MEMORANDUM

To:	Abraham Ejim	**Organisation:**	Environment Agency
cc:		**Organisation:**	
From:	James Sturman	**Our Ref:**	S1552-0010-3434JRS
Date:	26 May 2017	**No. of Pages:**	12
Subject:	Fire Prevention Plan Clarification		

Dear Abraham,

In response to your request dated 9 May 2017, regarding the Fire Prevention Plan (FPP) for the Rivenhall IWMF, please find below the information requested.

1 HEATING OF WASTE DURING BIO-DRYING

- *Waste is shredded prior to sorting and separation in the Materials Recycling Facility (MRF). It then either goes directly to RDF or is sent to the Mechanical Biological Treatment (MBT) facility for bio-dying.*
- *The bio-drying of waste at the MBT facility will potentially raise the temperature of the waste to between 50-60°C over a period of one-two weeks.*
- *Upon completion of the treatment in the MBT facility (the purpose of this activity is to produce RDF), the waste will then be sent back into the (MRF), for the removal of further recyclables, prior to the loose outputs being sent to the incinerator bunker. The MRF process will contribute further to maintaining those temperatures through introducing oxygen and heat (e.g. from conveyors).*
- *This heated waste (RDF) will then be placed into the incinerator bunker for up to 7 days before being fed into the incinerator.*
- *The RDF in the incinerator bunker will be stored to a maximum pile of 29,000 m^3 with processed RDF deliveries from both the MRF and MBT facilities from Monday to Friday (every day). The depth of the bunker will be 22.8 m high/deep.*
- *The RDF will be subject to regular turning and rotations using the grab in the incinerator bunker (for a period of 45 minutes every hour).*
- *Waste will cease to be delivered to the incinerator bunker by Friday evening. The incinerator will continue to process the remaining waste in the bunker over the weekend until a new delivery on Monday morning (Tuesday in the case of bank holidays) when RDF deliveries are resumed.*
- *Over the weekend, the FPP states that the RDF will be processed until the bunker is 'nearly empty'.*

Key issues to be addressed

(1) The MBT will raise temperatures to 50-60°C and will be subject to further mechanical processing prior to a maximum 7 days of storage in a large and deep bunker. We consider that the combination of treatment processes and storage will increase the risk of self-combustion.

i. What is the critical temperature of the RDF in the pile/bunker of 29,000 m^3? This is the point at which thermal runaway occurs and results in combustion.

ii. **How will the temperature within the centre of the storage pile be monitored?**

iii. **Upon determining the critical temperature for the waste in the bunker, what will the trigger temperature be to enact your fire-fighting strategy (suppressions systems)?**

iv. **How will self-heating and subsequent self-combustion be prevented in the bunker?**

v. **Should the critical temperature be reached, what measure(s) will be pursued to reduce the potential fire risk posed by the waste?**

A site specific self-heating analysis of the bunker may need to be undertaken to determine some of the above points. See the document, BRE Review of Environment Agency Fire Prevention Plan https://www.gov.uk/government/consultations/fire-prevention-plan-review.

In response to the initial background to this question, reference should be made to Answer No 4 below that addresses how the temperatures in the MBT process will be monitored and controlled. This also explains how the MRF process is more likely to reduce temperatures following removal of waste from the MBT, and how the excess storage space in the RDF bunker area will be used to detect, control and reduce the risk of hot-spots within the RDF. As concluded "all MBT and MRF operations will be undertaken with the objective of reducing the temperature of the processed RDF to as low as possible prior to transportation to the CHP bunker".

With regard to when the RDF is held in the CHP bunker, there is no direct measurement of temperature at the centre of the bunker. However, there is continuous thermal mapping of the surface of the waste within the bunker which will identify hotspots below the surface. The thermal mapping will be displayed within the control room and will be used by the crane driver to manage temperatures within the bunker. Turning and mixing the waste with the crane will help to reveal any hotspots.

The waste in the bunker is inherently non-homogenous. There will, therefore, be a range of 'critical' temperatures for the different waste steams which will be treated within the Facility. However, whilst the trigger temperature for the firewater cannons is subject to detailed design, the 'typical' trigger temperature for firewater cannons within a waste bunker at an EfW is around 55°C, as measured by the thermal imaging camera mounted in the bunker.

The crane is sized so that the time for waste mixing and management is approximately 45 minutes per hour, i.e. only 15 minutes is required for feeding waste to the furnace. Therefore, before the critical temperature is reached in an area within the bunker, hotter areas can be readily identified and, if necessary, fed into the feed hopper to be incinerated.

If when the critical temperature is identified within the bunker and the feed hopper for the incinerator is full; the fire water cannons will be activated to reduce the temperature in the area where self-heating has occurred.

(2) After entering the incinerator bunker, the RDF will be subject to regular turning (45 minutes every hour). This activity may exacerbate any hot spots and increase the risk of self-heating due to the introduction of oxygen.

i. **How will hot spots be identified and managed on route to and within the bunker?**

ii. **Provide details of how you intend to minimise the potential for self-heating of the waste stored within the bunker. Propose an alternative approach to regular turning of the waste or demonstrate how the intended storage or the regular turning will not increase the potential to lead to self-combustion.**

As stated in response to Q1 above, thermal imaging cameras will be installed around the perimeter of the waste bunker. The thermal imaging cameras will provide continuous thermal mapping of the surface of the waste within the bunker which identifies hotspot below the surface. The thermal mapping will be displayed within the control room and will be used by crane driver to manage temperatures within the bunker.

The turning of waste within the waste bunker is standard practice at UK EfW plants. As well as helping to mix the waste (to produce a more homogenous fuel which is better for control of the incineration process), it helps to prevent the formation of hotspots. Turning helps to release heat that has built up in the waste. By taking grabs of waste and then spreading over a wider area, turning dissipates entrained heat and removes thermal inertia within the waste. It also increases the evaporation of water, a heat absorbing process. These factors help to minimise the risk of self-heating and ignition. Furthermore, if the heat does not dissipate as expected, the firewater cannons will be activated to reduce the temperature in the area where self-heating has occurred.

(3) The proposed incinerator bunker storage process does not adequately meet the first-in first-out principle (FIFO). The FPP must identify the measures the operator intends to implement to meet the FIFO principle.

i. What is the estimated quantity of residual RDF which remains in the bunker over the 2 or 3 day weekends before deliveries resume on Monday morning?

ii. How will you ensure that this older material is processed first?

iii. How will you ensure that the older RDF does not become mixed with the newer material?

In the time leading up to a weekend, the waste bunker will be filled to a level which is sufficient to operate the CHP Plant at full capacity until waste deliveries resume at the start of the following working week. An extra half- or one-day's waste may be added to allow for any unexpected disruptions to waste deliveries. So, for 2- or 3-day weekend, the bunker would normally be filled with 3-4 days waste This is normal practice at UK EfW plants. Assuming a maximum of 1 day's waste in the bunker at the end of the weekend, the quantity of waste remaining would be 1,750 tonnes. (This is calculated as (2 streams) x (maximum waste throughput per stream 36.5 t/h) x 24 hours).

To ensure that the older material is processed first, the older material will, where practicable, be stacked on one side of the bunker, prior to new waste being transferred into the bunker.

Bunker management procedures will be employed to ensure that the fuel being fed into the furnace is reasonably consistent in terms of net calorific value (NCV). The bunker management procedures, in common with practices at UK EfW plants, will involve mixing some older and newer wastes. By achieving a more homogenous mix with relatively consistent NCV combustion within the furnace can be more easily optimised.

2 DETECTION AND SUPPRESSION SYSTEMS

- *As the site situation still exists within the design stage, many operational aspects of the site are not yet known. Therefore, for a number of aspects of the FPP, pre-operational measures will be included within the permit (should it be granted), especially for the detection and suppression systems.*
- *Only high level details are therefore provided as specific locations and detailed design is not yet available. For the detection systems, the FPP states that the whole site will be covered by; smoke and heat detection (including temperature probes), CCTV visual flame detection and spark, infrared and ultraviolet detection. No further site specific details are provided.*
- *The suppression system will involve; sprinkler and water deluge systems, foam systems, inert gas and CO_2 suppression systems. Their FPP commits their design, installation and maintenance to third party verification by a UKAS accredited body. In addition, the FPP states that much of the design is in line with the US standard NFPA 850.*

Key issues to be addressed

(4) While we do not expect the Applicant to provide extensive details on their systems (based on the lack of available operational knowledge), we need to ensure that certain issues relating to detection and suppression systems are addressed during the permit determination. These are fundamental in understanding the fire-risk at the site.

i. During the MBT process, how will you monitor and detect hot spots and situations of self-heating from waste in the bio-dryers?

ii. How will these measures be monitored?

iii. What detection systems will be employed to identify if the waste has entered the self-heating or there is a deep seated combustion event?

The batches of wastes to be treated in the MBT Clamps will be logged in a central computer operating system that records the date and time of each Clamp (numbered) as it is filled and emptied. The batches will be processed under First-In First-Out (FIFO) principles.

The proprietary design of the MBT clamping system (which has been proven to be effective and reliable at other similar operational sites) incorporates six temperature probes inserted into the waste within each clamp at regular intervals; 2 at the front, 2 in the middle and 2 at the back. These are pushed into the top of the waste after each clamp has been filled and prior to the retractable roof being fixed over the clamps. When the roof is drawn back, these temperature probes are removed prior to handling the waste. The six probes are placed 0.5 m from the wall and at a depth of between 1 m to 1.5 m into the waste. An additional temperature probe, or flat-plate sensor, is then placed on the surface in the middle of the clamp. All temperature probes are attached to data loggers, and are calibrated every 3 months by an independent laboratory. There will be an appropriate number of spare temperature probes and data loggers kept on site in the MBT Supervisor's office.

In accordance with section 1.3.2.1 "MBT Operation" of the Supporting Information submitted with the application, the waste in the MBT clamps will be no more then 3 metres deep (at placement in the clamps). At similar sites, known to GFC where no known combustion has occurred, temperature probes at 1.0 to 1.5 m are appropriate to detect any "deep-seated" combustion at the lower levels. Should subsequent practices and monitoring suggest otherwise, additional probes at greater depth will be installed in agreement with the Environment Agency.

The temperature of the bio-drying material within the MBT is continuously monitored and logged every 6 hours, whilst also being displayed on a continual basis. The displayed temperatures are reviewed and logged each day by the MBT Supervisor at the beginning of the day and at further intervals as necessary to investigate any particular concerns about rising temperatures.

During the bio-drying process, the MBT Supervisor examines the temperatures to ensure no temperature probes are broken and that the required time and temperature, less than 60°C throughout the entire mass, is being achieved. A time/temperature graph is produced and again examined to ensure that it has met the required time/temperature. The data is stored on the central management computer system in the office and backed-up as necessary.

Unlike similar clamps in use at operational sites elsewhere, the Rivenhall MBT facility is not being used to produce ABPR-compliant compost as all output will be either recycled or made into RDF to be processed in the CHP Plant. Hence, the strict temperature requirements are not necessary; however, the data will be available to review against the risk of internal combustion. Based upon experiences in similar operational clamps, it is unlikely that temperatures will reach considerably above 60°C within 7 days, and this will be set initially as a target maximum. If the material appears to be gaining temperature at a rate according to the time/temperature graph that could lead towards an excess of 60°C, it will be removed and sent to the MRF prior to 7 days.

The layout of the seven temperature probes, and the regular data logging and inspection/review for operational purposes, has been proven to be effective in alerting operational staff to the potential for unusual temperature rises or internal combustion. The layout and temperature will be displayed graphically on the monitoring screens. Layout, depth and number of probes can be modified according to experience and any concerns raised by the EA.

During all aspects of shredding, handling, treatment and storage of wastes in the MBT and MRF processes, care will be taken to reduce and minimise heat within wastes to reduce the risk of self-combustion. As there is plenty of floor capacity within the MRF/MBT reception building and tipping floor/bunkers, spreading of waste over a wider area will be undertaken where possible during shredding such that is has cooled as far as possible prior to placing in the MBT clamps. Similarly, the process of removing the bio-dried waste from the clamps and placing by wheel loader into the MRF hopper will be carried out so as to help cool the waste during this process (e.g. the time taken and the spreading out of wastes). The MRF screening, conveying and picking processes will inherently break up wastes into smaller quantities for handling thereby reducing temperatures, and reducing risks of self-combustion. Finally, there is considerably more space for the final RDF product than one-day's storage at the end of the MRF lines and a revolving arm distributor will place the RDF into several shallow piles in this area, rather than one deep pile, to aid further cooling down before collection and transportation to the CHP bunker. These controls and good operational practices should ensure that the temperature of the RDF manufactured on site will be considerably less than the 50- 60°C in the clamps by the time the RDF is transported internally and placed in the CHP bunker.

GFC understand from their technology supplier for the MRF that, it is not anticipated that there will be a high risk of hot-spots or self-combustion during the process. However, if there are any concerns about hot-spots during operations at the Rivenhall IWMF, as seen or detected in the waste in the RDF bunker area, such waste will be left to cool down in small piles, and/or doused with water or foam. All MBT and MRF operations will be undertaken with the objective of reducing the temperature of the processed RDF to as low as possible prior to transportation to the CHP bunker.

(5) The fire suppression systems will draw water from the Upper Lagoon (25,000m^3 of water) which is fed from an additional lagoon, New Field Lagoon (250,000 m^3 of water). We are satisfied that there is an appropriate water supply. However, there are still issues relating to the suppression system.

i. Should the full requirement of water supply be used on the 29,000 m^3 bunker fire, a total of 34,800 m^3 will be used. This level of water will sit in the bunker and 'drown' the RDF. We need clarity on whether this is the aim of the suppression system. If so, a large quantity of firewater and saturated RDF will need to be disposed of. Is this the suppression strategy proposed at the incinerator bunker? Provide a more detailed procedure of how the operations will cease and how the large quantity of waste water and RDF will be dealt with.

ii. In the above scenario, a high demand on water supply is required per minute. As per the FPP guidance, a 29,000 m^3 pile requires approximately 193,300 litres of water per minute. Demonstrate that the pumping system is feasible to provide this level of water. Support this with evidence. Provide evidence to support the claim that the fire water delivery system can provide the required water rates.

iii. If it is not proposed to drown the waste. What is the aim of the suppression systems? Please provide evidence and justification to support the claim that the proposed system meets the FPP objectives and/or guidance.

- **minimise the likelihood of a fire happening**
- **aim for a fire to be extinguished within 4 hours**
- **minimise the spread of fire within the site and to neighbouring sites**

In the EA's Clarification request, dated 4 April 2017, GFC was asked to confirm there was sufficient water supply to satisfy the requirements of the FPP Guidance, which states that '*You'll need a water supply of at least 2,000 litres a minute for a minimum of 3 hours for a 300 cubic metre pile of combustible material*'. It was demonstrated in the response to the Schedule 5 Request that this volume of water was available if required. However, this information was not provided as confirmation that the volume of water would be used to 'drown' a fire within the bunker. In practice, considering the scope of the fire detection and suppression systems identified in the Fire Prevention Plan, and the experience of other UK EfW plants the 'typical' quantities required for fighting a fire at the Facility will be a fraction of those stated in the guidance. Indeed, the quantity of water in the lagoons immediately available for firefighting at the Facility is far in excess of the insurers' requirements and recognised fire prevention standards (e.g. NFPA 850)

As explained in response to Q1, and also within the fire prevention plan, the facility has been designed with fire prevention systems which will be used to identify potential hot spots within the bunker, and management measures will be implemented to minimise the risk of a fire, and mitigate the potential consequences of a fire. The fire suppression systems (water cannons) will also be implemented to suppress hot spots as well as extinguishing fires, if necessary. The firewater cannons are directional and capable of delivering approximately 950 litres per minute at a pressure of 700 kPa of water directly at the hotspot or source of fire, thereby are more efficient and effective use of the available firewater.

Given the fire detection and suppression measures already described and in light of the experience at UK EfW facilities with similarly designed waste bunkers, it should be very unlikely that a significant fire will be able to develop in the bunker. However, if a significant fire did develop, dependant on the nature of the hot spot within the waste bunker and the successful implementation of the fire mitigation measures, the CHP plant may not need to be shutdown. It should be possible to manage most hot spots with the measures identified in response to Q1 without implementing shutdown of the CHP plant. If the fire is a significant fire which cannot be managed with the measures identified, then the plant will be evacuated until it is safe to return into the building. All staff will be prohibited to return into the building until they are informed it is safe to do so by the emergency services.

Upon being granted access to the building, an assessment of the condition of the building will be undertaken – depending on the extent of the fire this will be undertaken within the independent fire insurers.

If there are large quantities of water from implementation of the fire suppression systems, arrangements will be implemented to gully suck the firewater from the bunker, and transfer it to a suitably licenced waste management facility.

Detailed fire procedures for the operation of the Facility will be developed prior to commencement of operation of the Facility. These procedures will take into consideration all of the measures incorporated into the design of the facility during detailed design.

Only when it is considered that it is safe, by all parties, will the start-up procedures for the facility be implemented.

As stated above, the information relating to the provision of 193,300 litres of water per minute being available to the Facility was provided in response to the Clarification request, dated 4 April 2017. However, as demonstrated in the response, this volume of water is available, if required.

As stated previously, the facility is subject to detailed design. This includes all of the fire detection and suppression systems. Therefore, at this stage it is not possible to provide evidence that the firewater delivery system can provide the rates of water required by the guidance. However, we can state that it will be designed on this basis. Two independent pumps will be provided - one electric motor driven pump; and one diesel engine driven pump. Pumps and piping will be sized in accordance with good engineering practice and design margins to ensure required flowrates can be achieved.

GFC would propose that the EP includes a condition which required GFC to submit this detail to the EA, following detailed design and prior to commencement of operation of the CHP Plant.

3 PAPER PULP PROCESS

- *Baled incoming waste paper will be stored in 750 m³ piles. They will have separation distances of 6 m in between the piles and are adjacent to firewalls. This material is stored for up to 24 days before processing in the pulping plant.*
- *The output baled product paper, known as Market De-inked Pulp (MDIP) is classified as non-waste by the Applicant. It is also stored in 750 m³ piles and has 6 m separation distances. A maximum storage time of 33 days is stated.*

Key issues to be addressed

(6) The incoming waste bales are stored in pile 5.5 m high (1.5 m higher than the maximum height). Higher piles increase the insulation capacity of the waste and contribute to self-heating.

i. Provide a justification which demonstrates that the increased height will not lead to increased fire risk. Your response should address the objectives of the guidance, below.

- **minimise the likelihood of a fire happening**
- **aim for a fire to be extinguished within 4 hours**
- **minimise the spread of fire within the site and to neighbouring sites**

Alternatively, if you are not able to provide an adequate justification, reduce the pile height to a maximum of 4 m.

It is proposed that the pile heights for both RCP and MDIP will be no greater than 4 metres unless otherwise agreed with the EA in the future. The FPP and the Drawing "Waste Reception & Storage Areas" have been modified, refer to Appendix A .

ii. The FPP states that the incoming paper is processed to the FIFO principle. Provide information that demonstrates that this can be achieved in practice.

- **Are incoming paper bales processed as a single batch before new waste paper bales are accepted?**
- **If not, what recording system is employed to ensure that older paper bales are processed first? Is the waste barcoded or tracked?**

Notwithstanding the need for effective fire prevention and control measures, recovered paper (RCP) stock rotation is the key to the high quality operation of the paper processing plant under FIFO principles (First in First out) for the following reasons. Good quality control and proper stock rotation helps prevent bale degradation which can occur if bales are left stacked on top of each other for months on end. If stacked for too long the edges of the bales may begin to crumble and the stack could start to tilt. The paper may also start to break down and go yellow and this is to be avoided as it will mean additional chemicals and cost will be required to maintain the brightness of the finished pulp

In terms of stock control, or in the event of a plant shut down or breakdown, it is important to maintain the most recent supplies on site to avoid the above. It is also important if it becomes necessary to go back to a supplier on quality issues, which is not so easy if the bales have been in stock for some while. Quality Control procedures will focus on receiving and processing as soon as is practicable in a stock rotation system to identify any problems with individual suppliers.

Stock control and fire prevention methods will include the following:

- All relevant information including grade, volume and delivery date on the RCP for recycling, as delivered by suppliers, will be recorded in a database for all consignments that are accepted as being within the Operator's quality specification.

- Each RCP consignment will be tagged with a bar coded label recording consignment information including the quality, supplier details and delivery date. This data will be used throughout the pulp production process to allow pulp characteristics to be tracked back to source, allowing the Operator to work with suppliers to achieve optimum quality.
- Inspection results will be documented with the information in respect of load, the grade and the supplier. This information will be filed in order to help the evaluation of suppliers.
- RCP will be stored in piles according to paper quality and as indicated on the Waste Reception & Storage Drawing. The exact location of the piles will be recorded in the database, and cross-referenced with the relevant consignment bar code.
- Paper will be blended according to the required pulp quality being manufactured. Paper will be processed according to its arrival date to ensure it is used within 1 month of arrival in the plant.

Utilising the management systems of the central database and the respective consignment bar codes, the Operator will ensure that RCP is processed in accordance with the FIFO principles, thereby maintaining high quality control in addition to reducing the risks of fire.

4 SITE LAYOUT PLAN

The site layout plans clearly indicate the locations of where the various activities will be undertaken. However, the physical layout of the waste piles is not defined in those areas.

(7) Re-submit the layout plan which adds the following details:

- **i. The scale representations of the waste piles in each activity area (the maximum amount of piles in the various areas of the site);**
- **ii. The pile dimensions for each pile;**
- **iii. The 6m separation distances to reflect how they are described in the FPP.**

Drawing titled "Waste Reception & Storage Areas" has been updated to indicate individual piles with explanatory notes describing the pile sizes and/or maximum dimensions.

5 PILE SIZES AND FORM

There is still a lack of clarity regarding the pile sizes of materials at some of the activity locations on the site.

(8) The removed recyclables area is described as storing 25 bales in one pile. Each bale is 1.3 m^3. What are the dimensions of the pile (length x width x height)?

Drawing titled "Waste Reception & Storage Areas" has been updated to indicate clearly the 8 individual recyclate piles with explanatory notes describing the pile sizes and/or maximum dimensions (Individual Piles dimensions 3.5 m wide by 3.5 m long by 4 m high), refer to Appendix A .

(9) The MRF and MBT incoming waste bunkers are adjacent to each other and separated by a bay wall. Each will have 432 m^3 of incoming waste. However, no fire wall is proposed to separate these bays.

i. Explain how the partition wall will be effective at preventing the spread of fire to the neighbouring pile.

ii. Alternatively, provide details of how the two incoming waste piles will be separated by a minimum 6 m separation distance.

*There appears to be confusion in this statement that is not taken directly from the application. There are two separate bays, one for MBT and one for MRF, but they are individually walled and these two side-walls are separated by a clear 6 metres. As stated in Section 3.1.1.1 in the most recent FPP submitted in response to the Clarification request, dated 4 April 2017, "There will be clear separation of 6 metres between the bunker/bay side-walls for incoming MBT wastes and the side-wall for the adjacent feeding bay into the MRF"

Drawing "Waste Reception & Storage Areas" has been updated to indicate clearly the two individual piles, held in concrete walled bays that will be 6 metres apart, with explanatory notes describing the pile sizes and/or maximum dimensions, refer to Appendix A .

(10) In order to determine what the maximum pile sizes should be in relation to the FPP guidance, provide details of the typical particle sizes (mm) of the waste at each stage. Details on maximum pile sizes and particle size can be found in section 9.1 of the FPP guidance.

Drawing "Waste Reception & Storage Areas" has been updated to indicate clearly the individual piles with explanatory notes describing the particle sizes, pile sizes and/or maximum dimensions, refer to Appendix A .

Yours sincerely
FICHTNER Consulting Engineers Limited

James Sturman
Associate Senior Consultant

Nick Claridge
Principal Consultant

Appendix A - Waste Reception & Storage Area Drawing