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Indaver Ireland Limited

IE Licence Review Application

Assessment of Compliance with Conclusions on Best Available techniques from the BAT Conclusions for the Production of Chlor-alkali (2013)

Reference: LA010332

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1. Introduction

This report has been prepared for the purposes of Section 4.7 of an Industrial Emissions Licence (IE) Review application submitted by Indaver Ireland for their site at Carranstown, Duleek, County Meath. This report, which applies to IE Licence W0167-03, consists of a review of the licensed activities on site and the proposed activities to which the licence review relates in the context of any applicable Best Available Techniques (BAT).

The Industrial Emissions Directive 2010/75/EU (IED) and the European Union (Industrial Emissions) Regulations 2013 (SI 138 of 2013) define BAT, BAT Reference Document (BREF) and BAT Conclusions (BATC) as follows;

The Industrial Emissions Directive defines Best Available Techniques as follows: 'best available techniques' means the most effective and advanced stage in the development of activities and their methods of operation which indicates the practical suitability of particular techniques for providing the basis for emission limit values and other permit conditions designed to prevent and, where that is not practicable, to reduce emissions and the impact on the environment as a whole: a) 'techniques' includes both the technology used and the way in which the installation is designed, built, maintained, operated and decommissioned; b) 'Available techniques' means those developed on a scale which allows implementation in the relevant industrial sector, under economically and technically viable conditions, taking into consideration the costs and advantages, whether or not the techniques are used or produced inside the Member State in question, as long as they are reasonably accessible to the operator; **c)** 'best' means most effective in achieving a high general level of protection of the environment as a whole;
The Industrial Emissions Directive definition of BAT Reference Document is as follows: "(11) 'BAT reference document' means a document, resulting from the exchange of information organised pursuant to Article 13, drawn up for defined activities and describing, in particular, applied techniques, present emissions and consumption levels, techniques considered for the determination of best available techniques as well as BAT conclusions and any emerging techniques, giving special consideration to the criteria listed in Annex III;" SI 138 of 2013 has a similar definition.
The Industrial Emissions Directive and SI 138 of 2013 have the same definition of BAT conclusions, as follows: 'BAT conclusions' means a document containing the parts of a BAT reference document laying down the conclusions on best available techniques, their description, information to assess their applicability, the emission levels associated with the best available techniques, associated monitoring, associated consumption levels and, where appropriate, relevant site remediation measures;

The Industrial Emissions Directive 2010/75/EU replaced seven existing directives including the Integrated Pollution Prevention and Control (IPPC) Directive (2008/1/EC).

- Historically, the BREF process for the IPPC Directive produced guidance documents that member states had to have regard to when permitting (licensing) installations.
- However, the IED has made BAT conclusions mandatory in the permitting process (Article 14(3) of the IED).

Where BAT conclusions are available for any new installations, they are expected to achieve the associated standard before commencement of operations.

For existing installations, the IED provides that where a Commission Implementing Decision on BAT conclusions is published, within four years (relating to the main activity of the installation), the Environmental Protection Agency (EPA) should undertake that 'all permit/licence conditions for the installation concerned are reconsidered, where necessary updated' and 'ensure compliance with the BAT'.

The European IPPC Bureau (EIPPCB) organises and co-ordinates the exchange of information between Member States and the industries concerned on Best Available Techniques (BAT), as set forth in Article 13 of the IED. The EIPPCB produces BAT reference documents (BREF) and BAT conclusions.

2. Activity

As per W0167-03 the facility is currently licensed to carry out the following activities as outlined in the First Schedule of the Environmental Protection Agency (EPA) Act 1992, as amended:

11.3: Disposal or recovery of waste in waste incineration plants or in waste co-incineration plants –

(a) for non-hazardous waste with a capacity exceeding 3 tonnes per hour,

(b) for hazardous wate with a capacity exceeding 10 tonnes per day.

Following implementation of the proposed development, which includes an increase in the amount of waste being accepted at the facility and the construction of a hydrogen generation unit, two new activities as outlined in the First Schedule of the EPA Act 1992, as amended, will be carried out:

5.13 (a) The production of inorganic chemicals, such as gases, such as ammonia, chlorine or hydrogen chloride, fluorine, or hydrogen fluoride, carbon oxides, sulphur compounds, nitrogen oxides, hydrogen, sulphur dioxide, carbonyl chloride (production means the production on an industrial scale by chemical or biological processing);

11.6 Temporary storage of hazardous waste, (other than waste referred to in paragraph 11.5) pending any of the activities referred to in paragraph 11.2, 11.3, 11.5 or 11.7 with a total capacity exceeding 50 tonnes, other than temporary storage, pending collection, on the site where the waste is generated.

3. BAT/BREF Assessments

A review of the European Commission Integrated Pollution Prevention and Control *Conclusions on Best Available techniques from the BAT Conclusions for the Production of Chlor-alkali (2013)* is presented in the table below.

Table 1 - Review of European Commission Integrated Pollution Prevention and Control Conclusions on Best Available techniques from the BAT Conclusions for the Production of Chlor-alkali (2013)

Best Available Techniques (BAT)		Applicability Assessment (describe how the technique applies or not to your installation)	State whether it is in place or state schedule for implementation
Cell technique			
BAT 1	BAT for the production of chlor-alkali is to use one or a combination of the techniques given below. The mercury cell technique cannot be considered BAT under any circumstances. The use of asbestos diaphragms is not BAT. a) Bipolar membrane cell technique. b) Monopolar membrane cell technique. c) Asbestos-free diaphragm cell technique.	Applicable. a) N/A b) N/A c) Applicable	Will be in place. The proposed development will include the installation and operation of a Hydrogen generation unit (HGU). The process that will be employed is alkaline water electrolysis which uses water as the feedstock in the presence of an alkaline solution (Potassium Hydroxide or KOH) to generate hydrogen and oxygen, electrical current will be supplied to two electrodes which are submerged in an alkaline – water solution producing hydrogen at the cathode and oxygen at the anode. The oxygen and hydrogen sides of the cell will be separated by an asbestos-free diaphragm
Decommissioning or conversion of mercury cell plants			
BAT 2	In order to reduce emissions of mercury and to reduce the generation of waste contaminated with mercury during the decommissioning or conversion of mercury cell plants, BAT is to elaborate and implement a decommissioning plan that incorporates all of the following features (listed in the BATC Document):	Not Applicable The proposed process is not a mercury cell plant.	N/A
BAT 3	In order to reduce emissions of mercury to water during the decommissioning or conversion of mercury cell plants, BAT is to use one or a combination of the techniques given below. a) Oxidation and ion exchange. b) Oxidation and precipitation. c) Reduction and adsorption on activated carbon.	Not Applicable The proposed process is not a mercury cell plant.	N/A
Generation of wastewater			

Best Available Techniques (BAT)		Applicability Assessment (describe how the technique applies or not to your installation)	State whether it is in place or state schedule for implementation
BAT 4	In order to reduce the generation of wastewater, BAT is to use a combination of the techniques given below. a) Brine recirculation. b) Recycling of other process streams. c) Recycling of salt-containing wastewater from other production processes. d) Use of wastewater for solution mining. e) Concentration of brine filtration sludges. f) Nanofiltration. g) Techniques to reduce chlorate emissions.	Applicable d) N/A e) Applicable f) N/A g) N/A h) N/A i) N/A j) N/A The process employed in the HGU will be alkaline water electrolysis which uses water as the feedstock in the presence of an alkaline solution (Potassium Hydroxide (KOH)) to generate hydrogen and oxygen. There will be no brine or salt-containing solutions involved in the process.	Will be in place. The gas from each cell will be fed into the gas/electrolyte separators at the front of the electrolyser. The oxygen separator will discharge the oxygen to atmosphere through a small vent stack and the hydrogen separator will send the hydrogen to the water scrubber. The electrolyte from both separators is then recycled back into the distribution channels in the bottom of the electrolyser unit. The HGU compressor will be fitted with a gas recycle loop which returns some of the hydrogen from the compressor outlet back to the inlet side of the compressor. The hydrogen gas recycle volume will be automatically adjusted by a control valve in the gas recycle loop. The proposed HGU will generate Hydrogen at a purity of up to 99.99% and any residual oxygen or water is reduced to an absolute minimum.
Energy Efficiency			
BAT 5	In order to use energy efficiently in the electrolysis process, BAT is to use a combination of the techniques given below. a) High-performance membranes. b) Asbestos-free diaphragms. c) High-performance electrodes and coatings. d) High-purity brine.	Applicable a) N/A b) Applicable c) Applicable d) N/A	Will be in place. The proposed HGU will involve two electrodes which are submerged in an alkaline – water solution producing hydrogen at the cathode and oxygen at the anode. The oxygen and hydrogen sides of the cell will be separated by an asbestos-free diaphragm. High-performance electrodes and coatings will be used in the beginning and throughout the maintenance of the plant.
BAT 6	In order to use energy efficiently, BAT is to maximise the use of the co-produced hydrogen from the electrolysis as a chemical reagent or fuel.	Applicable	Will be in place The hydrogen generated in the proposed HGU will either be fed into the natural gas grid, or stored on site for fuelling trucks, buses and other vehicles that have been either designed or retrofitted to run on hydrogen fuel cells. Hydrogen may also be tankered off-site for

Best Available Techniques (BAT)		Applicability Assessment (describe how the technique applies or not to your installation)	State whether it is in place or state schedule for implementation
			industrial use or to fuel distribution centres. When used as a fuel, hydrogen combusts to produce water vapour and hence is a clean fuel
Monitoring of Emissions			
BAT 7	BAT is to monitor emissions to air and water by using monitoring techniques in accordance with EN standards with at least the minimum frequency (as listed in the BATC document). If EN standards are not available, BAT is to use ISO, national or other international standards that ensure the provision of data of an equivalent scientific quality.	Not Applicable. There will be no emissions to air (other than oxygen) and water from the proposed hydrogen generation process.	N/A
Emissions to Air			
BAT 8	In order to reduce channelled emissions of chlorine and chlorine dioxide to air from the processing of chlorine, BAT is to design, maintain and operate a chlorine absorption unit that incorporates an appropriate combination of the following features: • absorption unit based on packed columns and/or ejectors with an alkaline solution (e.g., sodium hydroxide solution) as scrubbing liquid; • hydrogen peroxide dosing equipment or a separate wet scrubber with hydrogen peroxide if necessary to reduce chlorine dioxide concentrations; • size suitable for the worst case scenario (derived from a risk assessment), in terms of produced chlorine quantity and flowrate (absorption of the full cell room production for a sufficient duration until the plant is shut down); • size of the scrubbing liquid supply and storage capacity suitable to ensure an excess at all times; • in the case of packed columns, their size should be suitable to prevent flooding at all times; • prevention of ingress of liquid chlorine into the absorption unit; • prevention of backflow of scrubbing liquid into the chlorine system;	Not Applicable There will be no emissions of chlorine and chlorine dioxide to air from the proposed development.	N/A

Best Available Techniques (BAT)		Applicability Assessment (describe how the technique applies or not to your installation)	State whether it is in place or state schedule for implementation
	• prevention of solids precipitation in the absorption unit; • use of heat exchangers to limit the temperature in the absorption unit below 55 °C at all times; • supply of dilution air after chlorine absorption to prevent the formation of explosive gas mixtures; • use of construction materials which withstand the extremely corrosive conditions at all times; • use of backup equipment, such as an additional scrubber in series with the one in operation, an emergency tank with scrubbing liquid feeding the scrubber by gravity, stand-by and spare fans, stand-by and spare pumps; • provision of an independent backup system for critical electrical equipment; • provision of an automatic switch to the backup system in case of emergencies, including periodic tests on this system and the switch; • provision of a monitoring and alarm system for the following parameters: • chlorine in the outlet of the absorption unit and the surrounding area; • temperature of the scrubbing liquids • reduction potential and alkalinity of the scrubbing liquids; • suction pressure; • flowrate of scrubbing liquids.		
BAT 9	The use of carbon tetrachloride for the elimination of nitrogen trichloride or the recovery of chlorine from tail gas is not BAT.	Not Applicable	N/A
BAT 10	The use of refrigerants with a high global warming potential, and in any case higher than 150 (e.g., many hydrofluorocarbons (HFCs), in new chlorine liquefaction units cannot be considered BAT.	Not applicable Their proposed development does not include any chlorine liquefaction units and there will be no use of refrigerants with a high global warming potential	N/A
Emissions to Water			

Best Available Techniques (BAT)		Applicability Assessment (describe how the technique applies or not to your installation)	State whether it is in place or state schedule for implementation
BAT 11	In order to reduce emissions of pollutants to water, BAT is to use an appropriate combination of the techniques given below. a) Process-integrated techniques. b) Wastewater treatment at source. c) Wastewater pre-treatment. d) Final wastewater treatment.	Applicable a) Applicable b) N/A c) N/A d) N/A	Will be in place. A number of process integrated techniques involved in the proposed hydrogen generation process will ensure that there are no emissions of pollutants to water associated with the process. These include water purification, a scrubber unit for the efficient removal of residual KOH droplets from the hydrogen gas to protect downstream equipment from alkali deposits and corrosion, Gas recycling loops in the compressor and electrolyte separators, and a final polishing de-oxidiser and drying step to reduce any residual oxygen or water is reduced to an absolute minimum.
BAT 12	In order to reduce emissions of chloride to water from the chlor-alkali plant, BAT is to use a combination of the techniques given in BAT 4.	Not Applicable. The proposed hydrogen production process will not involve any emissions of chloride to water.	N/A
BAT 13	In order to reduce emissions of free chlorine to water from the chlor-alkali plant, BAT is to treat wastewater streams containing free chlorine as close as possible to the source, to prevent stripping of chlorine and/or the formation of halogenated organic compounds, by using one or a combination of the techniques given below. a) Chemical reduction. b) Catalytic decomposition. c) Thermal decomposition. d) Acidic decomposition. e) Wastewater recycling.	Not Applicable. The proposed hydrogen production process will not involve any emissions of free chlorine to water	N/A
BAT 14	In order to reduce emissions of chlorate to water from the chlor-alkali plant, BAT is to use one or a combination of the techniques given below. a) High-performance membranes. b) High-performance coatings. c) High-purity brine. d) Brine acidification. e) Acidic reduction.	Not Applicable. The proposed hydrogen production process will not involve any emissions to water.	N/A

Best Available Techniques (BAT)		Applicability Assessment (describe how the technique applies or not to your installation)	State whether it is in place or state schedule for implementation
	f) Catalytic reduction. g) Use of wastewater streams containing chlorate in other production units.		
BAT 15	In order to reduce emissions of halogenated organic compounds to water from the chlor-alkali plant, BAT is to use a combination of the techniques given below. a) Selection and control of salt and ancillary materials. b) Water purification. c) Selection and control of equipment.	Not Applicable. The proposed hydrogen production process will not involve any emissions of halogenated organic compounds to water.	N/A
Generation of Waste			
BAT 16	In order to reduce the quantity of spent sulphuric acid sent for disposal, BAT is to use one or a combination of the techniques given below. The neutralisation of spent sulphuric acid from chlorine drying with virgin reagents is not BAT. a) Use on site or off site. b) Reconcentration.	Not Applicable. The proposed hydrogen production process will not involve any quantity of spent sulphuric acid to be sent for disposal.	N/A
Site remediation			
BAT 17	In order to reduce contamination of soil, groundwater and air, as well as to halt pollutant dispersion and transfer to biota from contaminated chlor-alkali sites, BAT is to devise and implement, a site remediation plan that incorporates all of the following features. i. implementation of emergency techniques to cut off the exposure pathways and the expansion of the contamination; ii. desk study to identify the origin, extent and composition of the contamination (e.g. mercury, PCDDs/PCDFs, polychlorinated naphthalenes); iii. characterisation of the contamination, including surveys and the preparation of a report; iv. risk assessment over time and space as a function of the current and approved future use of the site; v. preparation of an engineering project including:	Not applicable	N/A

Best Available Techniques (BAT)		Applicability Assessment (describe how the technique applies or not to your installation)	State whether it is in place or state schedule for implementation
	a) decontamination and/or permanent containment; b) timetables; c) monitoring plan; d) financial planning and investment to achieve the target; vi. implementation of the engineering project so that the site, taking into account its current and approved future use, no longer poses any significant risk to human health or the environment. Depending on other obligations, the engineering project might have to be implemented in a more stringent manner; vii. site use restrictions if necessary due to residual contamination and taking into account the current and approved future use of the site; iii. associated monitoring at the site and in the surrounding areas to verify that the objectives are achieved and maintained.		