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File Note

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Date : 21.1.15

cc : Janet Etchells HM Principle Specialist Inspector (Process Safety)

Title : SITA ECO-PARK DEVELOPMENT at Charlton Lane, Surrey.
– Notes of Discussion at Site Meeting 12.12.14.

Introduction

1. The company plan to develop a pyrolysis gasification plant, anaerobic digester and small electricity generating station at this site, to create energy form waste (EFW). Following correspondence regarding complaints opposed to the development, a voluntary consultation on the proposals was held with the company. Initial discussions with the regulatory inspectors for this company established the current proposals fall outside HSE's enforcement remit until such time a physical work on site proceeds. As such, production of a formal inspection report and the associated recommendations for enforcement was not possible.

2. The following notes of our discussions with the company contain advice and guidance to the company on the current design. The comments direct the company towards aspects of the design where further consideration of best practice in risk control may be advantageous.

Description

3. The plant will receive municipal wastes which will be sorted and reduced in size to produce a standard specification feed for the gasification plant. The removal of tramp metals is achieved by magnetic and eddy current separators during the size reduction process. The planned gassifier was a continuous fluidised bed process operating 24/7. The gassifier was fed from a 5000 tne stock pile of ground waste (RDF) delivered to the in-feed conveyor on a walking floor. The stockpile would be about 5 meters deep and within a fire separated compartment of the gasification process building.

4. The plant is of a novel design where the fluidised bed pyrolysis process (resulting in gasification) is close coupled (within the same vessel) to the combustion of the product gases. It is the first time this process has been attempted on municipal solid wastes (MSW). A single reactor vessel is planed capable of handling 100,000 tons of waste per year.

5. The company have undertaken a HAZID (Hazard study 2) for the process, this was chaired by BPE the consultants designing the gasification plant. The company have developed a PFD and draft P&IDs for the process. A full HAZOP of the plant is planned, and external HAZOP training for SITA representatives on the HAZOP team will be completed prior to the study.

6. The process is based on the concept of minimising process inventory and maximising flow through the fluidised bed. The process inventory is intended to be no more than 20kg of MSW with a transit time of 7 minutes, only 2 minutes on the fluidised bed. The bed temperature is intended to be about 700 ^{0}C which is lower than the other large plant currently in operation. The fluidised bed will have two auxiliary fuel oil burners for start-up. The combustion zone will operate above 850 ^{0}C. The plant flows will be controlled by a Siemens S7 PLC with a WIN-CC SCADA interface. 3 Operations staff will be on each shift.

7. Combustion of the syngas will produce steam at 400 ^{0}C and 40 bar, for use in the steam turbine generators. The planned gross power output was 3.65 MW with a parasitic load of 1 MW.

8. The process was housed within a 140 x 65m building 18m high. The building was divided into separate fire compartments for waste reception, waste storage, gasification and power generation. On the western wall a semi-detached office and visitor centre building was planned. This block would have a population of about 50 persons maximum. The site was also a domestic and trade waste transfer station. Up to 1000 car and van movements per day occurred at the transfer station.

9. A 30 m^3 fuel oil storage tank was planned for the gasification plant start-up burners. This was to be located within a separate storage building.

10. The site also plans to operate an anaerobic digestion (AD) plant capable of processing 40,000 tons of organic (food) wastes per year. This comprises two 1500 m^3 fixed roof digester tanks, feeding a 2000 m^3 geodesic dome gas reservoir at 25 mbar pressure. The gas reservoir is fitted with a spring loaded pressure vacuum valve set a 35-40 mbar. The gas is fed to two gas engines for electricity generation. The tanks are enclosed within a 4m high bund wall, thus creating a large confined space around the tanks. Access around the tanks is to be provided by an elevated walkway. The AD plant has a flare blow-down facility planned. However, no fuel supply for the pilot flame was noted on the plans.

Commentary

11. The close coupled pyrolysis gasification and combustion process over a fluidised bed requires are high degree of process control to be successful. This is the first time this process has been attempted with a feed stream as variable as MSW. This presents considerable technical challenges due to the diversity of the composition of the waste stream. It is a concern that the level of carbonisation and deposit formation on the fluidising particles, and within the plant chambers, may not be even. This may result in challenges in controlling the particle regeneration rate and fluidising gas flows.

12. The company plans for a full HAZOP of the gasification plant is endorsed. Those participating in the study should be fully trained and experienced in the application of the technique, and this should follow industry good practice and set out in standards [1] and I.Chem.E, guidance [2]. The control system risk assessment should include appropriate risk assessment [3] of the safety integrity of the required controls as set out in IEC 61511[4] and associated guidance [5]. For example, the use of a layer of protection analysis (LOPA) study to determine the safety integrity level (SIL) required of the controls.

13. The safety implication of such technical difficulties will be the need for more frequent plant shut-downs for internal cleaning, bed replacement, etc. Such internal maintenance activities are relatively high risk and require a high degree of safety control due to need for entry to internal confined spaces and risk of asphyxiating atmospheres being present. Suitable safety management systems, training and equipment will be required on site for confined spaces work [6].

14. The design should consider the nature of maintenance tasks that may need to be undertaken and where possible design out or minimise the need for confined space entry. These comments are particularly relevant to the anaerobic digester and the confined space created within the current bund design. The routine operational activities such as pump maintenance checks, valve operation, etc. should be designed so that entry into a confined space is not required.

15. The company should ensure there is adequate fire separation between the RDF waste stockpile and the adjacent process and office buildings.

16. The company should ensure provision is made to detect fugitive gases from the plant. Particular attention should be given to the provision of carbon monoxide detectors [7] within the RDF store and the gasification building compartments.

17. The company should consider provision of methods capable of detecting incipient fires within the RDF stockpile. These may include carbon monoxide detection, thermal imaging, combination detectors or other suitable measures.

18. The company should consider how a fire within the waste stockpile and gasification plant could be best controlled. HSE endorses the company's proposals to commission a study by expert fire surveyors, to develop the fire protection measures for the waste processing and gasification building. The constraints on the available fire water flow to site are noted. Thus, the fire fighting/suppression technology selected will be a key to the design of the fire water storage reservoir capacity. Consideration of low volume water mist application systems may be of advantage.

19. The company should develop suitable emergency plans [3] for control of the public onsite, and those seeking access to site, in the event of a fire within the process buildings.

20. Fuel oil storage tank should preferably be located in a well-ventilated location outside and in accordance with the guidance contained in HS(G)186 [8] note paragraphs 223 to 235. The planned location creates a conflict between fuel vehicle delivery movements and the transfer of green wastes. This arrangement is not ideal. The impact risk requires a better standard of control and options to reposition these operations should be explored.

21. The blow-down flare for the AD plant should be located in a safe place [9]. Consideration should be given to:

- the impact risk to the flare installation from road traffic,
- location of the fuel supply that is required to support the pilot flame,
- the thermal radiation created by flare operation in respect of vulnerable nearby structures (e.g. the gas holder membrane),
- the thermal effects at the site boundary and on public rights of way.

This is not an exclusive list.

Meeting Attendees

Stephen Green – HM Insp. H&S (SITA National Lead)
Sam Summerfield – HM Principle Sp. Insp. (Process Safety)
Justin Hampton – SITA Surrey, Plant Manager.
Gareth Phillips – SITA UK Property and Planning Manager
Mark Nightingale – SITA Surrey, Charlton Site Manager
Paul Leaver – SITA UK Health and Safety Manager
Jorge Hau – SITA UK – Construction Project Manager

References

1. BS IEC 61882:2001 – Hazard and Operability Studies (HAZOP Studies) – Application Guide – British Standards Institution

2. HAZOP Guide to Best Practice – 2nd Edition 2000, I.Chem.E./CIA.

3. Dangerous Substances and Explosive Atmospheres – Dangerous Substances and Explosive Atmospheres Regulations 2002, Approved Code of Practice and Guidance 2nd Edition L138. ISBN 978-0-7176-

6616-4

4. BS EN 61511 – 1: 2004 Functional safety — Safety instrumented systems for the process industry sector — Part 1: Framework, definitions, system, hardware and software requirements. – British Standards Institution

5. Layer of Protection Analysis – Simplified Process Risk Assessment. CCPS. ISBN 0-8169-0811-7

6. Safe Work in Confined Spaces – Confined Spaces Regulations 1997. Approved Code of Practice and Guidance L101. ISBN 0-7176-1405-0.

7. BS EN 60079-29-1:2007 Explosive atmospheres — Part 29-1: Gas detectors — Performance requirements of detectors for flammable Gases. British Standards Institution

8. The Storage of Flammable Liquids in Tanks. HS(G)186 ISBN 0-7176-1470-0

9. Agricultural Employer's Liability Insurance Association – Technical Information 4 – Safety Rules for Bio-gas Plants. 2008. http://www.lsv.de/fob/66dokumente/info0095.pdf

Other publications of interest.

BS ISO 7240-8:2014

Fire detection and alarm systems. Point-type fire detectors using a carbon monoxide sensor in combination with a heat sensor

BS EN 50543:2011

Electronic portable and transportable apparatus designed to detect and measure carbon dioxide and/or carbon monoxide in indoor ambient air. Requirements and test methods