Appendix A Accident Risk Assessment

Hazardous Event			Risk Assessment			Controls and Mitigations	Mitigation Factor	Residual Risk
Event	Pathway	Receptor	Frequency	Consequence	Risk			
1. *Material Delivery (Raw Materials, Waste)*								
Major vehicle accident – leading to a significant loss of reagents	• Air • Water • Land	• Staff • Public	3	2	6	• Site speed restrictions in place and compliance with highway speed restrictions • Approved carriers (i.e. trained hauliers employed by MVV) • Material clean-up arrangements in place • Road vehicles are robust and designed to withstand high speed collisions that may occur on public highways	5	1.2
Waste material loss from delivery vehicle	• Air • Water • Land	• Staff • Public	6	2	12	• All loads will be fully covered during transport • Site speed restrictions in place • Approved carriers (i.e. trained hauliers employed by MVV) • Material clean-up arrangements in place	4	3
Delivery of non-permitted waste	• Air • Water • Land	• Staff	3	2	6	• Facility will receive wastes delivered by Waste Collection Authority (WCA) and their contractors • Site will operate an authorised vehicle registration system • All loads will be visually checked against the details provided on the waste transfer documentation • All loads will be visually inspected at the point of discharge/off-loading • Non-permitted waste identified will be quarantined and transfer arranged to a suitably licensed facility	4	1.5
Silo (PAC/ urea/ sodium bicarbonate) overfills	• Air • Water • Land	• Staff	4	2	8	• Silo fitted with level alarm connected to the control system that will cause discharge into silo to be automatically stopped • Silos are equipped with local dust filter and over-pressure control	6	1.34
Dust release during discharge into silo (PAC/ Urea/ bicarbonate)	• Air • Land	• Staff	4	2	8	• Silo design in accordance with appropriate design, fabrication and safety standards • Silo equipped with local dust filter and over-pressure protection. • Load discharge supervised in accordance with operational procedures	6	1.34
2. ***Waste Storage***								
Inappropriate waste storage for incoming waste streams	• Water • Land	• Staff • Public	3	1	3	• Wastes accepted at the facility will be off-loaded to the relevant storage area • Wastes accepted will be discharged into reception pit within enclosed reception hall – pit can facilitate up to 10 days waste storage and the bale store can facilitate further 18 days waste storage	5	0.6
Fire in reception hall, waste bunker or bale-store area	• Air • Water	• Staff	4	2	8	• Turnover of waste in the bunker • CCTV observation of bunker from control room • Infra red fire detection and water deluge system in place • Fire waters can be contained in bunker and sampled prior to sewer discharge or removal by tanker • Emergency procedure in place	5	1.6
Fugitive release during transport of waste (cranes/conveyors)	• Air • Water	• Staff	3	1	3	• Waste movement will be undertaken by overhead gantry cranes within the fully enclosed treatment buildings • Transfer of reagents (bicarbonate / PAC / UREA) APC residue will be undertaken mechanically in enclosed conveyors and contained in storage silos	5	0.6
3. Raw Material / Reagent Storage								
Fugitive release from storage silo (PAC /Urea/ bicarbonate)	• Air • Water • Land	• Staff • Public	4	1	4	• Silo design is in accordance with appropriate design, fabrication and safety standards • Silo equipped with local dust filter	6	0.67
Fire/explosion in PAC silo and handling system	• Air • Water • Land	• Staff	2	3	6	• Silo design in accordance with appropriate design, fabrication and safety standards • Plant and equipment is earthed to dissipate electrostatic charge as an ignition source • PAC has a relatively high ignition temperature? • Silo provided with nitrogen blanketing system.	5	1.2
Rupture of PAC/ Bicarbonate / Urea silo due to accidental damage or spontaneous rupture of tank	• Air • Water	• Staff	1	3	3	• Vents on silo are designed to minimise back-pressure problems • Routine inspection and maintenance of silos • Silos are either elevated above vehicle manoeuvring areas and within enclosures. • .	5	0.3
Uncontrolled release of bicarbonate from mixing tank/ container	• Air • Land • Water	• Staff • Public	3	3	9	• Bicarbonate dossing rates confirmed at commissioning and verified with extractive emissions monitoring of relevant species and controlled by continuous measurement of emission levels. • Fill / level detection system on silo • Silo discharge within enclosure and containment system to prevent release onto land	5	1.8
Uncontrolled release of Urea from mixing tank/ container	• Air • Water	• Staff	3	3	9	• Vents on mixing container are designed to minimise back-pressure problems • Transport system from silo to mixing container equipped with local dust filter • Routine inspection and maintenance of mixing container and associated equipment • Mixing container bunded and contained within building • UREA dosing rates confirmed at commissioning and verified with extractive emissions monitoring of relevant species	5	1.8

Hazardous Event			Risk Assessment			Controls and Mitigations	Mitigation Factor	Residual Risk
Event	Pathway	Receptor	Frequency	Consequence	Risk			
						and controlled by continuous measurement of emission levels • Fill / level detection system on silo and mixing tank • Bund/collection system to prevent release onto land.		
4. ***EfW Combustion Process***								
Fire in furnace feed chute/hopper	• Air • Water	• Staff	3	2	6	• Feed chute is monitored by operators using CCTV linked to control room • Mixed waste feed in the feed chute effectively acts as a sealing plug • Fire detection and sprinkler system in place • Emergency response procedure in place	5	1.2
Back flow of combustion gases into feed chute	• Air	• Staff	3	1	3	• Suction within the furnace created by ID fan • ID fan provided with auxiliary drive motor • Suction maintained for short period by effect of main stack in event of total ID fan failure – allows controlled plant shutdown • Mixed waste feed in the feed chute effectively acts as a sealing plug • Level detection in feed hopper and alarms set within the automated control system • Extraction of tipping hall air to the combustion process	5	0.6
Furnace exhaust temperature falls below 850^{O}C	• Air	• Local habitat	4	1	4	• Automated control system has alarms linked to activation of automatic waste feed shutdown and operation of the auxiliary fuel systems • Temperature and other design basis operating parameters to be monitored continuously • Deviations from specified operating criteria will trigger restorative action via the automated control system	6	0.67
Pressure surge in combustion system	• Air • Noise	• Staff	3	4	12	• Pressure monitoring undertaken as part of automated control system and interlocks will be activated as appropriate • Emergency shutdown can be implemented if necessitated	6	2.0
Leak of gas oil (support fuel)	• Air • Water	• Staff • Public	3	1	3	• Contained site storage within building • Bunded tanks • Tanks and pipelines designed in accordance with current fuel oil storage regulations • Routine plant checks should identify leaks by odour	6	0.5
Fire due to ignition of gas oil (support fuel)	• Air • Water	• Staff • Public	2	3	6	• Contained site storage within building • Pipelines designed in accordance with current gas supply regulations • Appropriate fire detection and protection systems. • Routine plant checks should identify leaks by odour	6	1
5. ***Steam System/Power Generation***								
Steam leak to process buildings	• Air • Noise	• Staff	3	3	9	• Appropriate design, fabrication and inspection standards for steam systems will be employed • Statutory inspection and maintenance programme in place • Automated control system has controls and alarms for pressure • Routine operator checks should identify increased noise and/or visual leak • Initiate emergency evacuation procedures	6	1.5
Steam safety valve failure	• Air • Noise	• Staff • Public	2	2	4	• Appropriate design, fabrication and inspection standards for steam systems will be employed • Statutory inspection and maintenance programme in place • Automated control system has controls and alarms for pressure • Routine operator checks should identify increased noise and/or visual leak	6	0.67
Leak of lube or seal oil from turbo-alternator	• Water • Land	• Staff • Public	2	1	2	• Flanged connections kept to a minimum • Use of appropriate design and fabrication standards • Operator/preventative maintenance checks • Impervious floor slabs	5	0.4
Major vibration due to rotating machinery being out of balance	• Noise	• Staff • Public	2	2	4	• Use of anti-vibration mountings • Vibration monitors installed and automatic plant shutdown for turbine generator • Routine operator checks	5	0.8
6. ***Abatement System***								
Significant leak of flue gas to air before abatement (e.g. due to over-pressure, material defect, corrosion)	• Air • Land • Noise	• Staff	3	3	9	• System design in accordance with appropriate design and fabrication standards • System operates under negative pressure • Preventative maintenance strategy comprising routine inspections and planned maintenance • Automated control system has alarms and controls linked to system pressure and continuous emission monitoring • Automated controlled shutdown in the event of emergency situation	5	1.8
Fire/explosion in fabric filter	• Air • Water • Noise	• Staff • Public	2	3	6	• Low content of PAC (<1%) in the extracted APC residue • PAC dosing rates confirmed at commissioning and verified with extractive emissions monitoring of relevant species • PAC has an ignition temperature in excess of flue gas temperature • Filter provided with nitrogen blanketing system	6	1.0
Failure of main exhaust fan	• Air	• Staff	3	1	3	• Loss of flow or suction pressure in the fan will disable the furnace feed system and an immediate controlled	5	0.6

						shutdown of the plant will occur • ID fan provided with auxiliary motor.		
Emission limit values exceeded	• Air • Land • Water	• Public • Local habitats	4	2	8	• Operators will be fully trained in plant operation and emissions control procedures. • Emissions are continuously monitored in line with WID requirements • Process will be operated in strict compliance with start-up, operating and shutdown procedures • Automated SCADA control system is programmed with alarms and interlocks on main items of plant – automated waste feed interlock will activate in the event of ELV exceedance due to failure/fault on abatement equipment	5	1.6
7. ***Ash Handling and Disposal***								
Failure of ash discharger water seal	• Air • Water	• staff	1	2	2	• Negative pressure is maintained in furnace system at the ash discharger • Low water level alarm in ash discharger • Dual water supply from recirculated process water and mains	6	0.33
Fire Risk	• Air • Water	• staff	2	2	4	• Level alarms for water and ash in the discharger to prevent overfilling and over-heating • Water bath conveyor to cool ash • Conveyor discharges directly into ash bunker	6	0.6
Overflow of water from ash quench	• Water	• staff	2	1	2	• Use of impervious concrete floor slabs • Level monitoring will be employed • Routine operator inspections • Excess water can be discharged to foul sewer providing discharge consent limits can be met – otherwise material can be stored and removed by tanker form site	5	0.4
Spillage of bottom ash	• Air • Water • Land	• Surface or ground water • staff	5	1	5	• Low levels alarms will be employed for water in the ash discharger • Use of impervious concrete floor slabs underlain with HDPE leachate resistant membrane • Routine operator checks • Clean-up response procedures and equipment will be in place	5	1
Spillage of APC residue	• Air • Water • Land	• Surface or ground water • staff	3	2	6	• Material transported by enclosed conveyor systems between bag filter and storage silo • Dedicated storage silos equipped with level alarms and local dust filter • Discharge to road tanker via dedicated discharge points and in accordance with supervised discharge procedures • Discharge area enclosed.	5	1.2
8. ***General Site Issues***								
Ineffective firewater containment	• Water	• Surface or ground water	2	3	6	• Drainage system will be provided with isolation valves on the outlet so that potentially contaminated firewater can be contained, tested and removed by tanker if not suitable for discharge • Internal buildings will be equipped with a perimeter bund for containment of process/fire waters to facilitate collection of the water, testing and transfer off-site by tanker in the event that discharge to sewer cannot be undertaken	5	1.2
Flood Risk	• Water	• Surface or ground water	1	4	4	• The combined analysis hydraulic modelling study has demonstrated that the proposed EfW CHP facility is located on land outside of the fluvial and tidal extents for Flood Zone 3, Flood Zone 2 and Flood Zone 3 including climate change. Therefore the built development site is considered to be within Flood Zone 1; • Localised flood risk from surface water, sewers and artificial flood sources has been reviewed and are considered to pose a low risk to the site and access roads. • Site drainage has been designed taking 1:30 year and 1:100 year flood events • Flood risk assessment undertaken to verify flood risk status	6	0.67
Wrong connection in drainage system	• Water	• Surface or ground water	1	4	4	• Drainage design undertaken by suitably qualified engineers • Drainage design has been completed using appropriate modelling software • Construction of drainage will be undertaken in accordance with the specified designs and inspected and tested.	6	0.67
Main services failure	• Air • Water	• Staff • Public	4	1	4	• Facility can operate in island mode on loss of grid connection • Failure of site generating capacity will result in power being drawn from the local grid • Failure of both site generating capacity and service from the local grid will result in an emergency generator being utilised and UPS system provided for critical systems • Automated control system will operate an independent emergency shutdown programme to effect shutdown of the facility in safe mode in the event of long term service failure	5	0.8
Contamination carried onto highway	• Water • Land	• Public	5	2	10	• All incoming and outgoing loads will be sheeted • All internal roads, storage and processing areas will be hard-surfaced with concrete or tarmac, and swept regularly	5	2
Operator Error	• Air • Water • Land	• Staff • Public	3	3	9	• Automatic process control minimises likelihood and consequences of operator error • Provision of appropriate operator training • Technically competent person available at site • Internal operational control procedures • Strict compliance with site integrated management system	5	1.8
Site Security Breach resulting in	• Air	• Staff	4	3	12	• Site secured by a perimeter fence and lockable gates	5	2.4

vandalism/plant damage/accidental releases	• Water • Land	• Public • Surface or ground water				• Site monitored by CCTV • Site manned 24 hours a day and 7 days per week • All process buildings utilise lockable doors and security access system		
Failure of odour control systems	• Air	• Staff • Public	2	3	6	• Routine odour checks by staff • Air from within the waste tipping hall, waste bunker and bale store areas will be used as combustion air during normal facility operation and will be extracted via a carbon filter during periods when the furnace is stopped. • Tipping halls and bale store area will be equipped with fast acting roller doors. • Tipping hall, waste bunker and bale store will be maintained under slight negative pressure. • Air extraction system maintenance and checking	5	1.2
Fire/ explosion risk	• Air • Water • Land • Noise	• Surface or ground water • Public • staff	3	5	15	• The site has been designed in accordance with the Regulatory Reform (Fire Safety) Order 2005 and comprehensive fire detection and protection systems will be installed to NFPA 850 standards • Site will operate a defined emergency management procedure and drills/tests will be completed at defined intervals. • All fire detection and control systems will be routinely inspected and maintained • Plant automated control system is designed with an independent emergency control system that will automatically shut down the plant in safe mode minimising the potential for risk to human health	5	3
Release of effluent before monitoring checks have been completed	• Water	• Surface or ground water	4	3	12	• Contaminated surface, process or fire waters storage containment available to facilitate testing prior to release • All discharges will be undertaken to foul sewer in accordance with a trade effluent discharge consent • Surface water and process water will be reused on site where practicable	4	3
Equipment or plant fire (e.g. cabling faults)	• Air • Water	• Staff • Surface or ground water	3	3	9	• Plant/equipment will be designed in accordance with relevant design and fabrication standards • Preventative maintenance will include regulator inspection and maintenance regimes • Local fire extinguishers will be provided where identified in the fire risk assessment • Comprehensive fire detection protection systems throughout the process buildings to NFPA 850 standards	5	1.8