IED Requirements

Introduction

The TEGCO Immingham Ltd Installation at Netherlands Way, Stallingborough, Grimsby, DN41 8DF is an Energy from Waste (EfW) process. The installation is designed to consume 320,000 Te/yr of Refuse Derived Fuel (RDF) based on 10 MJ/kg (LHV), producing: -

- 12 MW electrical export,
- 51 MW thermal export (60 Te/hr) as steam (no condensate return).

The installation is a Combined Heat & Power (CHP) plant sized and is designed to replace the steam and electricity currently generated by an existing CHP plant on an adjacent industrial plant. The existing CHP plant is reaching the end of its operational life and will be decommissioned when the installation is operational.

The need to continue to take waste in the event that steam and/or electricity cannot be exported (e.g. customer is shutdown), the installation is designed such that all steam generated at normal waste feed can pass through the turbine and condenser resulting in 24 MW electrical export.

A proportion of the RDF is sourced from local waste management companies and transported to the installation by road. The remaining is sourced from further afield and transported by rail to 1 of 2 local railheads and the final transfer from the railhead to the installation is by road.

The installation will operate continuously (24 hr/day & 7 day/week) for >8,000 hr/yr.

The installation consists of 2 off 20Te/hr incineration lines (combustor, boiler & feed-water system) and a single turbine and air cooled condenser.

The installation is designed not to generate any waste water from the process during normal operation.

The installation is designed to be fully compliant with the 2019 European BREF for Waste Incineration (JRC 118637) and the associated BAT Conclusions published in the Official Journal of the European Union on 3rd December 2019.

Requirements

The requirements are referenced to the paragraph numbers in section 2 ('Key Issues') of S5.01 'Incineration of waste: additional guidance' (under the sub heading 'European legislation and your application for an EP Permit').

Requirement 1

The installation consists of 2 incineration lines, identified as: -

- Combustion Line 1,
- Combustion Line 2.

The lines are identical and each consists of: -

- Crane fed grate feeder system (Feed chute and grate feed unit),

- The grate consists of a combination of water and air cooled feed forward reciprocating grate units (4 off total).
- Residence time chamber incorporating:-
    - Support fuel (gas) burner,
    - Multipoint injection (21 injectors) SNCR system (Urea),
- Boiler unit feeding common steam system,
- Dry sorbent injection system (reactor and bag filter) using Powdered activated carbon and Calcium Hydroxide,
- ID fan,
- Flue gas recirculation,
- CEMs and discharge stack.

Fuller details are provided in the Non-Technical Description document.

Point 2

The design capacities of the installation are: -

- 40 Te/hr RDF total for the installation,
- 20 Te/hr RDF total for each incineration line,

Requirement 3

The RDF incinerated at the installation is not "hazardous" and is produced treatment of non-hazardous wastes only.

Requirement 4

The temperature after the last injection of combustion air is ≥ 850°C with a residence time ≥ 2 seconds.

In normal operation, 7 pyrometers are used to optically measure the temperature and build a 2D temperature profile in the residence time chamber. The incineration lines are to a proven design by an established supplier to the incineration industry resulting in high confidence that IED requirements will be met.

The final detailed design is supported by CFD modelling to demonstrate that required temperature and residence time requirements are achieved and TEGCO understands that the EA has previously accepted such CFD modelling as demonstration of compliance with IED requirements.

If such modelling is not acceptable, a trial will be completed as outlined in EA "R&D Technical Report P4-100/TR, Part 2" or suitable protocol agreed with the EA.

Requirement 5

<u>Start-Up</u>

The incineration units are started up using support fuel only (Natural gas) and the combustion control system will prevent the grate feed unit feeding RDF onto the grate until suitable conditions are present including minimum temperature of ≥ 850°C in the residence time chamber.

ELV exceeded

The combustion control system monitors the emissions detected by the CEMs and operational parameters/alarms on all abatement plant. In the event an ELV is exceeded the combustion control system will stop further feed of RDF onto the grate.

Low combustion chamber temperature

In the event that the temperature monitored in the residence time chamber starts to fall towards 850°C, the combustion control system will initiate use of support fuel to maintain a temperature ≥ 850°C. In the event that the residence time chamber temperature continues to fall, the combustion control system will stop further feed of RDF onto the grate. If relevant temperatures (and/or other process parameters) cannot be restored, the combustion control system will initiate a "shutdown" of the incineration line. The temperature at which the support fuel is activated will be finalised during commissioning to achieve a balance between support fuel use and unstable operation caused by excessive shutdowns.

Requirement 6

RDF feed onto the grate is prevented when the temperature drops to 850°C as specified in IED.

Requirement 7

The incineration lines at the installation do not use oxygen enrichment

Requirement 8

Each incineration line is fitted with at least 1 support fuel burner, designed to maintain a temperature ≥ 850°C as specified in IED.

Requirement 9

The installation is connected to the natural gas main and natural gas is used as the support fuel on both lines.

Requirement 10

The equipment supplier has a number of plants using this grate technology that incinerate wastes more varied in physical and chemical composition (e.g. municipal wastes) than the RDF burned at this installation. These plants have a proven history achieving full burnout and producing bottom ash/slags that achieve the quality standard required by the IED.

The installation therefore does not include any pre-treatment methods to ensure the quality standards required by the IED.

Requirement 11

The installation does not use fluidised bed technology.

Requirement 12

The waste incinerated at the installation is referred to as RDF or Refuse Derived Fuel.

The specification for RDF is detailed in Appendix 2 of the Non-Technical Description document.

The RDF from the various suppliers is fed from a common feed bunker to both incinerations lines (Combustion Line 1 & Combustion Line 2).

The primary waste description is "wastes from the mechanical treatment of waste (for example sorting, crushing, compacting, pelletising) not otherwise specified."

The RDF is supplied to the installation under the following EWC classifications: -

- 19 12 10; combustible waste (refuse derived fuel),
- 19 12 12; other wastes (including mixtures of materials) from mechanical treatment of wastes other than those mentioned in 19 12 11.

The annual RDF disposal at the installation is in the range: -

- Minimum; 0 Te/year,
- Maximum; 320,000 Te/year (based on 8,000 hrs/year operation).

The RDF incinerated at the installation is not hazardous waste (EWC classifications are for non-hazardous waste) therefore sub-requirements 12.e.i to 12.e.vi are not applicable to the installation.

Requirements 13 – 19

The RDF incinerated at the installation is not hazardous waste (EWC classifications are for non-hazardous waste) therefore requirements 13 to 19 are not applicable to the installation.

Requirement 20

The Flue Gas Cleaning (FGC) technique is via dry reagent/adsorbent injection and does not generate any waste water flows.

Requirement 21

All drains from process areas, (including Water Treatment Plant reject streams) are collected in the Process Waste Water pit and reused within the incineration process. The use of "Process water" from the waste water pit exceeds the flows into this pit during operation. This applies during both: -

- Normal Operation: CHP (Operational mode 1) with 60 Te/hr steam and electricity exported to local industrial off-taker,
- Abnormal Operation: Full condensing mode (Operational mode 2) with no steam export and electricity exported to the off-taker and/or National Grid.

The rainwater run-off drains system collects rainwater from all surface areas that are not exposed to RDF or residues. This is a SUDs system designed to provide abatement of potential atmospheric surface contamination and restrict total flow to predicted green-field run-off rates providing a significant reduction compared to the current unrestricted surface water run-off rates. The rainwater run-off drains also collect wash water (boiler feed quality demineralised water) used to clean the exterior surfaces of the ACC radiators. To ensure no contamination of the drains areas where spillage is possible (e.g. raw material deliveries and residue export) have valves that are interlocked with the transfer systems to ensure that these areas are isolated prior to delivery/export activities commencing.

TEGCO propose the following monitoring for this discharge: -

- Flow rate & daily total flow
- Collection & analysis of a 24 hr flow related composite sample for the following: -
    - pH,

    - Oil & Grease,
    - Suspended Solids/Turbidity,
    - Chemical Oxygen Demand/Biological Oxygen Demand.

A packaged sewage treatment plant to BS 12566 with a maximum discharge flow of ≤ 5m^3/day is proposed as costs to connect to the local sewer are considered excessive. This is to discharge into the detention basin of the rainwater run-off system to utilise a single discharge. TEGCO propose the following monitoring at the discharge from the sewage treatment plant: -

- Flow rate & daily total flow
- Collection & analysis of a 24 hr flow related composite sample for the following: -
    - pH,
    - Oil & Grease,
    - Suspended Solids/Turbidity,
    - Chemical Oxygen Demand/Biological Oxygen Demand.

In the event of a fire or spillage of contaminated water within process areas, the building will be isolated from the process waste water pit and the water retained within the building the relevant building. All buildings have a 600 mm upstand (including at doors) meaning that they will act as bunds. The greatest fire risk is in the RDF Receipt & Storage hall where the reception pits and feed bunker will provide up to a further 9,000 m3 of water storage capacity.

However in the event that contaminated water (fire water or following a spillage) enter the rainwater run-off drains discharge to the adjacent beck can be prevented by: -

1. Stopping the discharge pump
2. Closing the penstock valve

The detention basins (one at each end of the installation) provide capacity to hold 1,440 m^3 of water and are connected via a large balance line. This allows firewater to be extracted from the detention basins to continue firefighting activities and minimising the resultant volume of firewater generated. An impervious membrane is incorporated into the detention basin construction which will prevent contamination of ground/ground water. The retained water can be tested and either discharged or transferred to tanker for off-site disposal.

A plan of the surface rainwater run-off system is included in Appendix 3 of the Non-Technical Description document.

Requirements 22 - 25

There are no emissions to water from the prescribed process meaning that Requirements 22 – 25 are not applicable to the installation.

Requirement 26

As noted above, there are discharges of uncontaminated rainfall run-off water and from a packed sewage treatment plant. TEGCO will monitor these as required by the EA (scope, methods and ELVS) in the permit and/or develop proposed requirements via a pre operational or improvement condition.

Requirement 27

The residues from the incineration plant are: -

- Bottom Ash/slags,
- Fly ash,

- FGCr.

Bottom Ash/Slags

The use of an RDF as a waste fuel means that the wastes streams have been pre-treated, with many non-combustible materials (e.g. metals & inerts) removed for reuse, recovery or recycling. This minimises the quantity of Bottom Ash/slags produced.

The Bottom ash/slags are kept separate from all other residues, this material is sent to suitably regulated facilities for: -

1. Reuse,
2. Recycling,
3. Recovery,
4. Disposal.

The hierarchy above is used to minuses the quantity of Bottom ash/Slags being sent for disposal.

FGCr

The use of RDF helps minimise the concentrations and variability of polluting species within the waste burned. This combined with a reciprocating grate and advanced control system result in steady loading on the abatement plant allowing raw material usage (Hydrated lime and Powdered activated carbon) to be minimised while ensuring that emissions performance is maintained.

The FGC system incorporates an internal recycle of a proportion of the residues, further reducing raw material usage.

Hydrated lime is used (rather than sodium bicarbonate) as this produces FGCr for which: -

- Outlets for reuse are commercially available,
- Have significantly lower "leaching potential" thereby reducing the environmental risk/treatment requirements if sent for disposal.

The FGCr are kept separate from all other residues, this material is sent to suitably regulated facilities for: -

1. Reuse,
2. Recycling,
3. Recovery,
4. Disposal.

The hierarchy above is used to minimise the quantity of FGCr being sent for disposal.

Fly ash,

The combustor and combustion control system are designed to ensure consistent combustion conditions, maximising burn out and minimising fine particle carryover into the boiler. The boiler is designed (using CFD) to minimise the potential for particle fallout or impingement on surfaces within the boiler. These minimise the quantity of Fly ash produced.

Fly ash composition is difficult to predict, however it will sent to suitably regulated facilities for: -

1. Reuse,
2. Recycling,
3. Recovery,

4. Disposal.

The hierarchy above is used to minimise the quantity of FGCr being sent for disposal.

Requirement 28

The Continuous Emission Monitoring equipment: -

- Has MCERTS certification,
- Is suitably ranged (as per Environment Agency guidance) to reflect the ELVs,
- Is installed in compliance with Environment Agency Monitoring Guidance Note M1,
- Incorporates automatic calibration (zero and span checks),
- Is initially calibrated and routinely performance checked (against prescribed standard test method) as required by BS 14181,
- Is maintained as per manufacturer's instructions,
- Is maintained by qualified staff,
- Maintenance & operational records are routinely reviewed and maintenance activity reviewed/increased if required,
- A proprietary emissions data handling and reporting system, with MCERTS certification is used.

The data handling system also communicates with the process controls systems and incorporates algorithms to correctly identify, classify the emissions data (e.g. valid ½ hr averages, valid daily averages, plant status etc.) and compile a database covering all periods of process activity. The system produces reports (e.g. daily, monthly & yearly) quantifying compliance with the various performance and operational requirements outlined in IED.

Requirement 29

<u>Start-Up</u>

Start-up ends when the grate feed system starts feeding RDF onto the grate. The grate feed system is interlocked via the control systems and RDF feed onto the grate cannot start unless all relevant process systems are operating correctly and within operating parameters (including having minimum inventories of raw materials etc.). Start-up may be slightly extended to prevent generation of in-valid ½ hour averages.

<u>Shutdown</u>

Shutdown is deemed to commence at the time RDF feed onto the grate is stopped by the control system (e.g. equipment failure) or operator input. In normal operation, RDF feed onto the grate may be paused or slowed to extremely low rate as part of the normal control system response to process conditions.

The CEMS and emissions data management system continue to function during start-up and shutdown. As noted above, the emissions data management system is in permanent communications with the combustion and process control systems and will "tag" the raw data accordingly.

Data during start-up, shutdown and periods of "Other Than Normal Operational Conditions" (OTNOC) is therefore retained, is available for inspection and to aid investigation etc.

Requirement 30

See document OTNOC for details.

Requirement 31

As the instruments are MCERTS certified, the values of the 95% confidence intervals will not exceed those listed in IED, latest Incineration BAT Conclusions Document, Environment Agency guidance or permit conditions at the time the instruments are installed. If these are later reduced the instruments will be modified/upgraded (if practicable) or replaced (e.g. at the end of their sensible operational life) within a suitable timeframe agreed with the Environment Agency.

Requirement 32

The following methods are proposed to allow correction of emissions to the "Normalised" conditions specified in the directive.

Incineration Line	Process Variable	Proposed Monitoring
Combustion Line 1	Oxygen Content	Heated Zirconia Probe
	Temperature	Thermocouple (RTD'S)?
	Pressure	Pressure Transmitter K Hastelloy
	Moisture Content	FTIR
Combustion Line 2	Oxygen Content	Heated Zirconia Probe
	Temperature	Thermocouple (RTD'S)?
	Pressure	Pressure Transmitter K Hastelloy
	Moisture Content	FTIR