FRC LA-IPPC Supporting Document

Freedom Resource Conversion Application Checklist

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Introduction

Freedom Resource Conversion (FRC) propose to develop a pyrolysis installation that will produce 'end of waste' oils from specified waste materials. The end of waste oils will be utilised as fuel oils, solvents or diluents such as those used in cleaning fluids and/or coating industries. End of life plastic feedstock will be supplied from a range of mixed plastics which are currently being disposed of to landfill or sent for incineration/energy recovery. Freedom Resource Conversion technology will convert these materials into a liquid pyrolysis oil. It is anticipated that an off-take agreement for the pyrolysis oil will be in situ ahead of the commissioning of the first unit. All pyrolysis oil will be sold and taken off-site via tankers to end customers.

Name of Operator	Freedom Resource Conversion (FRC)
Activity Address	Freedom Farm
	Cowle's Drove
	Hockwold, Thetford
	IP26 4JQ
National Grid Reference	TL 71755 87355

Appendix 1 – Site Plans (Section 4)

Site & Installation Boundary Plan	Figure 1
Plant Schematic	Figure 2

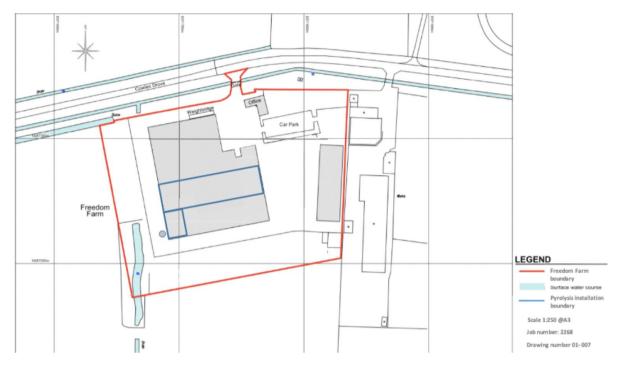


Figure 1 - Installation boundary – Freedom Farm (red), FRC (blue)

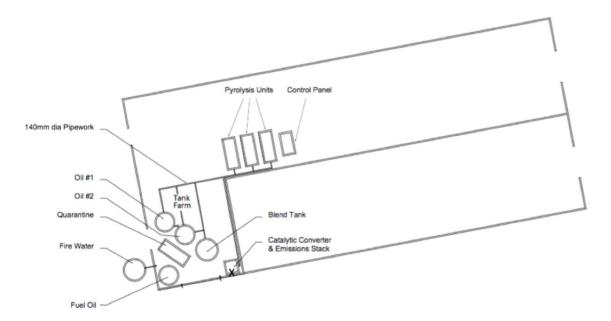


Figure 2 – FRC plant schematic

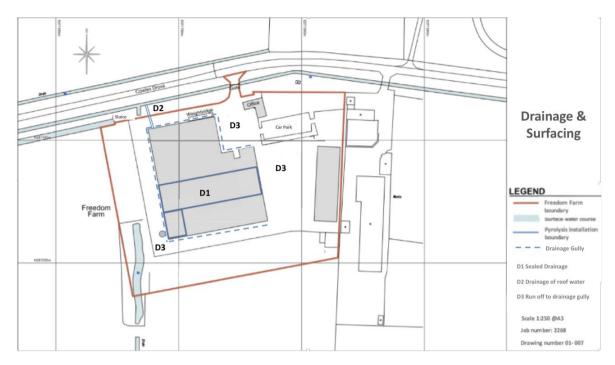


Figure 3 – Drainage and surfacing

<u>The Site</u>

The Site is located at an existing Material Recycling Facility at Freedom Farm, Cowles Drove, Hockwold, Thetford, Norfolk, IP26 4JQ. The national grid reference TL 71755 87355 and its existing curtilage area is approximately 2.64 ha. The site is situated in a predominantly rural area/open countryside outside the recognised development limit for the nearest settlement and is accessed via Cowles Drove. To the west of the site, along Cowles Drive is a soils recycling operation; beyond this are a number of farms. To the immediate north is Cowles Drove with farmland beyond. East of the Site is an engineering company with residential properties and a Riding Centre nearer to the B1112. To the south is open country down to earth bank flood defences with the Little River Ouse beyond.

The site is currently operated as a Materials Recycling Facility by Freedom Recycling Ltd. Freedom Recycling currently operates the site in accordance with planning permission Ref. C/2/2006/2001 issued on 16 January 2007 (copy included in Appendix 1) and Environmental Permit EAWML/75188 (the Permit) issued by the Environment Agency on 22 January 2007. The site is therefore regulated by both Norfolk County Council as local planning authority and by the Environment Agency.

Freedom Farm MRF has been operated by Freedom Recycling since 2006. Under its existing planning permission, the installation/site is described as " a material recycling facility to recover, reuse and recycle wastes through separation, bulking and transfer of household and commercial wastes". The waste is delivered to site and held within the designated holding area. Thereafter in undergoes a number of operations as prescribed by permit before being taken off site. The proposed pyrolysis activity will be situated within the existing sorting warehouse which is divided into separate buildings/areas. The site is occupied by a large "L" shaped warehouse of approximately 6,000 m2 floor area located in the centre of the Site, marked in Appendix 1, Figure 1.

Appendix 2 – Waste types and activities (Section 5)

Section 5.1 - Waste types for conversion

The feed stocks will include waste streams in the table below. The Freedom Farm site already has the permit to receive these wastes under the sites existing Environmental Permit EAWML/75188.

Waste Code	Description
20 01 39	Municipal plastics
15 01 02	Plastic packaging
02 01 04	Agricultural films
07 02 13	Waste plastic from plastic manufacturing
12 01 05	Plastic turnings and shavings
16 01 19	Plastics from end of life vehicles
17 02 03	Plastic from construction
19 12 04	Plastics from waste treatment facilities

Table 1 – List of Waste Codes for sources of plastics for pyrolysis

The primary feedstock for the process will be Polyethylene (LDPE) and mixed rigid plastics (HDPE) that are currently destined for landfill disposal or incineration. Plastic bags, films and trays will be sourced from in-store retailer collection points and directly from manufacturing sites.

The current Environmental Permit for Freedom Farm sites makes the provision to manage up to 50,000 tonnes of waste per annum. FRC would have the potential to process 10,000 tonnes of this provision.

Section 5.2 - Delivery and Reception of Waste

Freedom Resource Conversion will utilise end of life plastics solely supplied by Freedom Recycling under their existing permit. Feedstocks will be sourced from Norfolk and the surrounding regions. These plastics are currently being disposed of to landfill or incinerated. The End of Life plastics will be handled, sorted and prepared by Freedom Recycling before being delivered to FRC prior to conversion.

All plastics delivered to Freedom Recycling will be assessed accordingly and weighed using the onsite weighbridge. Accepted materials will be unloaded and stored on hard standing within the Freedom Recycling buildings in accordance with their current permit.

Plastics consisting of the appropriate polymer types of LDPE (low density polyethylene), HDPE (high density polyethylene) and PP (polypropylene) will be further hand sorted by Freedom Recycling prior to its preparation and supplied as a feedstock to FRC.

Feedstocks will be batch coded and weighed and placed into containers prior to supply to FRC. FRC will store the minimum quantities of required feedstock within its facility prior to loading it into the feedstock hoppers.

Section 5.3 - Information about waste arriving at the site

End of life plastics supplied by Freedom Recycling shall have a unique delivery and batch numbers. Batch numbers shall be used for audit trail purposes to identify the source of plastic used by FRC as well as information relating to the date and individuals involved in its preparation. Representative samples of feedstock batches will be maintained for quality assurance purposes.

The pyrolysis plant will utilise End of Life plastics with European Waste Catalogue codes as tabulated in table 1 above. Standard checks will be made on all the paperwork accompanying each

delivery so that only appropriate polymer types meeting the required criteria will be accepted, i.e. consisting only of carbon and hydrogen with no other pollutants.

Feedstock Consistency

Only plastic materials with known polymer streams, supplied and prepared by Freedom Recycling will be accepted for use by FRC. The consistency of pre-treated feedstock for the process will be maintained by Freedom Recycling using strict acceptance criteria, visual inspections and working with MRF operators that utilise separation technologies such as Near Infra-Red (NIR) to minimise contamination and non-target materials.

As required by the QP PFO all feedstock materials will be checked by Freedom Recycling to ensure they meet the acceptance criteria and permit conditions. Checks will be made to ensure that the plastics do not contain excessive contamination or non-target materials prior to sorting and granulation. Records will be maintained of all incoming wastes and prepared feedstocks to be processed through the installation. This includes the following information:

- Date of receipt;
- European Waste Catalogue (EWC) code and description;
- Place of origin (where known);
- Quantity by weight/volume;
- Carrier's name and contact details;
- Supplier's name and contact details; and
- Confirmation if the feedstock was accepted or not

Appendix 3a – Description of the Plant (Section 6)

Section 6.1

The pyrolysis system is a low temperature de-polymerisation system that breaks down the long hydrocarbon molecular chains in high density polyethylene, low density polyethylene and polypropylene (HDPE, LDPE & PP) plastics converting them into shorter hydrocarbon chains of pyrolysis oil in a continuous process.

The system provides optimum, stable conditions for de-polymerisation and a high level of temperature control for the optimisation of pyrolysis oil production and minimisation of non-condensable gas production. The synthesis gas is then passed through a condensing unit where it is cooled and condensed into a pyrolysis oil. Any remaining residual non-condensable gas is passed through a catalytic converter prior to release to the atmosphere via the emissions stack. The Pyrolysis Technology is CE certified and has inbuilt remote monitoring systems and a fire suppression system.

Table 2: Description of plant					
Manufacturer	Confidential		Proposed stack and c conditions	lischarge	
Model			Stack height (m)	7.5m	
Year of manufactu	re 2016		Efflux speed (m/s)	n/a	

Serial number (if known)				Efflux temperature (K)	ambient
Thermal input kW		Rate	of pyrolysis	s (kg/h)	
Secondary combustic converter	n chamber/	afterburner	Catalytic		
Afterburner fitted	n/a	n/a Inlet ambient temp		Additional information	Doc ref
Residence time (s)	n/a	Outlet temp	ambient	Technical drawing	Doc ref

Sections 6.2 - 6.4

The feedstock being utilised in the conversion activity consists only of HDPE, LDPE and PP that consist of long chain hydrocarbons containing only carbon and hydrogen as verified by an independent analysis conducted by ITIR Innovation. As none of these plastics contain any Halogens; Nitrogen or Sulphur the requirement to monitor for these elements and any oxidised compounds thereof is unnecessary/superfluous.

On comissioning regular third party monitoring will be undertaken to ensure low levels of CO; CO₂ & VOCs as well as monitoring to ensure continuing low levels of NO₂

The feedstock will be only sourced from Freedom Recycling as an assured source. Due to the rigorous procedures and protocols in place at Freedom Recycling all non-target material will already be extracted prior to use thus avoiding the production of potentially hazardous residues. The residual gases that are not converted are neutralised and passed through a catalytic converter similar to that used in a modern car.

The feedstock being utilised in the conversion activity consists only of HDPE, LDPE and PP. None of these plastics contain any Halogens; Nitrogen or Sulphur but consist of long chain aromatic hydrocarbons as supported by the analysis of the feedstock undertaken by ITIR Innovation a UKAS accredited laboratory for these analyses.

Compound	
HCI	Feedstock does not contain Chlorine
H2SO4	Feedstock does not contain Sulphur
Dioxins	As no chlorine present in feedstock and
	temperatures in the catalytic converter are
	below the Robinson Reformation reaction
	there is no possibility of Dioxins being formed
Furans	Feedstock does not contain the precursors to
	enable the formation of furans.

The residual non-condensable gases are released from the catalytic converter via a stack with a height of 7.5m, (one meter higher than the building apex). Due to the low throughput of gases via the stack the gases are expected to leave the stack near ambient temperature, as such it will not be viable to recover any energy from the catalytic converter.

6.5 Monitoring

On commissioning regular third party monitoring will be undertaken to ensure low levels of CO; CO₂; VOCs; [HCl; H₂SO₄] thereby confirming the absence of these compounds as well as monitoring to ensure continuing low levels of NO₂ (None of the above plastics contain Nitrogen). To this end BS Sampling ports will also be installed for quality assurance purposes. Freedom Farm have in the past carried out passive NO₂ sampling and undertaken monitoring for NOx and the levels observed show no exceedances at the nearest domestic receptors either at 80m nor 400m. All monitoring will be carried out by MCERTS accredited personnel to approved BS or BS EN standards or to the approved standards at the time of testing.

The frequency and type of emissions monitoring will be determined concluding an initial monitoring exercise under normal running conditions and feedstock. This initial monitoring programme will be prescribed and conducted by both MCERTS accredited body. Monitoring has yet to be undertaken using the prescribed feedstock.

6.6 Prevention of operation in certain circumstances

The commencement of the catalytic converter is prerequisite of the start-up process of the installation. The operating manual and accompanying procedural checks will be in place to ensure the catalytic converter is working. Control panel warning systems will also be engaged if the catalytic converter is not in operation.

6.7 Minimisation of Residues

After each 29-day cycle the pyrolysis plant will be shut down for cleaning and maintenance. Any build-up of residues shall be removed as per protocols and procedures minimising any risk and disposed of via approved routes.

6.8 Accidents and incidents

The following actions will be undertaken in accordance with installation user manual and the sites Health and Safety and Environment Management Systems practices. Further details regarding the mitigation measures in place can be found in Appendix 3c – Risk assessment and precautions:

Oil or gas leakage within pyrolysis container:

The pyrolysis unit will be situated within its own enclosed and bunded container. In the event that there is a leak from the pyrolysis unit any fluids will be captured within the bund.

On discovery of an oil or gas leak the on-site operative will raise the alarm and use the emergency shut down procedures as outlined within the apparatus operational manual. Doors to the pyrolysis container will then be closed and the equipment left to cool to an ambient temperature.

Once the equipment is at an ambient temperature the pyrolysis container bund will be emptied. Once emptied the pyrolysis container will be opened and ventilated. Once the container is regarded safe to enter the source of leak will be identified and assessed to identify the root cause. Once the cause of the leak has been identified and mitigated, repairs to the equipment will commence. During this period any potential ignition sources will be removed and/or prevented from entering the facility.

Oil leakage from pipework and tanks:

The installation will be continually monitored 24 hours/day whilst it is in operation. In accordance

with the sites health, safety and environment management system regular inspections of the entire facility will be conducted twice per day.

On the discovery of any oil leak from pipework or oil storage vessels the associated pipework will be closed off using the appropriate stop valves. Any leaks or spillages will be dealt with using the on-site spill kit equipment in accordance with the sites health, safety and environmental procedures. In the event of a significant leak that could breach the installation internal bunding it will be captured by the Type 1 interceptors located throughout the Freedom Farm site.

Fire within the pyrolysis container:

The pyrolysis unit is container is fitted with its own integrated fire detection and inert gas fire suppression system. If a fire is detected within the pyrolysis unit the alarm will be raised. On hearing the alarm operatives will shut down equipment if deemed safe to do so and exit the installation, call the emergency services in accordance with the sites health, safety and environment management systems.

Operatives will only be allowed to inspect the pyrolysis container once it is deemed safe to do so by the emergency services.

Fire within the installation or neighbouring facilities:

On detection of a fire by an operative, neighbouring installation or via the automated systems, operatives will shut down any equipment if deemed safe to do and exit the site. Checks will be made that the emergency services have been notified and that the sites drainage systems are closed accordingly.

If deemed safe to do so site operatives will use the on-site fire extinguishers to enable their safe egress or to tackle a small fire.

6.9 Waste Waters

The installation is situated within a large warehouse building on hardstanding within the Freedom Farm site. The pyrolysis unit is contained within its own bunded container preventing the escape of any leaks from the unit. All oil containers will be fitted with secondary containment bunds with a capacity of >110% of their volumes. Spill kits and appropriate containers will be available and all staff will be trained to managed spills from within the facility.

Rain water run-off. The site is protected by type 1 interceptors located in strategic positions as specified by the Environment Agency and planners.

Emergency shut-off valves will be fitted to pumping systems. Oil transfer locations will be fitted with additional bunding and drip trays. Vehicles used to collect the end product are only able to drive on the hard standing on permitted routes around Freedom Farm.

Section 6 - Appendix 3c – Risk assessment and precautions

What do y	What do you do that can harm and what could be harmed				Assessing the ris	k
Hazard	Receptor	Pathway	Risk management	Probability of	Consequence	What is the overall risk?
				exposure		
What has	What is at risk?	How can the	What measures	How likely	What is the	What is the

the potential to cause harm?	What do I wish to protect?	hazard get to the receptor?	will you take to reduce the risk? If it occurs who is responsible for what?	is this contact?	harm that can be caused?	risk that still remains? The balance of probability and consequence.
Odour Organic residue on feedstock	Site staff, hauliers, local residents and neighbours - pollution to atmosphere	Air	Assessment of quality of incoming feedstock, quarantine and rejection of loads on inspection. Random sampling and analysis of materials Rotation of feedstock material, reduced storage times of incoming bales. Feedstock stored within buildings at all times and measured via the weighbridge.	Medium	Nuisance and complaints - spurious emissions	Medium/low
Pyrolysis of plastics	Site staff, local residents and neighbours- pollution to all medium	Air via opening of pyrolysis chamber or leaks - watercourses through escape and contamination of drainage system. ground similar	Pyrolysis chambers to be at ambient temperature and purged prior to opening within building. Closed loop system with secure gaskets and minimum pressure environment. Frequent inspection of sumps and pipework	Low	Nuisance and complaints, plus associated fire risk. Possible uncontained emissions	Low
Char removal and storage, residual oil/tar	Site staff, local residents and neighbours - spurious emission to atmosphere	Air during transfer	Due to feedstock char production is minimised. All char to be stored within enclosed secured drums prior to removal from site. Removal and transfer of char to drums infrequent and within building using appropriate PPE and containment procedures.	Low	Nuisance and complaints Possible uncontained emissions	Low
Storage of oils, VOCs	Site staff, local residents and neighbours - spurious emission to atmosphere	Air	Oil storage tanks to be sealed and fitted with vapour recovery system to capture/utilise VOC's Pressure relief valves to be inspected for seating once a month to prevent over pressurisation of tank/uncontrolled releases to atmosphere.	Low	Nuisance and complaints, plus associated fire risk Possible uncontained emissions to atmosphere	Low
Catalysis of syn gas	Site staff, local residents and neighbours	Air	All syngas to be scrubbed/cleaned prior emission.	Low	Nuisance and complaints Possible	Low

	spurious emission to atmosphere		Emission limits set and monitored on stack periodically.		uncontained emissions to atmosphere	
Transfer of oils	Site staff, hauliers, local residents and neighbours. Possible uncontained emissions to atmosphere	Air	Fuel transfer systems with vapour control systems	Low	Nuisance and complaints, plus associated fire risk Possible uncontained emissions to atmosphere	Low

			Managing the risk		Assessing the risl	٢
	ou do that ca t could be ha					
Hazard	Receptor	Pathway	Risk management	Probability of exposure	Consequence	What is the overall risk?
What has the potential to cause harm?	What is at risk? What do I wish to protect?	How can the hazard get to the receptor?	What measures will you take to reduce the risk? If it occurs who is responsible for what?	How likely is this contact?	What is the harm that can be caused?	What is the risk that still remains? The balance of probability and consequence.
Noise and vibr					Г	
Forklift trucks	Site staff, local residents and neighbours	Air	Movement of feedstock only to occur within the building during nightshifts. FLT's fitted with directional noise alarms systems.	Medium if not restricted to dayshift	Nuisance and complaints	Low
Pyrolysis systems	Site staff, local residents and neighbours	Air	Motors, gears and augers for pyrolysis system to be regularly inspected and serviced.	Low	Nuisance and complaints	Low
Pumps/heat exchangers	Site staff, local residents and neighbours	Air	All pumping systems to be regularly monitored and serviced. Quiet pumps to be purchased and contained within main building.	Low	Nuisance and complaints	Low
Vehicle engine noise	Site staff, local residents and neighbours	Air/road	Delivery and collection of feedstock and products only conducted during daytime shifts.	Medium if not restricted to dayshift	Nuisance and complaints	Low
Lorry reversing alarms	Site staff, local residents and neighbours	Air	Site layout designed with one way system for delivery and collection trucks to avoid/minimise need to reverse vehicles. Deliveries/collections restricted to dayshifts.	Medium if not restricted to dayshift	Nuisance and complaints	Low

Fugitive emissions ri	sks					
To air						
Emissions from catalytic converter	Site staff, local residents and neighbours - spurious emission to atmosphere	Air	Periodic extractive monitoring & analysis of catalytic converter output. Feedstock acceptance criteria to prevent the pyrolysis of non-target materials.	Low	Release of hazardous gases - spurious emission to atmosphere	Low
Seals and gasket leakage	Site staff, local residents and neighbours - spurious emission to atmosphere	Air	Routine maintenance and inspection regime to monitor all seals and gaskets. System shut down where leakage is detected Air monitoring and sampling regime. Procedures and instruction to report any significant odour issue.	Low	Fire risk from release of flammable gases. Nuisance and complaints - spurious emission to atmosphere	Low
Oil spillage/leaks	Site staff, local residents and neighbours - spurious emission to atmosphere	Air	All storage containers appropriately bunded. All bund to be inspected as per protocals & procedures Spill kits readily available at all locations. All spills immediately dealt with absorbents stored in air tight containers.	Medium	Flammable and odorous vapour release to atmosphere	Medium
Dusts from feedstock	Site staff, local residents and neighbours - spurious emission to atmosphere	Air	Inspection and rejection system of incoming loads. Avoidance of double handling/baling of incoming materials	Low	Health risk. Nuisance and complaints - spurious emission to atmosphere	Low
Dust from pyrolysis char	Site staff, local residents and neighbours - spurious emission to atmosphere	Air	Pyrolysis impurities removal to be conducted in accordance with appropriate procedures within maintenance programme Pyrolysis chambers and filters only accessible when system is shut down for maintenance servicing	Low	Health risk. Nuisance and complaints - spurious emission to atmosphere	Low

To water						
Oil spillage/chemical leaks	Surface water	Surface water run-off	Hard standing across the site. Bunded oil tanks. Drip trays, spill kits and drain covers at sampling and transfer locations. Surface water interceptor drains and interceptors all above subject to rigours inspection as per procedures & protocols	Medium	Watercourse pollution. Damage to local water, wetland and grassland habitats	Low
Oil storage tanks leak	Ground water	Permeation to ground	Hard standing and bunded tanks Daily site inspection regime	Low	Ground water contamination	Low
Use/spillage of cleaning chemicals	Surface water	Surface water run-off	Low volumes of cleaning chemicals stored on site in appropriate sealed containers. Any spillages dealt with in accordance to site spillage procedures and work instructions.	Low	Watercourse pollution. Damage to local water, wetland and grassland habitats	Low
Oil delivery/collections	Surface water	Surface water run-off	Oil pumps fitted with automatic shut-off triggers. Oil transfers on hard standing with drip trays. Spill kits suitable located. Site drainage with surface water interceptors.	Low	Watercourse pollution. Damage to local water, wetland and grassland habitats	Low

Litter						
Litter blow from stored materials	Neighbours and local residents	Air/land	Prepared feedstock stored in appropriate containers within the installation. Regular sweeping and cleaning regime in place	Low	Nuisance and complaints	Low
Litter blow from feedstock delivery	Neighbours and local residents	Air/land	All deliveries of feedstock to be conducted within enclosed building within appropriate containers	Low	Nuisance and complaints	Low

Exceptional			
circumstances			

Unauthorised	Damage	Air/land/water	Site manned on a 24			
access / vandalism	resulting in oil release		hour basis, 7 days/week. Site has secure perimeter, access restricted to gated bridge. Bunded storage systems, hard standing and interceptor systems	Low due to hours of operation and site security	Pollution of air/water and land.	Low
Arson	Local human population, site staff, fire fighters. Watercourses and ground water	Air/land/water Smoke, oil and fire water run- off	Site security. Fire detection and automated fire suppression systems fitted. Surface water interceptor fitted with automated penstock valves. Feedstock storage to include fire breaks	Low due to hours of operation and site security	Pollution of air/water and land. Injury to human population	Low
Fire (other than arson)	Local human population, site staff, fire fighters. Watercourses and ground water	Air/land/water Smoke, oil and fire water run- off	Only appropriate equipment to be used in potentially flammable atmosphere including FLTs. Thermal oxidiser fitted and appropriately located to deal with problematic syngas. Hot working procedures. Fire detection and suppression systems	Medium/low due to flammable nature of pyrolysis oil and gases	Pollution of air/water and land. Injury to human population	Low due to safe working procedures and systems

Section 7 - Management and Training

Freedom Resource Conversions technology partner will carry out extensive training on the conversion technology and will be on site for commissioning and testing. All operatives will adhere to the operation manuals stated procedures.

An operations manager will be present on site during operating hours and be responsible for operating the conversion technology. FRC's management team will also have live links to the technology via telemetry systems.

Schedule of maintenance covering all plant and equipment at the installation

The site will adhere to a specific maintenance schedule provided by the technology provider. The conversion technology will be shut down after each 29-day cycle for cleaning, maintenance and inspection. The technology will under-go a full maintenance, cleaning and testing program over a period of 3 to 7 days annually. This will be carried out by representatives from our technology partner. FRC will keep a log to ensure the maintenance schedule is rigorously adhered to.

Record Keeping for incoming Wastes and Emissions Monitoring

Records will be maintained of all incoming wastes and prepared feedstocks to be processed through the installation FRC will utilise end of life plastics solely supplied by Freedom Recycling under their existing permit.

The frequency of emissions monitoring will be set by the regulator following the comissioning of

the first unit and as laid down in the SWIP permit as issued by the regulator; all records pertaining to the monitoring shall be kept on site by FRC as required under said permit.

Employees training & Compliance

All of FRC site workers will go through an induction, training and examination program ahead of being permitted to work on site. Each operative will be monitored by the management team to ensure that they adhere to the companies' EMS. FRCs management team has a demonstrable track record of working under Freedom Recycling's existing permit.

Notification of relevant bodies in the event of an incident or abnormal emissions.

Immediate corrective action will be taken by the operations manager in the event of an incident or abnormal emissions. Appropriate procedures will be implemented and reported accordingly to the relevant bodies.