, enabling Operators, like IGas, to convert natural gas to hydrogen at the wellsite; rather than in largescale, centralised, facilities, e.g. refineries. This offers the potential to provide it much closer to the point of use, for either public vehicles, HGVs, or mass-transport vehicles, or for availability to the open market, providing the opportunity to reduce CO_2 emissions and the production of combustion by-products (particulates and Nitrogen/Sulphur Oxides) through the displacement of diesel fuels, and so contributing to the UK's target of achieving carbon neutral status by 2050.

7.2.2.1 How SMR Hydrogen Production May Reduce Net CO_2

Whilst the production of hydrogen from the SMR process will increase the localised production of carbon dioxide within the site boundary, it is necessary to consider the use of the produced hydrogen. The hydrogen fuel will be used to replace conventional use of hydrocarbon fuels (such as natural gas and petroleum), thereby offsetting emissions produced by the SMR process.

It is anticipated that the emissions would likely be used to fuel HDVs, particularly buses. In 2019 GHG emissions from surface transport accounted for 22% of the UK's total emissions, which has been typical since the 1990s. A breakdown of the 2019 emissions are presented in Figure 7.1. This shows that buses currently account for approximately 3% (3 Mt CO_2-eq)) of all UK emissions, which are predominantly in the form of CO_2 from diesel combustion.

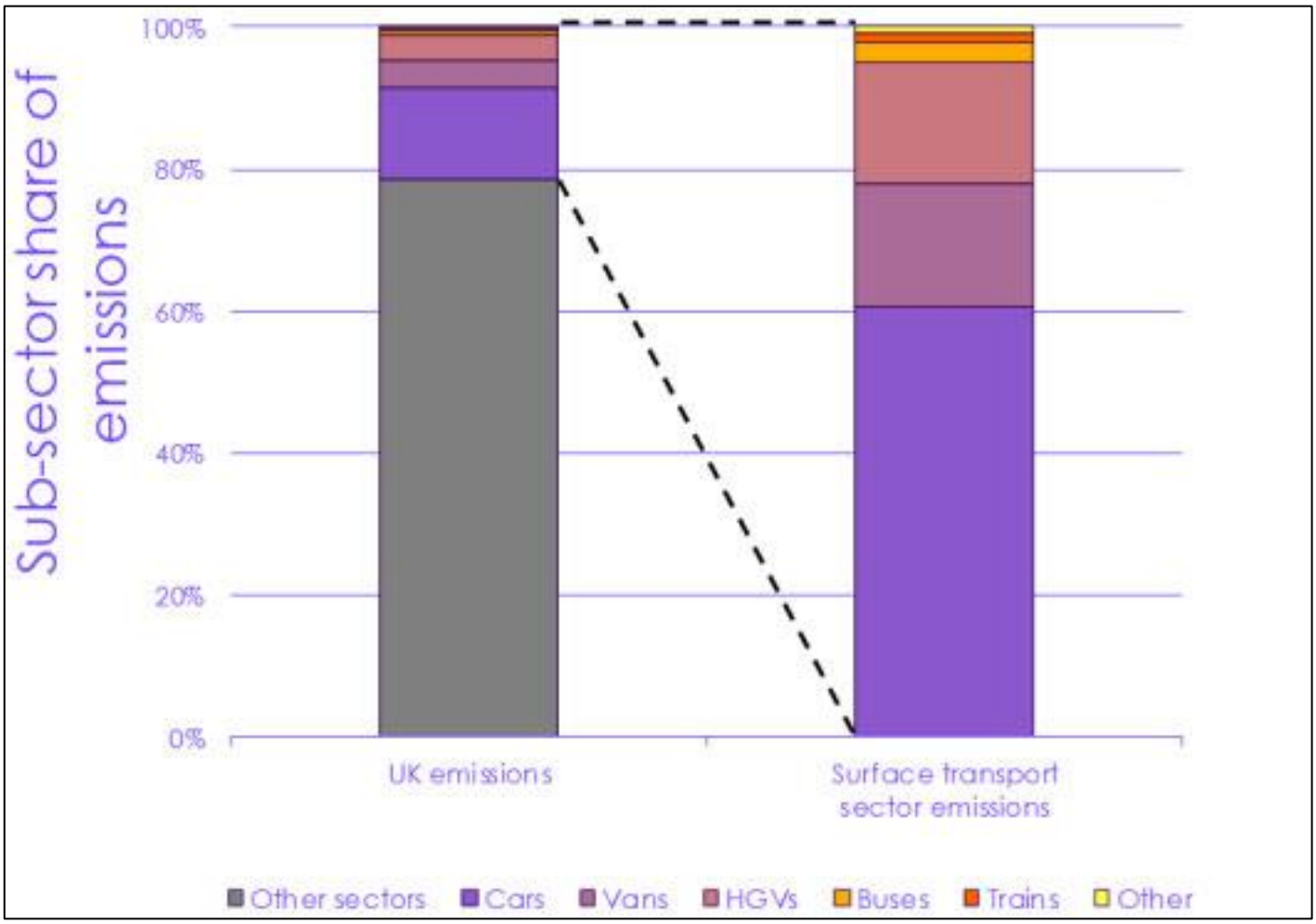

Figure 7.1: Breakdown of Surface Transport Emissions (2019)
(Source: BIES(2020) Provisional UK greenhouse gas emissions national statistics 2019; CCC analysis.)

Battery-electric busses are already being deployed, often due to local authority efforts to reduce air pollution. However hydrogen offers the closest user experience to current diesel operations. Given sufficient hydrogen refuelling infrastructure, fleet operators would be able to fill up vehicles either in-depot or from filling station on-route as currently, or both. Hydrogen is also a particularly attractive solution for vehicles requiring longer independent range. The sixth carbon budget methodology report explains that hydrogen uptake could be relatively quick, reaching 77% of larger HGV's by 2035 and 99% by 2040 (CCC,2021). London currently has eight hydrogen buses operating, and UK manufacturer Wrightbus recently announced plans to manufacture 3,000 hydrogen buses. Hydrogen bus sales couple increase relatively quickly, potentially reaching up to 69% of all sales by 2030 and 95% by 2035 (CCC,2021).

The production of hydrogen fuel is therefore highly important to enable the Government to progress with their plans to achieve the sixth carbon budget and their path to Net Zero. It is thus considered that taking account of how the hydrogen produced from the proposed development will be used is an integral part of assessing the overall impact of the development.

The likely greenhouse gas emission savings from using the hydrogen produced as a fuel have been determined by comparing it with diesel fuelled buses and other low carbon alternatives. The comparison is set out in Table 7.1 below.

Fuel[a]	Emissions Rate (gCO_2eq/km)[b]	Annual Journey Length (km)[c]	Tonnes CO_2eq per year	Tonnes CO_2eq Sixth Carbon Budget	Lifetime Mt CO_2eq
Hydrogen	-	2,433,333	0.00	0.00	0.00
Diesel	1,138.02	2,433,333	2,769.17	13,845.86	0.17
B100 Biodiesel	899.57	2,433,333	2,188.96	10,944.79	0.13
Compressed Natural Gas	0.005	2,433,333	0.01	0.06	<0.01
Biomethane	0.005	2,433,333	0.01	0.06	<0.01
Biogas	0.005	2,433,333	0.01	0.06	<0.01
Hybrid	711.34	2,433,333	1,730.93	8,654.64	0.10
Fuel Cell Electric Vehicle	-	2,433,333	0.00	0.00	0.00

Table Notes:

a. Emissions account only for those released from buses, not the production or transport of fuel.

b. Emission rate calculated using DEFRA's EFT for a single bus travelling at 20kph.

c. The consumption of hydrogen per bus is 9-10 kg/100km for a 18m articulated bus (NewBusFuel,2017). Since the SMR will produce 1,000kg of hydrogen per day (365,000 per year), it is estimated that buses could travel at least 2,433,333km per year using the hydrogen produced from the Proposed Development.

Table 7.1 Comparison of bus GHG emissions for different fuels (Source: APS - Greenhouse Gas Assessment: Albury Park (2021)

This demonstrates that the hydrogen produced from the proposed Albury development may lead to a reduction of up to ~2,769 tonnes CO_2-eq per year and ~13,846 CO_2-eq within the sixth carbon budget.

Putting this into context of what emissions would need to be offset, the Proposed Development is estimated to exceed the 1% criteria at a local scale during the sixth carbon budget by 3.36 tonnes CO_2-eq. This is significantly smaller than the conventional emissions from diesel, biodiesel and hybrid buses.

Overall, the Proposed Development is expected to lead to a reduction of at least 0.1 Mt CO2-eq over the lifetime of the site. Taking account of this saving, the Proposed Development will have net positive effect and is considered not significant.

7.2.3 Production Maintenance

During the lifetime of the proposed production operations plant and equipment (including MCPSG and SMR Plant) will be the subject of planned maintenance to ensure that they continue to operate at optimum efficiency and reduce the likelihood of breakdowns. As a result, there will be a period where the natural gas produced from the well will be the subject of either export via pipeline or, should exportation be unavailable or not viable, will be cut off and the well shut in until it the plant is ready to be used again. In either scenario no waste will be generated.

7.2.4 Emergency Scenarios

In the event of an emergency the well will be shut in with any residual gas at surface used up by either the MCPSG, SMR plant or via exportation. No venting or incineration will be required.

7.3 Well Abandonment and Partial Well Abandonment

Following the completion of the workover and subsequent production operations the well will undergo a period of suspension to allow IGas to analyse and interpret the data acquired during the production operations.

In the event that the borehole is not successful in establishing commercially producible hydrocarbons, the borehole may be abandoned in accordance with Oil & Gas UK Guidelines for the abandonment of wells, which requires all distinct permeable zones penetrated by the borehole to be isolated from each other and from surface by a minimum of one permanent barrier. If any permeable zone penetrated by the borehole is hydrocarbon-bearing or over-pressured and water-bearing then the requirement is for two permanent barriers from surface, the second barrier being a back-up to the first.

In addition to the Oil & Gas UK Guidelines for the abandonment of wells, the borehole abandonment will be undertaken in accordance with the following regulations:

- The Borehole Sites and Operations Regulations 1995; and
- Offshore Installations and Wells (Design & Construction) Regulations 1996

The initial design and construction of the borehole takes into consideration the permeable zones encountered during the drilling operation and whether any of these zones are hydrocarbon-bearing or over-pressured and water-bearing. Construction of the boreholes will therefore provide adequate sealing of these zones when cementing in the various steel casing strings, ensuring compliance with the Oil & Gas UK guidance.

Based on a borehole construction, which complies with Oil & Gas UK guidance, the internal section of last cemented casing string will be subject to borehole abandonment. The operation involves the setting of cement barriers, extended above and below the permeable zone(s). Retainers are positioned within the internal casing string immediately below the required cement depth, which prevents the cement from moving or slumping during setting.

Once the borehole is abandoned, the casing strings will be mechanically cut off at 1.5m below original ground level, the top 2m filled with cement and a steel plate welded over the top. The pre-cast concrete drilling cellar would then be removed and the site restored to its former use.

8. WASTE DESCRIPTION AND MANAGEMENT ARRANGEMENTS

An assessment of the potential extractive waste arising from the operations has been undertaken. The potential waste, together with its classification, anticipated quantities, prevention, minimisation, treatment and disposal is provided within this section.

- Table 8.1 - Well Suspension Brine;
- Table 8.2 - Paraffin Waxes (Low Volume); and
- Table 8.3 - Formation Water (Low Volume);

Well Suspension Brine		
Waste Classification, Quantity and Storage	**Classification**	Non Hazardous
	EWC Code	01 05 08
	Estimated Quantity	32m^3
	Onsite Storage	1 x 60m^3 Horizontal Cylindrical Bunded Closed Tank
	Storage Duration	Maximum 7 Days
	Odour Potential	No Odour Anticipated
Operation / Activity	The ALB-1 well may be the subject of a of a period of suspension. Following suspension, any further operations will require the suspension brine to be circulated out of the well to an onsite storage tank via surface pipework.	
Waste Prevention and Minimisation	The suspension brine will be stored onsite for subsequent reuse if required for the well at a later date if the well will need to be suspended again. The suspension brine can also be used at another site used by IGas for the same purpose.	
Waste Treatment and Disposal	Once the suspension fluid has fully served its purpose at the wellsite, the suspension brine will be removed from site via a licenced haulier to an Environment Agency permitted waste water treatment works facility where it is processed, treated and discharged in accordance with the permitted controls of the water treatment facility.	
Waste Remaining in the Formation	None. Suspension brine is circulated out prior to workovers commencing. Following operations, it will be circulated back down the well if the well is subject to further suspension however it is not considered a waste due to serving the purpose of suspending the well.	
Monitoring	An inspection of the fluid tanks that contain the suspension fluid shall be carried out prior to being used and will be subject to regular visual inspections and annual thickness checks.	

Table 8.1: Well Suspension Brine

Paraffin Waxes		
Waste Classification, Quantity and Storage	**Classification**	Non-Hazardous
	EWC Code	16 03 06
	Estimated Quantity	<50kg
	Onsite Storage	Enclosed Units
	Storage Duration	Maximum 7 Days
	Odour Potential	Refer to Odour Management Plan
Operation / Activity	An assembly will be run into the borehole and will scrape and remove any paraffin from the well casing to surface.	
Waste Prevention and Minimisation	The prevention and minimisation of paraffin waxes is extremely limited due to forming naturally within the casing.	
Waste Treatment and Disposal	The paraffin waxes will be collected onsite and transported via a licenced haulier to an Environment Agency permitted waste treatment facility where it is processed, treated and discharged in accordance with the permitted controls of the treatment facility.	
Waste Remaining in the Formation	None.	
Monitoring	Units will be inspected prior to use to ensure that they are suitable for holding from the casing and subject to weekly inspections.	

Table 8.2: Paraffin Waxes

Formation Water		
Waste Classification, Quantity and Storage	**Classification**	Non-Hazardous
	EWC Code	01 01 02
	Estimated Quantity	Not expected – Waste stream included as a precaution
	Onsite Storage	1 x 30m^3 Horizontal Cylindrical Bunded Closed Tank
	Storage Duration	Up to 3 Months to Allow for Radionuclide Analysis
	Odour Potential	Refer to Odour Management Plan
Operation / Activity	There is a very low possibility of formation water being produced together with gas. Formation water is separated from the gas on surface using temporary fluid separation equipment and transferred via pipework to storage tanks located onsite for offsite removal. Formation water has the potential to contain low levels of Naturally Occurring Radioactive Material (NORM).	
Waste Prevention and Minimisation	The ability to prevent or minimise recovery of formation water is extremely limited. No consideration has been given at this stage for reinjection of produced formation water due to the low volumes. Formation water cannot be reused onsite due to unknown components within the formation water and high salinity. Therefore, formation water is considered a waste, and will be tested at a laboratory and its components determined should it arise.	
Waste Treatment and Disposal	Depending on the outcome of radionuclide analysis formation water will be transported via a licenced haulier to either an Environment Agency permitted waste water treatment works facility where it is processed, treated and discharged in accordance with the permitted controls of the water treatment facility, or to a bespoke RSR permitted waste treatment facility for treatment and disposal in accordance with the Best Available Technique (BAT).	
Waste Remaining in the Formation	None. Formation water naturally occurs within certain hydrocarbon bearing formations and is only considered as a waste when produced from the well.	
Monitoring	IGas have an appointed a Radioactive Waste Advisor who will advise on the correct and appropriate monitoring arrangements.	

Table 8.3: Formation Water

8.1.1 Non-Extractive Waste

During the Albury workover and subsequent production operations there will be non-extractive wastes generated onsite, including:

- Surface run-off water;
- Waste water and sewage;
- Waste engine, gear and lubricating oils;
- Waste hydraulic oils;
- Oil rags and absorbents;
- Waste oil filters;
- Paper and cardboard;
- Canteen waste;
- Cement
- Wood; and
- Metal.

There will be no treatment or disposal of non-extractive waste onsite and any storage will be limited to temporary storage, pending collection. No temporary storage of non-extractive waste will exceed 12 months.

9. ENVIRONMENTAL AND HUMAN IMPACT

The Albury Wellsite was designed and constructed with consideration for both environmental and human impacts. Permitted activities, will take place within the wellsite only.

The site has been constructed so to provide complete containment of any spillages in the unlikely event they occur onsite. An enclosed containment ditch has been excavated and installed around the perimeter of the active area of the wellsite. Following the excavation of the perimeter ditch, the wellsite was overlaid with an impermeable membrane to provide wellsite integrity and ensure that any surface run off liquids, either rain water or spillages, flow to the perimeter ditch for subsequent removal via road tanker and disposed at an Environment Agency licenced waste facility. The membrane is protected by geotextile placed above and below the membrane to ensure that damage is not incurred and integrity is maintained.

An Environmental Risk Assessment has been prepared in support of the Environmental Permit application and the undertaking of the Albury workover and subsequent production operations. The Environmental Risk Assessment has been undertaken in accordance with Environment Agency guidance.

This qualitative risk assessment has considered odour, noise, fugitive emissions, dust, air emissions, releases to water environment, waste, global warming potential, and potential for accidents and incidents as these relate directly to the activities.

The assessment concluded that with the implementation of appropriate risk management measures, potential hazards from the activities are likely to not be insignificant, this is largely due to the fact the Albury Wellsite is located within a rural area with few receptors, the site has been designed and constructed with the aim of containing spillages, and the operations are of a short duration. The Albury permit application will not include a mining waste facility.

Measures to minimise the environmental and human impact of the operations have been incorporated as part of the initial site selection process, site design and construction. The measures to mitigate long term environmental impact are:

- Site located suitable distance from residential properties;
- Site design to include impermeable membrane and containment ditches;
- Wellbore lifecycle designed to protect groundwater;
- Hierarchy of waste management;
- Operating procedures and inductions;
- Waste handling, storage and disposal regime;
- Continuous training and development;
- Restoration and aftercare.

10. CONTROL AND MONITORING OF WASTE AND EMISSIONS

The environmental risk assessment has identified the requirement to control and monitor waste generated from the Albury operations. A brief description of the control and monitoring of waste is provided below.

10.1 Baseline Monitoring

No baseline monitoring has been undertaken at the Albury Wellsite. A scheme of monitoring will be created by IGas and agreed with the Environment Agency prior to the operations taking place to ensure that an accurate representation of environmental conditions have been recorded and can be benchmarked against future monitoring results during operations. Baseline monitoring will include air quality with the results being submitted to the environment agency in accordance with the requirement of the environmental permit.

10.2 Releases to Groundwater

The potential for a release to groundwater exists both at surface and within the subsurface and has been assessed within the Environmental Risk Assessment (IGAS-EPR-ALB-ERA-007), submitted together with this Waste Management Plan in support of the Albury permit application. As no groundwater activities are taking place and there are no groundwater boreholes at the Albury Wellsite, a scheme of groundwater monitoring has not been proposed at this time.

10.2.1 Surface Release

Incorporated into the design of the Albury Wellsite is an impermeable membrane. The impermeable membrane prevents surface fluids (mainly rainwater) from penetrating the underlying subsoils. Surface fluids migrate along the surface of the impermeable membrane to a perimeter ditch, where it is contained. Fluids at surface will be limited to small volumes of formation water. Well suspension brine may be held at site periodically.

10.2.2 Subsurface Release

Subsurface releases are mitigated by adopting the best practice approach to wellsite construction, and well construction.

10.3 Releases to Air

In the event of any unexpected release of natural gas the Environment Agency will be notified in accordance with the permit requirements. Details of the quantities of any gas releases will be recorded by the operator along with the measures taken to manage them and made available to the Environment Agency on request.

10.4 Odour and Noise

The extractive wastes that will be generated are not anticipated to be malodorous and nor are any of the associated processes that will be performed. Measures will be taken to minimise all fugitive emissions which may cause odours. An Odour Management Plan will be prepared for the site and will be implemented should odour be apparent. Noise will be managed in accordance with any planning conditions set by the Planning Authority.

10.5 Waste Management

The quantity of each waste will be recorded as it is removed from site. All records of waste movements (extractive and non-extractive wastes) will be retained by the operator and made available for inspection by the Environment Agency on request.

10.6 Contractor Performance

IGas is ultimately responsible for any waste generated onsite during the operations. IGas will not delegate its responsibilities or accountabilities as Operator to a contractor.

Contractors, who are involved in the generating of waste and subsequent reuse, recycle or disposal will first have been selected in accordance with the IGas Environmental Management System.

10.7 Security

Security of the wellsite is provided in the form of a security fence and lockable access gates. The positioning of, both permanent and temporary equipment will be within the confines of the security fence.

10.8 Complaints

In the event that a complaint is received from stakeholders, including neighbours, the complaint shall be recorded and investigated in accordance with IGas's Management systems.

Complaints relating to the environment will be reported to the Environment Agency within the required timescales, as determined by the severity and environmental impact of the incident initiating the complaint and/or permit conditions. In some cases, permit conditions will require notification the Environment Agency within 24 hours or without delay for a potentially polluting incident.

Following notification, measures to prevent reoccurrence will be agreed with the Environment Agency, together with a programme for implementation. Implementation of the actions will be monitored and the Environment Agency informed.

11. ENVIRONMENTAL INCIDENT MANAGEMENT

The potential for an environmental incident to occur during operations is minimal. The source of such incident is contained within the wellbore and contained within the wellsite.

11.1 Containment within the Wellbore

Pressure control equipment is deployed on the well in accordance with the relevant American Petroleum Institute (API) Recommended Practices (RP) and/or applicable British Standard (BS).

During short duration well operations, well control equipment and/or pressure control equipment will be deployed on the well in accordance with the relevant American Petroleum Institute (API) Recommended Practices (RP) and/or applicable British Standard (BS).

Well control equipment and/or pressure control equipment is subject to a schedule of certification and testing, together with a requirement for those operating well control equipment to be certified competent.

11.2 Wellsite Containment

Incorporated into the design of the Albury Wellsite is an impermeable membrane. The impermeable membrane prevents surface fluids (mainly rainwater) from penetrating the underlying subsoils. Surface fluids migrate along the surface of the impermeable membrane to a perimeter ditch, where it is contained.

In addition, general spill containment and clean up equipment is provided onsite. In the very unlikely event of an environmental incident occurring beyond the capabilities of the equipment or personnel onsite then a specialist contractor, will be called to assist IGas in dealing with the incident.

11.3 Fire Response

Whilst a fire is associated more so with the health and safety of the personnel onsite, a fire does have the potential to lead to an environmental incident. It is imperative, therefore, that any potential for a fire and subsequent emergency response is identified and included in the operational planning. The Site Safety Document, which is a requirement under Regulation 7 of the Boreholes Sites and Operations Regulations 1995, specifies the arrangements for identification and mitigation in the event of a fire, including consultation with the local Fire & Rescue Service.

Containment of any firefighting fluid is provided by the impermeable membrane incorporated in to the design of the wellsite. In the event that such requirements were to be necessary, continued monitoring of the containment ditch shall be implemented to ensure it does not exceed its containment capacity.

Additional water is available onsite and should be used to keep the areas adjacent to the fire cool to avoid any damage being sustained to the impermeable membrane.

11.4 Incident Reporting and Investigation

All incidents, no matter how minor, are reported in accordance with IGas's management systems. The procedures therein provide for the investigation of all incidents to ensure lessons are captured and actions implemented to avoid reoccurrence.

In addition, the procedure provides for the notification to the relevant Regulatory Authority in the event of an incident which extends beyond the containment of the wellsite.

Environmental incidents will be reported to the Environment Agency within the required timescales, as determined by the severity and environmental impact of the incident and/or permit conditions. In some cases, permit conditions will require notification to the Environment Agency within 24 hours or without delay for a potentially polluting incident.

Following notification, measures to prevent reoccurrence will be agreed with the Environment Agency, together with a programme for implementation. Implementation of the actions will be monitored and the Environment Agency informed.