WREN RENEWABLES LIMITED
RIVENHALL IWMF
OUTLINE FIRE STRATEGY

Document production & approval record				
ISSUE NO. 6	**NAME**	**SIGNATURE**	**POSITION**	**DATE**
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Checked by:	Nick Claridge		Principal Consultant	12/01/15

Document Revision Record				
ISSUE NO.	**DATE**	**DETAILS OF REVISIONS**	**PREPARED BY**	**CHECKED BY**
1	03/09/2014	First issue.	ABM	
2	08/09/2014	Tender Issue	ABM	
3	06/11/2014	Updated following Building Insurance meeting	ABM	
4	09/10/15	Coordinated with Schedule and Drawing updates	ABM	
5	11/01/15	Internal issue - Updated following Building Insurance telephone conference	ABM	NDC
6	24/01/15	Minor updates. Remove reference to ESP.	NDC	
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TABLE 1

1.1. Fire Risk Evaluation

Rivenhall Integrated Waste Management Facility

Building	***Staffing***	***Function***	***Fire Hazard*** (Place of Special Fire Risk to be assessed by EPC contractor; x = no, ✓ = yes,)	***Fuel***	***Fuel Volume*** (to be reviewed by the EPC contractor) Refer to drg 213033 110U	***Fire-fighting Equipment for consideration*** *note - automatic fire detection and manual suppression means to be installed throughout*	***Direct Mitigations for consideration***
Weighbridge	3 persons, Mon to Fri and Sat am		x			-	Fire control for any electrical areas
Paper Pulp Plant	Temporary (Maintenance and Control)	FAS Rooms	✓	Cabinets and electric equipment and fittings		Suppression System	Fire/smoke detection
		Chemical Storage Tanks	✓	Chemicals (refer to Voith Specification)		Suppression System	Fire/smoke detection
		Transformers	✓	Oils/Resins		Suppression System	Fire/smoke detection
		MCC Room	✓	Cabinets and electric equipment and fittings		Suppression System	Fire/smoke detection
		DCS Room	✓	Cabinets and electric equipment and fittings		Suppression System	Fire/smoke detection
		Sludge collection and storage	x			Automatic Sprinkler System	
		Process Area	x			Automatic Sprinkler System	
		Laboratory	x			Fire extinguishers	
		Control Room	x			Fire extinguishers	
		Social and Welfare Facilities	x			Fire extinguishers	
MDIP Storage	Temporary (Despatch)		✓	Paper		Automatic Sprinkler System	First-in first-out (FIFO) stock rotation. Site security to prevent arson.
RCP Storage	Temporary (Delivery)		✓	Paper		Automatic Sprinkler System	FIFO Site security to prevent arson.
Sludge Treatment and Storage	Temporary (Collection and Disposal		x			Automatic Sprinkler System	

Building	***Staffing***	***Function***	***Fire Hazard*** (Place of Special Fire Risk to be assessed by EPC contractor)	***Fuel***	***Fuel Volume*** (to be reviewed by the EPC contractor) Refer to drg 213033 110T	***Fire-fighting Equipment for consideration***	***Direct Mitigations for consideration***
Waste Water Treatment Plant	Temporary (Maintenance and Control)	Chemical Dosing	x			Automatic Sprinkler System	
		Reverse Osmosis Room	x			Automatic Sprinkler System	
		Polymer Room	✓	Synthetic Polymers		Automatic Sprinkler System	Fire/smoke detection
		Evaporation Area and all other Process Areas	x			Automatic Sprinkler System	
		Welfare and Office Facilities	x			Fire extinguishers	
MRF	Temporary (Delivery, Sorting and Despatch.)		✓	n/a to this project		Building structure to accommodate loading from fire sprinkler system.	Independent system to be installed during future contract
MBT	Temporary (Delivery, sort and despatch)		✓	n/a to this project		Building structure to accommodate loading from fire sprinkler system.	Independent system to be installed during future contract
Vehicular Circulation	Temporary (Traffic control and cleaning)		x	EPC contractor		Automatic Sprinkler System	
RDF Reception Hall	Temporary (Traffic control and cleaning)		✓	EPC contractor		Automatic Sprinkler System	
CHP Plant	Temporary (Maintenance and control)		✓	EPC contractor		To be assessed by EPC contractor	
Ash Storage Area	Temporary (Maintenance and control)		✓	EPC contractor		Automatic Sprinkler System	FIFO Site security to prevent arson.
External Plant and Equipment	Temporary (Maintenance and control)		✓	EPC contractor			

Fire-resistant fluid shall be specified and used throughout for all hydraulic systems

TABLE 2

1.2. Fire Strategy Summary

Rivenhall Integrated Waste Management Facility (Section A, Section B and Section C Works)

			The Building Regulations 2010		*NFPA 850 / NFPA 101*
Mandatory Standard	*Aspect of Safety*		*Recommendation*	*Clause*	*Recommendation*
	Building type		Industrial (Normal/Higher Hazard to be assessed for each area)		Special Purpose Industrial Occupancy in NFPA 101
Compartmentation	Maximum Compartment Area		10200sq.m		
	Minimum Resistance of Compartmentation and Elements of Structure		120mins	5.2.1.4	Fire-barriers should have a minimum of 2hrs fire-resistance
				5.2.2.1	Openings in the fire-barrier should have a rating consistent with the barrier. Windows in the barrier should have shutters or an automatic water curtain
Separation	Separation of Office and Industrial Occupations		90mins	5.2.1.1 - 3	The electrical generation and high voltage D.C converter station should be subdivided into separate fire areas, separated by fire-barriers.
	Separation of Works			9.5.2.3	It is recommended, as a minimum, fire area boundaries be provided to separate the receiving/storage area and the processing area
				40.2.5.1.2	New ancillary facilities in special-purpose industrial occupancies shall have not less than 2hr fire resistance rated separation from the predominant industrial occupancy, and shall have one means of egress that is also separated by 2hr construction
	Separation Combustibility		Non-combustible materials	5.4.2	Construction materials should be non-combustible or of limited combustibility
	Supporting Structure		Non-combustible, 120mins fire-resistance	7.1.3.2.1(5)	2-hour fire resistance-rated separation shall be supported by construction having a minimum 2-hour fire resistance rating
	Transformer Separation			5.2.4.3 and Table 5.2.4.3	Transformer with 1890-18925l of oil requires a minimum of 7.6m separation or by a 2hr-rated firewall
Structural Protection	Protection of Elements of Structure		120mins	7.1.3.2.1(5)	2-hour fire resistance-rated separation shall be supported by construction having a minimum 2-hour fire resistance rating
Cavities	Cavity Length		20 metre maximum cavity length		
Internal Linings	Classification of linings		National class 0	5.4.5.2 - 3	Interior finishing in buildings critical to power generation should be Class A. Class A or B may be used in those not critical to generation
External Walls	Fire Resistance of External Walls		Document B, Sections 12 and 13		
Spread on External Walls	External Wall Cladding		Document B, Section 13		

			The Building Regulations 2010	***NFPA 850 / NFPA 101***	
Spread From Neighbouring Buildings	Roof Coverings		Document B, Section 13	5.4.4	Roof coverings should be Class A to NFPA 256 or Class I (or fire classified) where a metal deck is used
Means of Escape	Maximum Travel Distance		25m/45m for normal hazard, 12m/25m for higher hazard	40.2.6	122m maximum travel to exit, max 15m dead end, 30m common path of travel (all sprinklered)
	Minimum Number of Exits		1 / 2 for storey height <7.5m / >7.5m	40.2.4.1.1	Not less than two means of egress from every storey or section, not less than one exit without traversing another storey
	Minimum Escape Widths		1050mm/850mm	7.2.1.2.3.2 (3)	710mm Minimum widths for Corridors / Doors (provided for access required for occupants with severe mobility impairments)
	Door Swing		With direction of escape unless justified by assessment	7.2.1.4.2 (1)	Door may swing either way when serving less than 50 occupants
	Minimum Stair Width		1000mm	7.2.2.2.1.2 (A)	915mm where serving less than 50 occupants
	External Escape Stairs		Where top storey <7.5m no enclosure is required, >7.5 subject to discussions with approving authority	7.2.2.6.2 7.2.2.6.3.1	Stairs above 11m from ground level required an opaque visual barrier not less than 1220mm in height. Protected from the interior by the same resistance as enclosed stairs.
Escape Lighting	Emergency Lighting		An assessment is required to justify the omission of emergency lighting from any areas	5.7.2	Emergency lighting should be provided for critical plant operation areas
				40.2.9.2	Emergency lighting shall not be required for special-purpose industrial occupancies without routine human habitation
Communication	Evacuation Method		Determined at design stage		
	Detection		System selection based on risk	6.7.1 - 2	Automatic Detectors should be installed according to NFPA 72. Manual devices should be installed in all occupied buildings
	Alarm			6.7.3	Plant wide audible fire alarm or voice communication or both should be installed for evacuation and alerting of plant emergency organisation
Fire and Rescue Service Access	Access Provision		Vehicle access to at least one elevation where principle entrances are located		
	Vehicle Access Routes		High Reach - 3.7m Width, 4m Clearance, 26m Turning Circle, Pumping Appliance - 3.7m Width, 3.7m Clearance, 16.8m Turning Circle		
	Hardstanding		6x20m Operating Space, within 2.2m of building		

		The Building Regulations 2010		*NFPA 850* / *NFPA 101*	
Fire and Rescue Service Water Supply	Water Supply		To be determined by the Contractor and agreed with the Purchaser's insurers. It is anticipated that the 'Upper Lagoon' will satisfy any requirements.	6.2.1	The water supply should be based upon providing a 2hr supply to both that required by any fixed fire suppression system and a hose stream of not less than 1890l/min
	Public Water Supply		Hydrants within 60m of an entrance and all elevations, at least 12m from building with adjacent parking for an appliance	6.4.1.1	Hydrant spacing should be a maximum of 91m
	Alternative Water Supply			6.2.6.1 - 2	Water tanks should be sufficient to provide the supply required by 6.2.1 and should be replenishable within 8hrs
Fire and Rescue Service Facilities	Required Facilities		Fire-fighting stair, lift, lobby, ventilation, dry main to be discussed with fire service due to unique building circumstances. (Technically single storey but with upper levels).		
	Fire Fighting Stairs		Min 1m width, Long fire resistance duration		
	Fire Fighting Lift		If required, within protected zone and within its own medium resistance compartment		
	Fire Fighting Lobbies		If require, located in protected zone and provided on every storey, at least 5sq.m in area and 1.5m in each direction		
	Heat and Smoke Control		Ventilator at least 1sq.m at the top of any required fire-fighting stairs		
	General Smoke Control		Smoke control is required throughout the Facility		
	General Heat Control		An assessment is required for all storage areas		
	Fire Mains	2.14.7	Dry fire main, inlet not more than 18m from appliance hardstanding, outlets on every storey	6.4.2.1	Standpipe and hose systems should be installed
	Drainage			5.6.1	Provision should may made in all fire areas for the removal or containment of liquids without the flooding of equipment or endangering other areas (in the event of sprinkler activation / hose use)
Automatic Fire Suppression Systems	Provision of Suppression		No Requirement	9.5.4.2	Storage Areas should have automatic sprinklers throughout
	Explosion Protection		Requirements to be confirmed by the Contractor during detailed design for Section A, Section B and section C Works	9.5.2.2 and 9.5.4.2	Particle size less than 80 mesh and moisture content less than 30% presents an explosion risk. Where present explosion venting or suppression should be provided

1.3. Overview

This outline fire strategy is based upon the following points:

- This strategy for compliance with the Building Regulations 2010 uses Fire Safety, Approved Document B, Fire Safety for Buildings other than Dwelling houses as guidance for meeting the life safety requirements.
- Guidance for property protection and management in NFPA 850 *Recommended Practice for Fire Protection of Electric Generating Plants* (with reference to NFPA 101) for fire protection in electric generating plants is considered, along with that contained in the following ACE Technical Guide:

  - Energy from Waste EfW - Fire Systems. (Issue 1.0, 26 March 2014)

  - Waste Processing Plants - Fire Systems (Issue 1.0, 26 March 2014)

It is not intended that this document provides a complete fire strategy but to indicate design assumptions, opportunities for cost reduction, the required safety systems and areas of protection to be incorporated into subsequent design iterations. These points shall be evaluated as part of the full fire risk evaluation and fire strategy which shall be undertaken by the Contractor. The proposals contained in this document are subject to discussions with Building Control, the Fire and Rescue Service, Purchaser and its insurers and may be subject to revision.

It is stressed that early consultation and coordination with ACE is essential to progress and complete the Detailed Fire Strategy for the Site.

1.4. Proposal

The proposed scheme is an integrated waste managed facility to provide steam to a paper pulping plant and will generate electricity. The main building rises from a general floor slab level of 35.0m AOD to a maximum roof level of 60.75m with a range of suppression systems proposed for the protection of areas of heightened fire risk.

1.5. Key Fire Safety Issues

The following table sets out issues requiring discussion between the Contractor and various stakeholders.

Issue	Comment
Fire Risk Evaluation	The fire risk evaluation in 1.1 has been prepared using a combination of provided information and information generic to Energy from Waste plants and this Facility. This should be reviewed by the Contractor and amended as necessary for the purposes of the fire strategy developed by the Contractor.
Travel Distances	Travel distances of up to 25m (one direction) and 45m (more than one direction) are considered as acceptable for normal hazard industrial premises. The Contractor shall undertake a risk assessment to determine levels of fire hazards and interaction of stored substances[and determine appropriate travel distances. The Contractor shall seek an exemption with Building Control based upon low occupancy, low fire risk and familiarity of occupants for relevant areas of the Facility. Fire safety engineering can provide an alternative approach to fire safety. This shall be investigated by the Contractor.

	It is possible that an underground, protected concrete "tunnel" may be required to provide a safe means of escape from some areas in the event of a fire.
Escape from upper levels	Two directions of escape are required from occupied upper levels. Alternative exits shall be investigated for these areas.
Roof Access	Safe access to roof areas needs to be reviewed as roof openings are not permitted.
Suppression	Suppression details to be discussed with Purchaser and its Insurers. Details of electrical installations within the facility are required to assess the appropriate method of suppression.
Fire-fighting Shaft	The Facility is to be regarded as single storey, but contains upper floors, some of which will be open mesh grating. The requirement and specification of any fire-fighting shafts are dependent on height. It is currently anticipated that protected staircases and dry risers be provided, however this will require discussion and confirmation with the fire service and Building Control.
Water Supply	An adequate water supply for both the sprinkler systems and fire service use is required and should be discussed with the fire service and Purchaser's insurers. It is anticipated that the Upper Lagoon will satisfy the water supply requirement.
Smoke Venting	Smoke and heat venting shall be provided if recommended as an outcome of the Contractor's final fire stratey, based upon an assessment of the fire risks presented. However, the Contractor shall considerthe smoke reservoir space available in the compartmentsas the Planning permission does not currently allow roof ventilation. This issue should be discussed with the Purchaser, Building Control and the fire service.
'Blast' Walls	Fire walls, designed for 34kN/m^2, have been specified around oil filled transformers. These are not required by the design standards, and should be assessed based on the transformer specifications.
Fire-resistant construction	Separation of the various areas is required for insurance and property protection purposes and the strategy should be discussed with the Purchaser's insurers.
Structural Fire Protection	The provision of fire-protection to the structure supporting the fire separation walls may be assessed using fire-engineering methods to examine the potential for savings which shall be the subject of the Variation under the Contract. This approach should be discussed with Building Control. An agreement on the fire separation strategy should be achieved before this is conducted.
Building Separation	Separation to the other buildings on site and to site boundaries shall be considered.

1.6. Occupation

At least two staff are expected to be permanently located within the respective control rooms of the CHP Plant, Pulp Plant and WWTP. The process areas of each plant s are normally unoccupied, except during daily routine monitoring or maintenance which is typically performed by 4 to 6 members of staff during normal working hours. In addition mechanical/electrical and C&I maintenance will be carried out in workshops. Approximately 5 management/admin staff will be present in the office areas of the respective plants during normal working hours Monday to Friday.

A total of approx. 90 employees will be employed within the facility, 30 to 40 during the day, the remainder working shifts. The employees will be divided approximately equally between the three Sections

Deliveries to the site take place Monday to Friday, 0700 to 1830 hours and Saturday 0700 to 1300 hours only. Three employees will be located in the weighbridge office.

There will be a visitor's centre off site at Woodhouse Farm with the number of visitors to the facility limited to a maximum of 30 persons. A 'bridge' with access to the CHP Plant offices and control room will be provided by the Contractor as part of the civil engineering and building works for the Site.

1.7. Separation, Compartmentation and Structural Protection

Areas with a heightened chance of fire are to be considered 'areas of special fire risk', and should be protected accordingly.

The following areas are considered areas of special fire risk under NFPA 850 and will require separation through fire-resistant construction (indoor) or by distance (outdoor). The design of these areas shall be reviewed and agreed with the Purchaser's insurer:

- Pulp Plant
- Material Deinking Pulp (MDIP) Despatch
- Recovered Waste Paper (RCP) Storage
- RCP feed to process area
- Sludge Storage
- RDF Reception Hall
- Waste Bunker
- Boiler House
- Turbine Hall
- Ash Hall
- Transformer Rooms
- Switchgear and Battery Rooms
- Electric Rooms
- Oil tanks and flammable stores
- Vehicle circulation areas
- Stores
- Workshops
- Treatment Plant
- Offices and Welfare

All areas are to be considered single storey for the purposes of compartmentation and protection. This assumption generally requires that less than half the available floor area of each storey is solid, however engagement with Building Control at an early stage is recommended to ensure this point will be permitted going forward.

NFPA 850 recommends that fire-resistant barriers rated to 2 hours are installed to provide separation of the areas of special fire risk from each other and the rest of the building. Any doors, shutters or penetrations through these walls should also have a fire-resistance rating of 2 hours of protection in accordance with NFPA 850.

Where fire-resistant separation is installed, the supporting structure is recommended to be protected to at least the same rating as the separation – 2 hours in the case of the areas of special fire risk.

2 hours of fire resistance all offices and welfare facilities and the process/industrial areas is required, with one hour fire protection required for the structural elements of the office and welfare areas.

Any external escape stairs should be protected against the outbreak of fire within the building by a wall of minimum 30-minute fire resistance extending not less than 2m from the staircase. Any fire-fighting staircase requires a long fire-resistance rating (120mins), although this is required only for the wall separating it from the process areas and is not required for the three other enclosing walls. This should be confirmed with the fire service.

The Purchaser's insurer is likely to require120 minutes of separation to be provided between the different areas of the facility.

The supporting structure of the 2hr compartment wall is recommended to be provided with 2hrs of fire protection according to the NFPA. Within the process areas, where the compartment is large and the volume of combustible material is

low, there is the potential for taking a performance based approach and conducting structural fire calculations. These may show that the 2hrs of support can be provided either without, or with a reduced thickness of fire resistant coatings. This approached should be confirmed with the Building Control before undertaking to ensure that it will be deemed as an acceptable alternative.

1.8. Detection and Alarm

The fire alarm and detection system shall be of an L1 standard, according to BS5839-1, and shall include manual call points. Point detection should be provided in the building. It is proposed that all parts of the building evacuate simultaneously on the detection of a fire in any part, and a facility wide audible fire alarm be installed for evacuation and for alerting the plant emergency organisation.

1.9. Means of Escape

The means of escape strategy shall consider egress through both protected staircases and horizontal exits to adjacent compartments.

However, due to the size of the overall facility a protected concrete “underpass” may be required for escape.

Due to the low occupancy of this facility, staircases are required for the providing multiple directions of escape rather than for accommodating occupant numbers.

Emergency lighting shall be provided in all areas of special fire risk and in areas critical to the operation of the facility.

1.10. Fire Spread

All construction materials are recommended to be non-combustible, with linings in accordance with Sections B2, B3 and B4 of the Building Regulations.

Cavities over 20m in length should be divided to prevent the unseen spread of fire between areas or fire compartments.

1.11. Fire Service Access and Facilities

Access is provided to 100% of the perimeter of the Site using the one-way traffic roadway.

A water supply is required to be available that is sized for simultaneous use by both the fire service and by any automated suppression systems that are installed. It is anticipated that the “upper lagoon”, maintained capacity of approx. 25,000m³ will be adequate to satisfy the requirements of the Purchaser’s insurers. Further recommendations from NFPA850 include that a minimum of 2hrs of supply should be available and that any water supply should be replenishable within an 8hr period. These aspects shall be subject to Contractor’s discussions with the fire service and the Purchaser’s insurers in order to determine the required provision.

The abstraction of process water and fire water shall be agreed with the Purchaser’s insurers with full details of level control from New Field (and possibly Sheepcote) Lagoon.

Fire mains and hydrants are required in accordance with Section B5 of the Building Regulations.

1.12. Provision of Suppression and Explosion Protection

The following systems are recommended for the suppression of fires and for reducing the risks posed by explosions:

- NFPA 850 recommends that an automatic sprinkler and water mist system should be installed throughout fuel storage, reception and bunker areas. Water cannons are also required to the bunker area. Although not re-

quired by the Building Regulations, these systems are beneficial for the purpose of reducing fire growth in further areas and a water mist system is recommended for use in the turbine hall over the base of the turbine equipment, feed oil lines and further areas of fuel or biomass storage.

- A dry pipe system should be employed to prevent maintenance issues due to freezing.
- Electrical rooms, including the MV/LV switchgear, battery and transformer rooms should have a gaseous suppression system.
- Explosion venting or suppression is recommended in the transformer room.
- ATEX rated equipment is designed to reduce the risk of the igniting an explosive atmosphere, and is recommended for use where there is the possibility of an accumulation of airborne dust particles in storage areas.
- Portable suppression provision lies with the operator of the building, depending on the risk the extinguisher is required to cover all mobile foam trolleys are recommended to be provided to deal with a range of possible fire sizes on site, operated by appropriately trained staff.

1.13. Hydraulic Systems

Fire resistant fluid (FM approved) shall be specified for all hydraulic systems.

1.14. Smoke Control

Automatic smoke and heat venting should be provided for all process, storage and circulation areas and should be considered in the control room, cable spreading rooms and switchgear room. Local manual operation should be provided in addition to remote operation from the control room.

1.15. Drainage

Drains shall be designed to receive 10 minutes of fire water flow.

1.16. Management

Management issues should be addressed in the full fire strategy document.