Beddington Lane Anaerobic Digestion Plant Permit Application

PR/NP3522SM/A001 We Need More Information About Your Application CRM:0169037

Management of Carbon Dioxide

1. Background

SUEZ Propose the construction of an Anaerobic Digestion (AD) plant at Beddington Lane, Croydon, CR0 4TD.

The Proposed Development would comprise an AD Facility capable of treating up to 100,000 tonnes per annum (tpa) of food waste (from municipal waste collections and some commercial food waste collections). It would enable the management of food waste that is currently being sent either to landfill or incinerated in energy recovery facilities. The food waste treated at the AD Facility would facilitate the generation of biogas within the digester tanks. The biogas is stored in the top of the tank within a membrane gas holder.

The composition of biogas is mainly methane (CH_4) ~60% and carbon dioxide (CO_2) ~40%. Other gases in very small quantities within the biogas include hydrogen sulphide (H2S), nitrogen (N2) and oxygen (O2) and possibly traces of volatile organic compounds (VOC).

To make use of the CH4 and CO2, biogas is drawn from the gas holders to a manifold from which it can be directed to an emergency flare, gas engine or gas upgrading unit.

The emergency flare will only be operated in extreme circumstances where the gas upgrading unit **and** the gas engine are both unavailable **and** there is insufficient storage capacity in the gas holders.

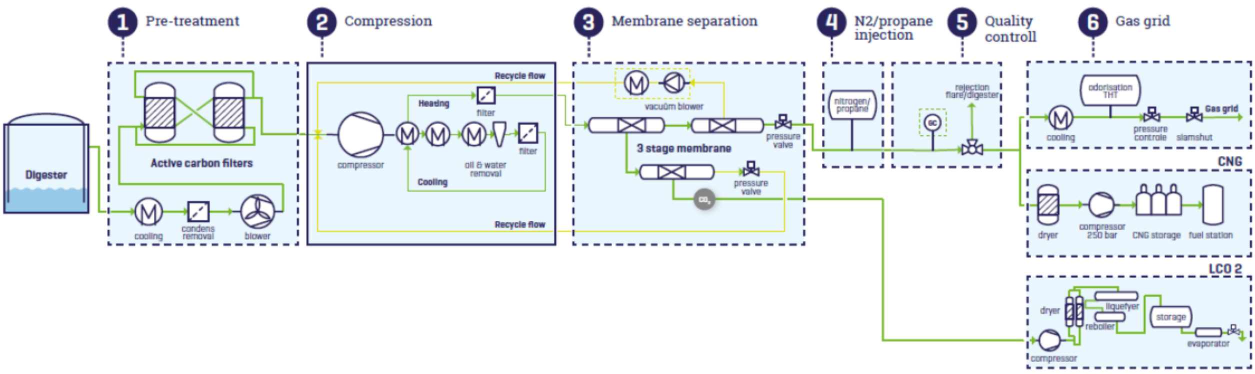
The gas engine may be used to generate supplementary power to the AD facility by burning the biogas. The gas engine will also be used when the gas upgrading unit is unavailable.

Partial removal of water and contaminants from the raw biogas takes place by condensation of saturated incoming biogas. Activated carbon removes contaminants as H_2S, NH_3, VOCs and siloxanes from the biogas. This stage is pre-treatment (which is the same as the first stage in biogas upgrading below).

Gas engines are commonly used on AD facilities and landfill sites to create electricity from biogas. CO_2 is not combusted in gas engines and is therefore vented to atmosphere.

2. Gas Upgrading

Gas upgrading unit is the default treatment for the majority of biogas generated at Beddington Lane which follows 6 stages.



General Carborex® MS flowchart

The first step in biogas upgrading is pre-treatment as described above (step 1 in the flowchart above) to remove contaminants other than CH_4 and CO_2. After the pre-treatment, the biogas is compressed (step 2) to create a driving force for membrane filtration. After compression, the biogas is first treated to further reduce liquids (oil and water) and contaminants to protect the membranes. After treatment, the biogas is upgraded; in the membranes (step 3) CO_2 and H_2O are separated from CH_4. By separating H_2O, the dew point of the gas is reduced to ±-60°C. The CH_4-rich flow exits the system as product gas. Propane and odorant are added to the product gas (step 4) to increase the calorific value of the biomethane and meet the specification required by the gas distribution network. After passing the final quality control (step 5) the product gas is ready to be used in the gas network (step 6). The CO_2 flow exist the membrane system at a very high quality (typically > 98%). The CO_2 will be liquefied in the carbon capture unit to facilitate storage and transport off site to a suitable facility.

3. Carbon capture and venting

CO_2 would only be vented to atmosphere from the gas upgrading unit in the event that the carbon liquification module was unavailable (for maintenance) or the storage tanks for CO_2 were full. The availability of the liquification module would be guaranteed by the manufacturer at >90% but would expected to be available >98% of the time.

The CO_2 produced by the AD plant is biogenic rather than fossil carbon, therefore the capture of the molecules is removing carbon from the atmosphere which are already in the carbon cycle.

The below table provides an indication of the amount of carbon dioxide captured by the process and vented to atmosphere on an annual basis:

Description	Assumption	Units	Beddington Lane
Total Biogas production	Annual	m3/yr	10,065,683
Methane content of biogas	61%	%	6,140,067
Carbon Dioxide content of biogas	39%	%	3,925,616
Own Gas Consumption (to gas engines)		m3/yr	325,467
Net Biogas production		m3/yr	9,740,216
Methane (m3)	61%	Nm3/yr	5,941,532
Carbon Dioxide (m3)	39%	Nm3/yr	3,798,684
Annual operating hours	8000	hours	
CO2 module availability (guarantee)	%	90%	
CO2 module availability (expected)	%	98%	
CO2 captured by plant (range)		m3/yr	3,418,816 – 3,722,711
CO2 vented from gas upgrading (range)		m3/yr	75,974 – 379,686

It should be highlighted that if the carbon capture module was not included in the AD plant design (like at most other AD plants), the carbon dioxide would be vented to atmosphere whether treated by AD, In-vessel composted or home composted, therefore there are significant benefits of adding the carbon capture plant, removing over 3 million cubic metres of carbon dioxide from the atmosphere and venting between 2 and 10% of the CO_2 produced by the biogas each year.

The gas upgrading equipment is containerised. Any carbon dioxide vented during maintenance would be emitted from the exhaust located on the top of the gas upgrading container at a height of approximately 7m.

A typical general arrangement drawing of the carbon capture unit is provided on drawing reference 1018J-LCO2-EM.02.0001.

4. Risk to Health and Accident Potential

Carbon Capture and Storage is an emerging technology and is currently not specifically addressed under UK Health and Safety Legislation. However, the Health and Safety at Work Act requires that employers ensure the health and safety of workers and members of the public is protected so far is reasonably practicable.

The HSE publication “EHO40/2005 Workplace exposure limits” provides exposure limits for CO_2 with a long term exposure limit (8hr reference period) of 5000ppm and short term exposure limit (15 minute reference period) of 15,000ppm.

As detailed within Section 3 above, the CCS unit is proposed to be installed on the site to capture CO_2 which would, ordinarily, be vented directly to atmosphere. The manufacturers guarantee for the availability of the plant is 90% which represents a significant proportion of time when CO_2 will not be emitted from the activity to ensure that the short and long term exposure limits for site staff and the public are not breached. In addition, the area of the CCS will be a designated ATEX zone with site staff required to wear personal alarms for methane and CO_2 as well as there being zonal alarms for these gases.

The collection of waste gases is considered through the Common Waste Water and Waste Gas Treatment BREF under BAT 15 which requires that “In order to facilitate the recovery of compounds and the reduction of emissions to air, BAT is to enclose sources and to treat the emissions where possible” The description of the plant as detailed within Section 2 of this note satisfies this BAT requirement as all plant and pipework associated with the operation of the facility is enclosed.

The Waste Treatment BREF indicates that pipework and ductwork are potential sources of fugitive emissions to air. SUEZ will maintain a planned preventative maintenance schedule as part of the Environmental Management System which will include for the inspection of all pipework and canisters which are associated with the CCS plant to ensure there risk of fugitive emissions of CO_2 are minimised.

In light of the above it is demonstrated that the operation of the plant at Beddington Lane represents a significant improvement to the environment and public health as fugitive emissions of CO_2 which are normally associated with Anaerobic Digestion facilities will be collected through this plant. Whilst there is currently no published guidance around assessment of the risk to human health or accident prevention from CCS plants, SUEZ are able to demonstrate that the plant is compliant with relevant sections of current Best Available Technique Guidance for similar activities.