

Activity: Waste Reception and Acceptance			
Prepared by: Ricky Maylin	Approved by: Tony Calpin	Revision: 1.4	Dated: 01/02/2019

PURPOSE	To establish a Waste Acceptance Procedure		
CARRIED OUT BY	Plant Operator		
FREQUENCY	Continuous during operational hours		
DURATION	N/A		
Review Date:	03/05/19	Reviewed By:	Ricky Maylin
BACKGROUND	<p>Fernbrook Bio Ltd utilises a number of ways to secure waste contracts for receipt at the Rothwell Lodge AD Facility:</p> <ol style="list-style-type: none"> 1. It uses the services of specialist food waste brokers Axiom Environmental Ltd to source suitable source segregated biodegradable wastes; 2. It uses the services of the associated Whites Recycling; 3. Secures contracts directly. <p>In order to ensure that only wastes acceptable under the Environmental Permit, Animal By Products Regulation Approval and other complimentary quality requirements such as the Quality Protocol: Anaerobic digestate , Fernbrook Bio Ltd ensures that all the parties have a copy of the following documents:</p> <ul style="list-style-type: none"> ○ Input Materials Procedure SC01 ○ Input Material Supply Agreement SC01/F01 ○ Input Material Waste Categories SC01/F01 <p>All contracts should be secured following the Waste Acceptance Criteria. Weekly communication with the brokers allows the planning of the waste deliveries. All deliveries to the site should be pre-booked and be recorded in the weekly schedule.</p>		

INSTRUCTIONS	HSE&Q INFORMATION	COMPETENCE ASSESSMENT	
		Skills	Knowl edge
<p><i>Demonstrate and explain how each step is carried out. Allow the trainee to practice under supervision where safe to do so. Ensure the trainee understands how to tell if the task is working correctly, the warning signs of it starting to go wrong and what corrective action to take.</i></p>	<p><i>Use this information to ensure that stages that are critical to HSE&Q are understood. Ensure the trainee understands the consequences of performing the task incorrectly.</i></p>		
<ul style="list-style-type: none"> • When a vehicle arrives at the site it is directed to the weighbridge and the duty of care waste transfer note (DoC WTN) is checked. The majority of deliveries are covered by Annual Waste Transfer Notes, the remainder are provided with a DoC WTN when waste is accepted at the site. • If the material is on the weekly schedule spreadsheet (or additional deliveries have been agreed) and is as described in the documentation, the driver will be directed to the appropriate unloading area. <ul style="list-style-type: none"> ▪ Loose waste reception pit ▪ Packaged waste reception pit ▪ Liquid ▪ Palletised • <u>Reception Building</u>: All waste is unloaded within the Reception Building under the supervision of a Banksman. The Banksman will open the Reception Building door and guide the vehicle driver to the correct unloading point. The Reception Building door automatically closes once the vehicle is safely inside. • <u>Unloading</u>: Unloading will be supervised at all times. Input material will be unloaded in to the appropriate storage areas according to its form i.e. loose, packaged, 	<p>-Ensure correct PPE is worn at all times and your safety and others is taken as a priority.</p>	<input type="checkbox"/>	<input type="checkbox"/>

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<p>palletised or liquid. Once the material is discharged, and whilst still in the Reception building, vehicles are washed down and disinfected, with the wash water draining into the pits.</p> <ul style="list-style-type: none"> • <u>Inspection</u>: During unloading input materials are visually checked by the Banksman, this inspection process is supplemented by CCTV coverage. In the case of liquids the inspection is done via pH testing (see SOP020) • <u>Rejection</u>: Where materials are identified which are outside the specification expected from the Input Materials procedure described above the Banksman will alert the Site Manager or nominated representative. The Site Manager will consider the appropriate action and discuss with the supplier to determine the correct response required. This will be determined on the basis of the amount and or type of contrary material. Potential action can include: <ul style="list-style-type: none"> ▪ Reload and return to producer; ▪ Reload and send for disposal (at producer’s expense); ▪ Quarantine until further investigation; ▪ If the rejection was a misunderstanding, accept and process. <p>If possible photographs will be taken of the contrary material.</p> <ul style="list-style-type: none"> • Where material is rejected, a record will be made on the waste transfer note. Other relevant information e.g. photographs, emails, records of conversations etc. will also be retained either electronically, as an entry in the site diary or as a file note. 			

Competence Assessment

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File the completed assessment in the trainee’s competence evidence record.

<p>Trainee I confirm that I have received training and have been observed carrying out this task and I am confident that I understand the correct procedures and precautions necessary to complete the task safely and effectively.</p>		
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Name of trainer:	Signature:	Date:

Activity: Waste Storage			
Prepared by: Ricky Maylin	Approved by: Chris Rhoden	Revision: 1.5	Dated: 06/07/2020

PURPOSE	To establish a Waste Acceptance Procedure		
CARRIED OUT BY	Plant Operator		
FREQUENCY	Continuous during operational hours		
DURATION	N/A		
Review Date:	06/07/21	Reviewed By:	Ricky Maylin
BACKGROUND	Materials awaiting processing will be stored in the following locations according to their form		
	TYPE	LOCATION	APPROXIMATE CAPACITY
	Loose	Inside reception building. Loose waste reception pit.	100m3
	Packaged	Inside reception building. Packaged waste reception pit	100 m3
	Packaged	Inside reception building. Palletised waste storage area	100 pallets
	Liquid	Outside in the tank area. Liquid tank (BV300)	75 m3 (working volume)
	Glycerol	Only in IBC's – maximum storage volume 30m3.	30m3
	Wood waste	Reception hall in dolav bins. Loose.	30t

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<ul style="list-style-type: none"> • Palletised waste is stored in the bay inside reception building until required. This material is manually depackaged, removing any cardboard packaging, which is then baled for recycling off site. The remaining material is discharged into the packaged pit. • The reception pits are emptied daily with material being tipped in the front and emptied from the back. • The liquid tank is continuously stirred and batches are discharged to the de-packaging process in a controlled manner to ensure the feedstock is of the correct consistency to avoid blockage before passing through the macerator and distributed to one or more of the buffer tanks. • Glycerol will only be accepted in IBC form. Maximum throughput 2m3/ day. An IBC heated jacket will be available to keep glycerol homogenies. Contaminates check plus details lab analysis if from new waste stream. 	<p>-Ensure correct PPE is worn at all times and your safety and others is taken as a priority.</p>	<input type="checkbox"/>	<input type="checkbox"/>

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Activity: Pre-Digestion Processing			
Prepared by: Amaya Arias-Garcia	Approved by: Tony Calpin	Revision: 1.2	Dated: 21/08/2017
PURPOSE	Pre-Digestion Processing		
CARRIED OUT BY	Operator		
FREQUENCY	Daily		
DURATION	N/A		
Review Date:	03/05/19	Reviewed By:	Ricky Maylin
BACKGROUND	<p>Post-manufacture food waste needs to be treated prior to being fed to the bacteria in the AD plant. This is necessary to separate out contaminants such as glass, metal and plastics which the bacteria cannot digest and that could block or wear down mechanical parts of the plant. The main focus of separation is to provide a relatively uncontaminated organic feedstock to the digester, and so packaging must be removed.</p> <p>Another consideration is that the separation stage also acts as a Hazardous Analysis and Critical Control Point (HACCP), where the particle size of the organic material is guaranteed at less than 12 mm prior to pasteurisation, which is a requirement under ABPR. Therefore if this is the case, all organic material must be screened to 12 mm or less in one plane, without a possibility of by-pass.</p>		

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		<ul style="list-style-type: none"> • As required, waste (packaged or previously palletised waste) in the packaged waste reception pit is loaded into a hopper using a crane with a grab (see SOP018). • This material then travels via a auger to the de-packaging machine where all types of packaging is removed from the organic material. The machine opens the packaging, macerates the material and filters the organics. • The de-packaging machine blends the solid waste with water and liquid waste from the liquid reception tank to form a soup of approximately 15% dry mater. • In addition to separating the contamination the de-packaging machine achieves a soup with a particle size less than 12mm in one plane. This is a requirement of the ABPR regulations so the operator should check the particle size daily and record the results in the site diary. • Material that has achieved the size threshold is then pumped into one of two buffer tanks where it is stored until required as feedstock for the digesters. 	<p>-Ensure correct PPE is worn at all times and your safety and others is taken as a priority.</p>

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Activity: Feedstock (soup) storage			
Prepared by: Ricky Maylin	Approved by: Chris Rhoden	Revision: 1.4	Dated: 06/07/2020

PURPOSE	To establish the operating parameters of the feedstock/soup storage tank		
CARRIED OUT BY	Operator		
FREQUENCY	Daily		
DURATION	N/A		
Review Date:	06/07/21	Reviewed By:	Ricky Maylin
BACKGROUND	<p>In order to ensure that the digestion process has a constant feedstock the soup produced by the pre-treatment is held in buffer tanks.</p> <p>The buffer tanks are labelled as BV100 and BV200 on the pipping and instrumentation diagram and they have a capacity of 192m3 per tank and a combined capacity of 384 m3.</p>		

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<p>The buffer tanks operate as follows:</p> <ul style="list-style-type: none"> • They are hydraulically stirred; • They are not heated so hydrolysis is unlikely to happen in the tank; • They are cleaned regularly to remove grit and prevent it travelling to the digesters. The regularity of the operation is determined based on the levels found when cleaning; • Samples are taken daily to monitor the Organic Loading Rate to the digesters (See SOP014 OLR determination). The OLR is recorded on the KPIs. • No more than 2m³ of glycerol we be added to any one of the buffer tanks. 	<p>-Ensure correct PPE is worn at all times and your safety and others is taken as a priority.</p>	<input type="checkbox"/>	<input type="checkbox"/>

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Activity: Feeding the plant			
Prepared by: Ricky Maylin	Approved by: Chris Rhoden	Revision: 1.5	Dated: 08/09/20

PURPOSE	To establish the feeding rate to the plant		
CARRIED OUT BY	Operator		
FREQUENCY	Daily		
DURATION	N/A		
Review Date:	06/07/21	Reviewed By:	Ricky Maylin
BACKGROUND	<p>The digestion process at Fernbrook Bio is mesophilic with digester temperatures maintained at around 40°C. Retention times vary according to the composition of the material in the digester at that time, but generally are around 45 days.</p> <p>The tanks are heated via internal heating coils filled with water. The water is heated using the waste heat from the engine. The engine runs with biogas produced by the fermentation of the organic material.</p> <p>Loading of the digesters is determined by the Site Manager and is adjusted twice per day. First in the morning after the lab analysis provide the Volatile Fatty Acid (VFA) concentration, and then in the afternoon after the lab analysis provides the Dry Matter (DM) content of the material in the buffer tanks.</p> <p>Assessment of the quantity to feed is based on the Organic Loading Rate (see SOP014 OLR determination) and the dry matter (see SOP013 dry matter determination) of the soup stored in the Buffer Tanks (see SOP004 Feedstock storage). In addition, the height of the liquid in the digester is also taken into account to consider the working volume of the digester.</p> <p>Each digester is fed 12 times per day every other hour. The site manager adjusts the quantity to feed on the SCADA system.</p> <p>If there is major maintenance due on the CHP's the feedstock should be reduced before work is completed to prevent the unnecessary burning of biogas. If the biogas volume increases beyond the maximum output of the CHP's the feed should be reduced to prevent large volumes of biogas being burnt. OLR should only be increased/ reduced by +/- 10% per day to prevent biological issues that could lead to increased VFA production/ foaming and CH4 fluctuation.</p>		

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<p>Process to feeding the plant</p> <ul style="list-style-type: none"> • Take a sample from the substrate inside the digesters at 7am; • Determine Volatile Fatty Acids (see SOP015 VFA determination); • If the VFAs have remained constant by approximately +/- 10% then maintain the OLR. This would be the case if other important parameters like Temperature have also remained constant. See Digester Monitoring SOP006 for more information; • See SOP014 OLR determination; • Adjust the feed on the SCADA system; • Take a sample of the soup inside the buffer tanks at 12pm; • Determine the DM content of the sample (see SOP013 DM determination); • Introduce the DM results in the KPI calculator and determine the amount of material to feed until the following morning to keep the OLR constant. This would be the case if other important parameters have been constant during the day. Also the daily checks should be taken into consideration; • Record VFAs, DM and feed rate on Key Performance Indicators file daily. • Additional measures in place for glycerol. 2m3/ day feed limit – tipped into diluted liquid pit. • Additional operational testing required if glycerol is being fed into the system. 	<p>-Ensure correct PPE is worn at all times and your safety and others is taken as a priority.</p>	<input type="checkbox"/>	<input type="checkbox"/>

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Name of trainer:	Signature:	Date:

Activity: Digester monitoring			
Prepared by: Amaya Arias-Garcia	Approved by: Tony Calpin	Revision: 1.3	Dated: 30/10/2017

PURPOSE	The objective of this procedure is to summarise the Key Performance Indicators to be monitored inside a digester.		
CARRIED OUT BY	Operator		
FREQUENCY	Daily		
DURATION	N/A		
Review Date:	03/05/19	Reviewed By:	Ricky Maylin
BACKGROUND	<p>There are several operational digester parameters that are worth monitoring as they highlight process instability and close monitoring can prevent many issues.</p> <p>These parameters are monitored at different intervals and the results recorded in the Key Performance Indicators spreadsheet.</p>		

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<p>Methane concentration</p> <p>A very useful monitoring parameter is the methane concentration of the biogas. The ratio of methane to carbon dioxide will vary widely with the type of feedstock and the loading/retention time of the digester. A typical range of methane concentration is 50% to 70%.</p> <p>Temperature</p> <p>The AD plant at Fernbrook Bio is a mesophilic digester. Mesophilic' refers to a group of microorganisms that work best at moderate temperatures (35-42°C). Maintaining a constant temperature is important for biogas production. The Fernbrook Bio plant is run at 40°C.</p> <p>PH</p> <p>The pH in the digesters needs to be between 7.0 and 8.5 for microbes to work optimally and produce a high biogas yield, particularly in the methanogenesis phase.</p> <p>It is risky to only use the pH as a control mechanism as by the time the pH is acidic it might be difficult to recover the digester. It is better to look at the Volatile Fatty Acids (VFA) and bicarbonate alkalinity.</p> <p>Volatile Fatty Acids</p> <p>VFAs are short-chained volatile organic acids such as acetic acid, propionic acid and butyric acid. They are intermediate molecules in the anaerobic digestion process that are produced</p>	<p>-Ensure correct PPE is worn at all times and your safety and others is taken as a priority.</p>	<input type="checkbox"/>	<input type="checkbox"/>

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<p>during the acidification step and are precursors of methane. Consequently, if they accumulate this often means that the production of methane is inhibited.</p> <p>The levels of VFAs within the digester can range from tens of mg/l to several thousand mg/l. typically, the higher the Organic Loading Rate (OLR) of a digester, the higher the residual VFAs. High VFAs would lower the pH and affect the microbes if the system does not have buffering capacity i.e. alkalinity. It would also be an indication that there is too much food for the microbe population.</p> <p>The VFAs should be looked at both in isolation and in conjunction with the Alkalinity.</p> <p>Alkalinity Buffer</p> <p>Methanogenic bacteria will only operate effectively within an alkaline pH environment.</p> <p>The alkalinity buffer within a digester acts as a safety net, offsetting these increases in acidity by absorbing free protons (hydrogen ions) so that the pH does not drop and inhibit the process.</p> <p>A stable digester will have an alkalinity concentration of at least 2,000 mg/l above the background VFA concentration</p> <p>Trace elements</p> <p>For anaerobic plants to operate effectively they require a variety of micro nutrients for the micro-organisms to grow and function properly.</p>			

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<p>It is often the case that anaerobic digesters and biogas plants are lacking in these vital micronutrients which means they do not work at their optimum. This can lead to poor organic solids removal and elevated VFA levels.</p> <p>To combat these problems a number of companies have developed a range of bio available micronutrient solutions with the required trace elements which help to optimise microbial performance in the digester.</p> <p>Key Benefits</p> <ul style="list-style-type: none"> •Increased biogas production •Increased methane content in biogas •Reduced digester VFAs <p>Carbon: nitrogen (C:N) ratio</p> <p>C and N are both required to sustain the bacteria in the digester. For optimum biogas efficiency a C:N ratio of between 20:1 and 30:1 is needed, as the bacteria in the digester consume about 30 times more C than N. To gain this optimum C:N ratio, a blend of feedstocks should be considered, as the C:N ratio in feedstocks can vary significantly (cow slurry 6:1 and potato starch 200:1). However, it is difficult to control the C:N ratio using feedstock, and digesters will operate within a much wider range than 20:1 to 30:1 without ill effects. Too much nitrogen will result in high levels of ammonia in the digester which will ultimately be rate limiting, whilst too low a figure will inhibit biological growth.</p>			

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Activity: Digester monitoring			
Prepared by: Amaya Arias-Garcia	Approved by: Tony Calpin	Revision: 1.3	Dated: 30/10/2017

PURPOSE	The objective of this procedure is to summarise the Key Performance Indicators to be monitored inside a digester.		
CARRIED OUT BY	Operator		
FREQUENCY	Daily		
DURATION	N/A		
Review Date:	03/05/19	Reviewed By:	Ricky Maylin
BACKGROUND	<p>There are several operational digester parameters that are worth monitoring as they highlight process instability and close monitoring can prevent many issues.</p> <p>These parameters are monitored at different intervals and the results recorded in the Key Performance Indicators spreadsheet.</p>		

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<p>during the acidification step and are precursors of methane. Consequently, if they accumulate this often means that the production of methane is inhibited.</p> <p>The levels of VFAs within the digester can range from tens of mg/l to several thousand mg/l. typically, the higher the Organic Loading Rate (OLR) of a digester, the higher the residual VFAs. High VFAs would lower the pH and affect the microbes if the system does not have buffering capacity i.e. alkalinity. It would also be an indication that there is too much food for the microbe population.</p> <p>The VFAs should be looked at both in isolation and in conjunction with the Alkalinity.</p> <p>Alkalinity Buffer</p> <p>Methanogenic bacteria will only operate effectively within an alkaline pH environment.</p> <p>The alkalinity buffer within a digester acts as a safety net, offsetting these increases in acidity by absorbing free protons (hydrogen ions) so that the pH does not drop and inhibit the process.</p> <p>A stable digester will have an alkalinity concentration of at least 2,000 mg/l above the background VFA concentration</p> <p>Trace elements</p> <p>For anaerobic plants to operate effectively they require a variety of micro nutrients for the micro-organisms to grow and function properly.</p>			

INSTRUCTIONS <i>Demonstrate and explain how each step is carried out. Allow the trainee to practice under supervision where safe to do so. Ensure the trainee understands how to tell if the task is working correctly, the warning signs of it starting to go wrong and what corrective action to take.</i>	HSE&Q INFORMATION <i>Use this information to ensure that stages that are critical to HSE&Q are understood. Ensure the trainee understands the consequences of performing the task incorrectly.</i>	COMPETENCE ASSESSMENT	
		Skills	Knowl edge
<p>It is often the case that anaerobic digesters and biogas plants are lacking in these vital micronutrients which means they do not work at their optimum. This can lead to poor organic solids removal and elevated VFA levels.</p> <p>To combat these problems a number of companies have developed a range of bio available micronutrient solutions with the required trace elements which help to optimise microbial performance in the digester.</p> <p>Key Benefits</p> <ul style="list-style-type: none"> •Increased biogas production •Increased methane content in biogas •Reduced digester VFAs <p>Carbon: nitrogen (C:N) ratio</p> <p>C and N are both required to sustain the bacteria in the digester. For optimum biogas efficiency a C:N ratio of between 20:1 and 30:1 is needed, as the bacteria in the digester consume about 30 times more C than N. To gain this optimum C:N ratio, a blend of feedstocks should be considered, as the C:N ratio in feedstocks can vary significantly (cow slurry 6:1 and potato starch 200:1). However, it is difficult to control the C:N ratio using feedstock, and digesters will operate within a much wider range than 20:1 to 30:1 without ill effects. Too much nitrogen will result in high levels of ammonia in the digester which will ultimately be rate limiting, whilst too low a figure will inhibit biological growth.</p>			

Competence Assessment

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Name of trainee:	Signature:	Date:
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<p>Trainer I confirm that the trainee has been observed carrying out this task and I am satisfied that he/she is able to do so safely and effectively.</p>		
Name of trainer:	Signature:	Date:

Activity: Pasteurisation			
Prepared by: Amaya Arias-Garcia	Approved by: Tony Calpin	Revision: 1.1	Dated: 10/09/2017

PURPOSE	Pasteurisation of Digested material		
CARRIED OUT BY	Operator		
FREQUENCY	Daily		
DURATION	N/A		
Review Date:	03/05/19	Reviewed By:	Ricky Maylin
BACKGROUND	<p>Kitchen waste and other food waste normally contain high numbers of pathogenic organisms such as Salmonella, E. coli and faecal Streptococci. Pasteurisation is the partial sterilization of a substance at a temperature and for a period of exposure that destroys pathogenic organisms without major chemical alteration of the substance.</p> <p>As well as diverting biodegradable waste from landfill and as well as producing renewable energy, Anaerobic Digestion produces biofertiliser in the form of digestate. The digestate, which contains valuable plant nutrients, is beneficially used in agriculture and horticulture. In order for this to be possible the biofertiliser should have no measurable traces of Salmonella and other pathogenic organisms. This is for three reasons: first, to reassure the public about the quality of food; second, to protect animal health; and third, to meet strict EU regulations.</p> <p>The EU Animal By Products Regulation (ABPR) requires that if food waste is treated in an AD plant then the process must be operated to strict standards. The maximum particle size of the waste must be 12mm (one of the reasons for the shredding operations in the reception hall) and the material must be held at a minimum temperature of 70°C for a minimum period of one hour in a pasteurisation tank either before or after the digester.</p> <p>The bio fertiliser produced at Fernbrook Bio is also compliant with the Biofertiliser Certification Scheme. Digestate that achieves certification is no longer classed as a waste and can be spread beneficially to land without the need for an Environmental Permit, providing a valuable source of organic, carbon-free fertiliser.</p> <p>In order to meet the criteria of the Biofertiliser Scheme, the standards of PAS110 and of the Quality Protocol for Anaerobic Digestate have to be met. These standards mirror the pasteurisation requirement from the ABPR regulations.</p>		

INSTRUCTIONS	HSE&Q INFORMATION	COMPETENCE ASSESSMENT	
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<p><i>Demonstrate and explain how each step is carried out. Allow the trainee to practice under supervision where safe to do so. Ensure the trainee understands how to tell if the task is working correctly, the warning signs of it starting to go wrong and what corrective action to take.</i></p>	<p><i>Use this information to ensure that stages that are critical to HSE&Q are understood. Ensure the trainee understands the consequences of performing the task incorrectly.</i></p>		
<ul style="list-style-type: none"> • In order to achieve the requirements for the ABPR and the PAS110 the digested material must be pasteurised at a temperature of 70°C or above for at least one hour; • Batches of up to 10t of digested material are pumped to each pasteuriser. The system has two pasteurisers; • The frequency and volume of these batches will be dependent upon the daily operations, specifically the current feed, the level in the digesters and the available storage in the digestate storage tank; • Control of the Critical Limits (temperature and retention time) are set, monitored and recorded by the computer control system; • Digestate in the pasteuriser cannot move to the Storage Tank until the Critical Limits have been achieved; • To ensure that the temperature is achieved the control system release temperature is set to 71 degrees C to achieve additional level of assurance; • When these are breached alarms are raised (via email and text) with the Site Manager who can remotely control pumps and valves or instruct a site operative to undertake any required corrective action; • The temperature probes are to be checked monthly with replacement temperature probes held as critical spares. 	<p>-Ensure correct PPE is worn at all times and your safety and others is taken as a priority.</p>	<input type="checkbox"/>	<input type="checkbox"/>

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Name of trainer:	Signature:	Date:

Activity: Pasteurisation			
Prepared by: Amaya Arias-Garcia	Approved by: Tony Calpin	Revision: 1.1	Dated: 10/09/2017

PURPOSE	Storage of Digestate		
CARRIED OUT BY	Operator		
FREQUENCY	Daily		
DURATION	N/A		
Review Date:	03/05/19	Reviewed By:	Ricky Maylin
BACKGROUND	<p>Once the material has successfully achieved the thresholds for pasteurisation the whole digestate is automatically pumped to the storage tank (BE100). The tank has a maximum operational capacity of 4000m³.</p> <p>The tank is covered and mechanically mixed to prevent settlement.</p> <p>The tank is connected to a carbon filter to treat the displaced air from the filling operation.</p>		

INSTRUCTIONS	HSE&Q INFORMATION	COMPETENCE ASSESSMENT	
		Skills	Knowl edge
<p><i>Demonstrate and explain how each step is carried out. Allow the trainee to practice under supervision where safe to do so. Ensure the trainee understands how to tell if the task is working correctly, the warning signs of it starting to go wrong and what corrective action to take.</i></p>	<p><i>Use this information to ensure that stages that are critical to HSE&Q are understood. Ensure the trainee understands the consequences of performing the task incorrectly.</i></p>	<input type="checkbox"/>	<input type="checkbox"/>
<p>Levels are controlled by automated sensors so if the level gets near the set limit there will be an alarm alert and the automatic ball valve fail safe system will be switched on shutting off the inlet valve of the storage tank. When the level is breached there is an automatic alarm sent to the site manager via email or 'phone.</p>	<p>-Ensure correct PPE is worn at all times and your safety and others is taken as a priority.</p>		

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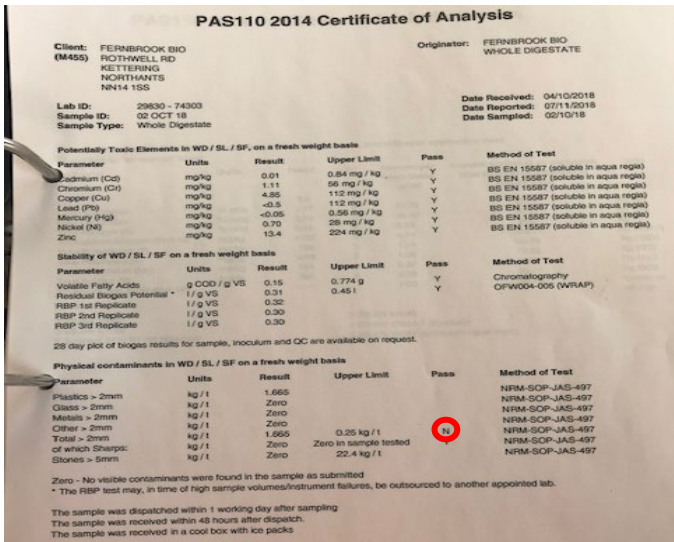
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<p>Trainer I confirm that the trainee has been observed carrying out this task and I am satisfied that he/she is able to do so safely and effectively.</p>		
Name of trainer:	Signature:	Date:

Activity: Sampling of digestate – analysis interrogation			
Prepared by: Ricky Maylin	Approved by: Tony Calpin	Revision: 1.2	Dated: 04/06/2019

PURPOSE	Describe the steps to sample whole digestate in compliance with PAS110		
CARRIED OUT BY	Operator, plant manager, farm liaison manager and TCM		
FREQUENCY	Monthly		
DURATION	N/A		
Review Date:	04/06/19	Reviewed By:	Ricky Maylin
BACKGROUND	<p>The bio fertiliser produced at Fernbrook Bio is also compliant with the Biofertiliser Certification Scheme. Digestate that achieves certification is no longer classed as a waste and can be spread beneficially to land without the need for an Environmental Permit, providing a valuable source of organic fertiliser.</p> <p>PAS110 covers whole digestate from an anaerobic digestion (AD) system that accepts only source segregated and/or biodegradable non-waste materials. It also covers liquor and fibre fractions that might be produced by separating whole digestate, after the AD process. The certification at Fernbrook only covers the whole digestate.</p> <p>In order to meet the criteria of the Biofertiliser Certification Scheme, the standards of PAS110 and of the Quality Protocol for Anaerobic Digestate have to be met. PAS 110 requires producers to take and send representative samples of digested materials to suitable laboratories for testing.</p> <p>Sampling of whole digestate should be done as described in Clause 10 of the PAS110 Standard. It shall only be applicable to the whole digestate output as per current certification. The digestate sample line requires flushing before a sample is taken. This is done by filling an IBC with digestate and taking the sample from the IBC. (ref 1)</p> <p>Digestate needs to be sampled to determine compliance with the requirements of PAS110, and to verify analysis undertaken by Animal & Plant Health Agency as part of the ABPR approval, the biofertiliser is sampled from the Storage Tank.</p>		

INSTRUCTIONS <i>Demonstrate and explain how each step is carried out. Allow the trainee to practice under supervision where safe to do so. Ensure the trainee understands how to tell if the task is working correctly, the warning signs of it starting to go wrong and what corrective action to take.</i>	HSE&Q INFORMATION <i>Use this information to ensure that stages that are critical to HSE&Q are understood. Ensure the trainee understands the consequences of performing the task incorrectly.</i>	COMPETENCE ASSESSMENT	
		Skills	Knowl edge
<p>Ref 1</p>  <ul style="list-style-type: none"> • Sampling for measurement of all determinants shown in Clause 12: Tables 3-5 of the PAS110 Standard, except for digestate stability, shall be carried out as described as follows: <ul style="list-style-type: none"> ○ Whole digestate shall be sampled after full treatment, when it is ready for use. ○ Each final sample shall be representative of the batch or portion of production sampled. 	<p>-Ensure correct PPE is worn at all times and your safety and others is taken as a priority.</p>	<input type="checkbox"/>	<input type="checkbox"/>

INSTRUCTIONS	HSE&Q INFORMATION	COMPETENCE ASSESSMENT	
		Skills	Knowl edge
<p><i>Demonstrate and explain how each step is carried out. Allow the trainee to practice under supervision where safe to do so. Ensure the trainee understands how to tell if the task is working correctly, the warning signs of it starting to go wrong and what corrective action to take.</i></p>	<p><i>Use this information to ensure that stages that are critical to HSE&Q are understood. Ensure the trainee understands the consequences of performing the task incorrectly.</i></p>		
<ul style="list-style-type: none"> ○ If a minimum storage period does not apply to whole digestate, sampling upon completion of full treatment may be done via one or more sampling access points appropriately located in the digestate production system. If a minimum storage period is necessary before the whole digestate is ready for use, it should be sampled after it has completed the minimum storage period and preferably before any more recently produced whole digestate enters the same storage tank. If sampled from a storage tank, thorough mixing should immediately precede sampling. ○ The minimum time between taking each representative sample for a batch or portion of production is defined in the Fernbrook Bio QMS. ○ Each sample shall represent a different batch or portion of production. ○ For each sample, the operator shall record, keep a copy of and inform the laboratory of: <ul style="list-style-type: none"> a) sampling date; b) sample type (whole digestate, separated liquor or c) separated fibre, as applicable); d) code for, or reference to, the sampled batch or e) portion of production; f) digestion facility name; and g) name of the person who carried out the sampling. ○ Each sample tested in order to demonstrate compliance with this PAS shall be tested by a laboratory that has no conflict of interest with the producer. 			

<p>INSTRUCTIONS</p> <p><i>Demonstrate and explain how each step is carried out. Allow the trainee to practice under supervision where safe to do so. Ensure the trainee understands how to tell if the task is working correctly, the warning signs of it starting to go wrong and what corrective action to take.</i></p>	<p>HSE&Q INFORMATION</p> <p><i>Use this information to ensure that stages that are critical to HSE&Q are understood. Ensure the trainee understands the consequences of performing the task incorrectly.</i></p>	<p>COMPETENCE ASSESSMENT</p>	
		<p>Skills</p>	<p>Knowl edge</p>
<ul style="list-style-type: none"> • Sampling for measurement of digestate stability (Annex A of the PAS110 Standard) shall be carried out at the end of the digestion process and prior to dispatch of digestate from the site of production. • Digestate spreading should be put on hold while awaiting results. <p>The analysis results should be reviewed by both the plant manager and farm liaison manager. The results should also be review in the monthly compliance meeting. (ref 3) process flow diagram.</p> <p>The results will be displayed in a similar format to the image below. If the sample has failed, the failing parameter will have a “N” in the column as highlighted below. (ref 2)</p> 			

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		Skills	Knowl edge
<p>Ref 3</p> <pre> graph TD A["Sample taken from site Copy of analysis request sheet retained on site."] --> B["Lab receive sample"] B --> C["Preliminary report issued to plant manager and farm liaison manager."] C --> D["No spreading while results outstanding"] D --> E["Analysis results reviewed"] E --> F["Confirmation email that the analysis has been reviewed between plant manager and farm liaison manager"] </pre>			

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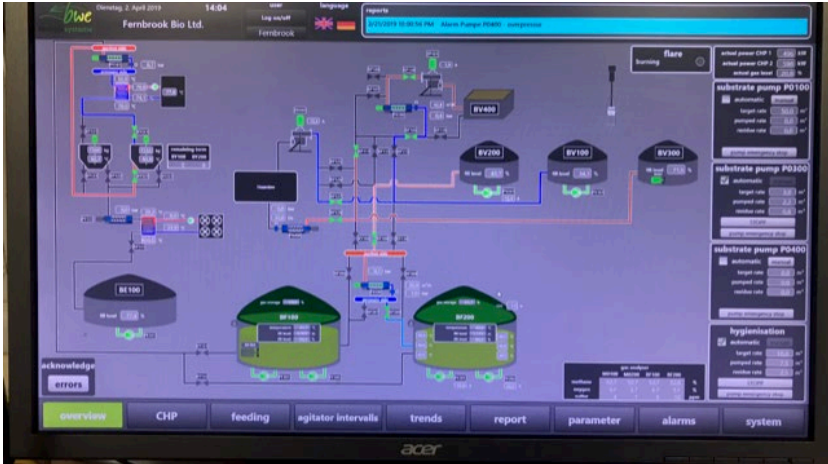
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Name of trainer:	Signature:	Date:

Activity: Process Control			
Prepared by: Amaya Arias-Garcia	Approved by: Tony Calpin	Revision: 1.1	Dated: 27/09/2017

PURPOSE	To describe the process control system and to define the capabilities		
CARRIED OUT BY	Operator		
FREQUENCY	Daily		
DURATION	N/A		
Review Date:	03/05/19	Reviewed By:	Ricky Maylin
BACKGROUND	<p>The Fernbrook Bio Anaerobic Digestion plant relies upon IT systems to control the movement of material through the digestion process and to provide operational safety systems.</p> <p>Key process areas, and where relevant their critical limits, are monitored and this information stored electronically. This IT system is supported by a manual system, which provides verification of the data and actions controlled and initiated by the IT system.</p> <p>The programme can be accessed remotely via Internet-based remote access.</p>		

<p>INSTRUCTIONS</p> <p><i>Demonstrate and explain how each step is carried out. Allow the trainee to practice under supervision where safe to do so. Ensure the trainee understands how to tell if the task is working correctly, the warning signs of it starting to go wrong and what corrective action to take.</i></p>	<p>HSE&Q INFORMATION</p> <p><i>Use this information to ensure that stages that are critical to HSE&Q are understood. Ensure the trainee understands the consequences of performing the task incorrectly.</i></p>	<p>COMPETENCE ASSESSMENT</p>	
		<p>Skills</p>	<p>Knowl edge</p>
<ul style="list-style-type: none"> The following is a screen shot of the scada system  <p>There are many different processes which operate the SCADA system, each one is unique to how the plant is operated i.e. moving liquid from the intake to a buffer tank has several valves, all with alarms, to indicate whether they are open or closed. If one of the valves does not open or close the alarm will automatically go off on the SCADA system shutting the line down and sending an alert to the site manager by email or 'phone. On the SCADA system the system lights up to show where valves are either open (enlarged bright green symbol) or closed (small, bold green symbol).</p>	<p>-Ensure correct PPE is worn at all times and your safety and others is taken as a priority.</p>	<p><input type="checkbox"/></p>	<p><input type="checkbox"/></p>

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Name of trainer:	Signature:	Date:

Activity: Process Inspection and Maintenance			
Prepared by: Amaya Arias-Garcia	Approved by: Tony Calpin	Revision: 1.1	Dated: 27/09/2017

PURPOSE	To describe the procedures for process inspection and maintenance		
CARRIED OUT BY	Operator		
FREQUENCY	Daily		
DURATION	N/A		
Review Date:	03/05/19	Reviewed By:	Ricky Maylin
BACKGROUND	<p>Process inspection and maintenance is important to maximise efficiency and to ensure optimal working conditions of equipment and process. Through inspection and maintenance equipment downtime is decreased and the number of major repairs is reduced. Fernbrook Bio achieves this via a number of in house operational activities plus through support contracts with specialist technical teams.</p>		

INSTRUCTIONS	HSE&Q INFORMATION	COMPETENCE ASSESSMENT	
		Skills	Knowl edge
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<ul style="list-style-type: none"> • Follow up the site checks SOP (SOP021) • Ensure that the preventative maintenance board is updated and that activities are being completed in line with the maintenance programme (pirana). • Ensure that the support contracts are reviewed and that the technical teams carry out inspections at the scheduled times to the required standard. 	<p>-Ensure correct PPE is worn at all times and your safety and others is taken as a priority.</p>	<input type="checkbox"/>	<input type="checkbox"/>

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Trainer I confirm that the trainee has been observed carrying out this task and I am satisfied that he/she is able to do so safely and effectively.		
Name of trainer:	Signature:	Date:

Activity: Odour Management			
Prepared by: Amaya Arias-Garcia	Approved by: Tony Calpin	Revision: 1.2	Dated: 23/10/2017

PURPOSE	To establish the odour management procedures onsite		
CARRIED OUT BY	Plant Operator		
FREQUENCY	Continuous during operational hours		
DURATION	N/A		
Review Date:	03/05/19	Reviewed By:	Ricky Maylin
BACKGROUND	<p>The Fernbrook Bio plant accepts organic waste that has the potential for causing odours. The plant was designed to avoid any fugitive emissions and to treat those that are unavoidable. The plant includes:</p> <ul style="list-style-type: none"> Fast rolling shutter doors in the reception building; Terminodour ionisation technology in the reception building; Once the waste is de-packaged the soup which is at ambient temperature is pumped to the buffer tanks. These tanks are not heated so the soup is maintained at ambient temperature. As the soup fills the tanks the air inside the tanks is displaced out of the tanks. This air is directed to a treatment system. The treatment system consists of a chiller and a carbon filter. The chiller drops the temperature of the air to 5 degrees so part of the moisture in the air condenses carrying with it some of the odour producing molecules. The carbon filter treats the air after. After digestion the digestate is pumped to the pasteurisation tanks where the material is heated to 70 degrees C. As the digestate fills the tanks the air inside the tanks is displaced out of the tanks. This air is directed to a treatment system. The treatment system consists of a water scrubber and then the air joins the same chiller and carbon filter used for the buffer tanks. After pasteurisation the sterilised digestate is pumped to the end storage tank. As the tank is being filled the displaced air is directed to a carbon filter The pasteurised digestate is stored in the end storage tank ready to be transported away as PAS110 fertiliser. When the tanker arrives onsite it connects to a dedicated carbon filter before filling up. This is to ensure that the air displaced from the tanker does not produce odour emissions. 		

INSTRUCTIONS	HSE&Q INFORMATION ✓	COMPETENCE ASSESSMENT	
		Skills	Knowl edge
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<ul style="list-style-type: none"> • Reception Building: <ul style="list-style-type: none"> ○ Ensure that the doors are closed as soon as vehicles enter the building; ○ The waste reception pits are managed to minimize the volume of unprocessed waste; ○ Ensure that any other door is kept closed; ○ Follow the preventative maintenance for the Terminodour system; • Measure daily the output from the carbon filters and change the filter if the following triggers are reached for more than two consecutive days; <ul style="list-style-type: none"> ○ More than 5ppm for H2S; ○ More than 20 ppm for ammonia; <p>If levels stated above are reached, please consider replacing the relevant media.</p> <ul style="list-style-type: none"> • Keep onsite replacement carbon filters to swap; • Carry out daily odour checks and ensure that actions are taken if an odour is detected. 	<p>-Ensure correct PPE is worn at all times and your safety and others is taken as a priority.</p>	<input type="checkbox"/>	<input type="checkbox"/>

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Trainer I confirm that the trainee has been observed carrying out this task and I am satisfied that he/she is able to do so safely and effectively.		
Name of trainer:	Signature:	Date:



Site Standard Operating Procedure – SOP012

Activity: Odour Management			
Prepared by: Ricky Maylin	Approved by: Tony Calpin	Revision: 1.3	Dated: 20/11/2019

PURPOSE	To establish the odour management procedures onsite
CARRIED OUT BY	Plant Operator
FREQUENCY	Continuous during operational hours
DURATION	N/A
BACKGROUND	<p>The Fernbrook Bio plant accepts organic waste that has the potential for causing odours. The plant was designed to avoid any fugitive emissions and to treat those that are unavoidable. The plant includes:</p> <ul style="list-style-type: none">• Fast rolling shutter doors in the reception building;• Terminodour ionisation technology in the reception building;• Once the waste is de-packaged the soup which is at ambient temperature is pumped to the buffer tanks. These tanks are not heated so the soup is maintained at ambient temperature. As the soup fills the tanks the air inside the tanks is displaced out of the tanks. This air is directed to a treatment system. The treatment system consists of a chiller and a carbon filter. The chiller drops the temperature of the air to 5 degrees so part of the moisture in the air condenses carrying with it some of the odour producing molecules. The carbon filter treats the air after.• After digestion the digestate is pumped to the pasteurisation tanks where the material is heated to 70 degrees C. As the digestate fills the tanks the air inside the tanks is displaced out of the tanks. This air is directed to a treatment system. The treatment system consists of a water scrubber and then the air joins the same chiller and carbon filter used for the buffer tanks.• After pasteurisation the sterilised digestate is pumped to the end storage tank. As the tank is being filled the displaced air is directed to a carbon filter• The pasteurised digestate is stored in the end storage tank.• The pasteurised digestate then goes through a separation process and has any plastic removed• This treated digestate is then stored in two separate tanks with a combined volume of 200m³. As the tanks are being filled the displaced air is directed to the same carbon filter as the end storage tank.•• When the tanker arrives onsite it connects to a dedicated carbon filter before filling up. This is to ensure that the air displaced from the tanker does not produce odour emissions.

INSTRUCTIONS	HSE&Q INFORMATION ✓	COMPETENCE ASSESSMENT	
		Skills	Knowl edge
Demonstrate and explain how each step is carried out. Allow the trainee to practice under supervision where safe to do so. Ensure the trainee understands how to tell if the task is working correctly, the warning signs of it starting to go wrong and what corrective action to take.	Use this information to ensure that stages that are critical to HSE&Q are understood. Ensure the trainee understands the consequences of performing the task incorrectly.		
<ul style="list-style-type: none"> • Reception Building: <ul style="list-style-type: none"> ○ Ensure that the doors are closed as soon as vehicles enter the building; ○ The waste reception pits are managed to minimize the volume of unprocessed waste; ○ Ensure that any other door is kept closed; ○ Follow the preventative maintenance for the Terminodour system; • Measure daily the output from the carbon filters and change the filter if the following triggers are reached for more than two consecutive days; <ul style="list-style-type: none"> ○ More than 5ppm for H2S; ○ More than 20 ppm for ammonia; • Keep onsite replacement carbon filters to swap; • Carry out daily odour checks and ensure that actions are taken if an odour is detected. 	-Ensure correct PPE is worn at all times and your safety and others is taken as a priority.		

Competence Assessment

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File the completed assessment in the trainee's competence evidence record.

Trainee I confirm that I have received training and have been observed carrying out this task and I am confident that I understand the correct procedures and precautions necessary to complete the task safely and effectively.		
Name of trainee:	Signature:	Date:
Trainer I confirm that the trainee has been observed carrying out this task and I am satisfied that he/she is able to do so safely and effectively.		
Name of trainer:	Signature:	Date:

Activity: Dry matter determination or Dry solids determination			
Prepared by: Amaya Arias-Garcia	Approved by: Tony Calpin	Revision: 1.1	Dated: 21/08/2017

PURPOSE	To determine the Dry Matter (DM) of a feedstock, soup or substrate		
CARRIED OUT BY	Operator		
FREQUENCY	Daily		
DURATION	N/A		
Review Date:	03/05/19	Reviewed By:	Ricky Maylin
BACKGROUND	<p>Dry Matter: The DM (or otherwise known as dry solids) is a measurement of the mass of something when completely dried. The dry matter of plant and animal material would be its solids, i.e. all its constituents excluding water.</p> <p>The Dry Solids (DS) content of a material is often critical to being able to predict the biogas yield. Comparing gas yields based on the m³/tonne dry solids is also a more objective method of comparing feed material than m³/wet tonne. The DS concentration is also a useful design tool, as the organic loading to a digester is usually dependent on it. See OLR determination SOP014.</p>		

INSTRUCTIONS <i>Demonstrate and explain how each step is carried out. Allow the trainee to practice under supervision where safe to do so. Ensure the trainee understands how to tell if the task is working correctly, the warning signs of it starting to go wrong and what corrective action to take.</i>	HSE&Q INFORMATION <i>Use this information to ensure that stages that are critical to HSE&Q are understood. Ensure the trainee understands the consequences of performing the task incorrectly.</i>	COMPETENCE ASSESSMENT	
		Skills	Knowl edge
<p>DRY MATTER DETERMINATION PROCEDURE</p> <ol style="list-style-type: none"> 1. Weigh the metal tray and record the figure in the log = W1 2. Put sample in metal tray 3. Weigh sample and metal tray and record figure in the log = W2 4. Put metal tray and sample in oven for 3 hours 5. Calculate the weight of the sample $W2 - W1 = W3$ 6. After 3 hours put sample in desiccator to cool down 7. Weigh the sample and tray after cooled = W4 8. Calculate the weight of the dry sample $W4 - W1 = W5$ 9. $W5 / W2 = W6$ 10. $W6 * 100 = \% \text{ dry matter}$ 11. Record the results in the Key Performance Indicator Spreadsheet. 	<p>-Ensure correct PPE is worn at all times and your safety and others is taken as a priority.</p>	<input type="checkbox"/>	<input type="checkbox"/>

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Trainer I confirm that the trainee has been observed carrying out this task and I am satisfied that he/she is able to do so safely and effectively.		
Name of trainer:	Signature:	Date:

Activity: Organic Loading Rate Determination			
Prepared by: Amaya Arias-Garcia	Approved by: Tony Calpin	Revision: 1.1	Dated: 21/08/2017
PURPOSE	To define a process to be followed when determining the organic loading rate (OLR) in the digester		
CARRIED OUT BY	Operator		
FREQUENCY	Daily		
DURATION	N/A		
Review Date:	03/05/19	Reviewed By:	Ricky Maylin
BACKGROUND	<p>OLR – the organic loading rate is the mass of volatile organic matter, or volatile solids (VS) that is treated per m³ of digester volume per day.</p> <p>A typical upper limit of OLR would be 4 kg VS per m per day, with few anaerobic digesters reliably proven above 5 kg VS/m³ /day.</p> <p>Volatile solids – A measure of the weight of solids that is combustible “volatilised” at a temperature of 500 °C. It is reported as a percentage of the total weight of the original sample. Methane production is often based on the volatile solids portion of the feedstock.</p>		

INSTRUCTIONS <i>Demonstrate and explain how each step is carried out. Allow the trainee to practice under supervision where safe to do so. Ensure the trainee understands how to tell if the task is working correctly, the warning signs of it starting to go wrong and what corrective action to take.</i>	HSE&Q INFORMATION <i>Use this information to ensure that stages that are critical to HSE&Q are understood. Ensure the trainee understands the consequences of performing the task incorrectly.</i>	COMPETENCE ASSESSMENT	
		Skills	Knowledge
<p>Steps to calculate the OLR:</p> <ol style="list-style-type: none"> 1. Determine the daily feed (kg) 2. Determine the dry matter of the feed (%) 3. Assuming 90% oDM% of DM determine the volatile solids (kg) 4. Determine the volume inside the digester. This might change everyday depending on the amount we pasteurise (m3) 5. Divide the VS by the volume (kgVS/m3/day) 	<p>-Ensure correct PPE is worn at all times and your safety and others is taken as a priority.</p>	<input type="checkbox"/>	<input type="checkbox"/>

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Trainer I confirm that the trainee has been observed carrying out this task and I am satisfied that he/she is able to do so safely and effectively.		
Name of trainer:	Signature:	Date:

Activity: Volatile Fatty Acids Determination			
Prepared by: Amaya Arias-Garcia	Approved by: Tony Calpin	Revision: 1.2	Dated: 10/09/2017
PURPOSE	To determine the total Volatile Fatty Acids in the digester		
CARRIED OUT BY	Operator		
FREQUENCY	Daily		
DURATION	N/A		
Review Date:	03/05/19	Reviewed By:	Ricky Maylin
BACKGROUND	<p>Volatile Fatty Acids (VFA) are short-chained volatile organic acids such as acetic acid, propionic acid and butyric acid. They are intermediate molecules in the anaerobic digestion process that are produced during the acidification step and are precursors of methane. As a consequence if they accumulate this often means that the production of methane is inhibited.</p> <p>The levels of VFAs within the digester can range from tens of mg/l to several thousand mg/l. typically, the higher the organic loading rate of a digester, the higher the residual VFAs. High VFAs would lower the pH and affect the microbes if the system does not have buffering capacity i.e. alkalinity. It would also be an indication that there is too much food for the microbe population.</p> <p>The VFAs should be looked at in isolation but also in conjunction with the Alkalinity.</p> <p>At Fernbrook the VFAs are determined photometrically using the Spectroquant® method.</p>		

INSTRUCTIONS

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HSE&Q INFORMATION

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COMPETENCE ASSESSMENT

Skills Knowledge

-Ensure correct PPE is worn at all times and your safety and others is taken as a priority.

1.01809.0001 November 2013

**Spectroquant®
Volatile Organic Acids
Test**

1. Method
In an acidic medium lower fatty acids ("volatile organic acids") react with a diol to form fatty acid esters, which are subsequently converted into hydroxamic acids with hydroxylamine. These in turn react with iron(III) ions to form red complexes that are determined photometrically.

2. Measuring range and number of determinations

Measuring range	Number of determinations
50 - 3000 mg/l ^{a)}	100
71 - 4401 mg/l ^{b)}	

^{a)} calculated as acetic acid
^{b)} calculated as butyric acid

For programming data for selected photometers / spectrophotometers see www.service-test-kits.com.

3. Applications
Sample material:
Digested sludge
Activated sludge
Process water.

4. Influence of foreign substances
This was checked in solutions containing 1500 and 0 mg/l acetic acid. The determination is not yet interfered with up to the concentrations of foreign substances given in the table.

Concentrations of foreign substances in mg/l or %		
Al ³⁺ 1000	Mn ²⁺ 50	Acetaldehyde 50
Ca ²⁺ 1000	NH ₄ ⁺ 1000	Acetone 1000
Cd ²⁺ 50	Ni ²⁺ 50	Ethanol 5%
Cr ³⁺ 50	Pb ²⁺ 50	Formaldehyde ¹⁾ 50
Cu ²⁺ 50	PO ₄ ³⁻ 1000	Surfactants ²⁾ 1000
Fe ³⁺ 1000	Zn ²⁺ 2000	NaCl 50%
Hg ²⁺ 50		NaNO ₃ 20%
Mg ²⁺ 1000		Na ₂ CO ₃ 10%

¹⁾ tested with nonionic, cationic, and anionic surfactants

5. Reagents and auxiliaries
Please note the warnings on the packaging materials!
The test reagents are stable up to the date stated on the pack when stored closed at +15 to +25 °C.

Package contents:
1 bottle of reagent OA-1
1 bottle of reagent OA-2
1 bottle of reagent OA-3
1 bottle of reagent OA-4
1 bottle of reagent OA-5
4 empty round cells with bar code

Other reagents and accessories:
MColorpHast™ Universal indicator strips pH 0 - 14, Cat. No. 109535
Pipettes for pipetting volumes of 0.50, 0.75, and 5.0 ml
Thermoreactor

6. Preparation

- Analyze immediately after sampling. Otherwise store at 4 °C for max. 24 hours.
- The pH must be within the range 2 - 12.
- Filter turbid samples.

7. Procedure

Reagent OA-1	0.75 ml	Pipette into a clean round cell.
Reagent OA-2	0.50 ml	Add with pipette.
Pretreated sample	0.50 ml	Add with pipette, close the cell tightly, and mix.

Heat the cell at 100 °C in the preheated thermoreactor for 15 min, then cool to room temperature under running water.

Reagent OA-3	1.0 ml	Add with pipette.
Reagent OA-4	1.0 ml	Add with pipette, close the cell tightly, and mix.
Reagent OA-5	1.0 ml	Add with pipette, close the cell tightly, and mix. A transient turbidity or precipitate may form.

Leave to stand for 1 min (reaction time), then measure the sample in the photometer.

Notes on the measurement:

- For photometric measurement the cells must be clean. Wipe, if necessary, with a clean dry cloth.
- Measurement of turbid solutions yields false-high readings.
- The color of the measurement solution remains stable for 30 min after the end of the reaction time stated above.

8. Analytical quality assurance
recommended before each measurement series
To check the photometric measurement system (test reagents, measurement device, handling) and the mode of working, a freshly prepared standard solution containing 2.05 g/l of sodium acetate anhydrous (corresponding to 1500 mg/l of acetic acid) (application see the website) can be used.
Sample-dependent interferences (matrix effects) can be determined by means of standard addition.
Additional notes see under www.qa-test-kits.com.

Characteristic quality data:
In the production control, the following data were determined in accordance with ISO 8466-1 and DIN 38402 A51:

Standard deviation of the procedure (mg/l acetic acid)	± 14.9
Coefficient of variation of the procedure (%)	± 1.0
Confidence interval (mg/l acetic acid)	± 30
Number of lots	1

Characteristic data of the procedure:


Sensitivity: Absorbance 0.010 A corresponds to (mg/l acetic acid)	10
Accuracy of a measurement value (mg/l acetic acid)	max. ± 73

For quality and batch certificates for Spectroquant® test kits see the website.

9. Notes

- Reclose the reagent bottles immediately after use.
- Information on disposal can be obtained at www.disposal-test-kits.com.

Merck KGaA, 64271 Darmstadt, Germany.
Tel. +49(0)6151 72-2440
www.analytical-test-kits.com
EMD Millipore Corporation, 290 Concord Road,
Billerica, MA 01821, USA, Tel. +1 978-716-4321



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Trainer I confirm that the trainee has been observed carrying out this task and I am satisfied that he/she is able to do so safely and effectively.		
Name of trainer:	Signature:	Date:

Activity: Preventing Foam			
Prepared by: Ricky Maylin	Approved by: Chris Rhoden	Revision: 1.3	Dated: 06/07/20

PURPOSE	To prevent foam inside the digesters		
CARRIED OUT BY	Operator		
FREQUENCY	Daily		
DURATION	N/A		
Review Date:	06/07/21	Reviewed By:	Ricky Maylin
BACKGROUND	<p>Problems with foam formation are often caused by using inadequate substrates, quick start-up process or when the addition of feedstock is increased suddenly. Heavy foam formation may also indicate suboptimal operating conditions or an unsuitable operation policy.</p> <ul style="list-style-type: none"> • Feeding fluctuations for solids and/or volume • Inadequate or inconsistent mixing • Temperature fluctuations • Surfactants • Excessive loading of easily degradable co-substrates • Overall loading rates too high due to: <ul style="list-style-type: none"> ○ Inadequate design ○ Loading rates greater than design due to processing volume taken up by grit or scum ○ Feeding error <p>Proteins play a major role in the formation of foam. Substrates with high protein content include food waste, grain, grass and poultry manure. During the degradation of proteins in the anaerobic digester, ammonium is produced which can have an inhibiting effect on biogas production and thus facilitates foam formation.</p>		

INSTRUCTIONS	HSE&Q INFORMATION	COMPETENCE ASSESSMENT	
		Skills	Knowl edge
<p><i>Demonstrate and explain how each step is carried out. Allow the trainee to practice under supervision where safe to do so. Ensure the trainee understands how to tell if the task is working correctly, the warning signs of it starting to go wrong and what corrective action to take.</i></p> <ul style="list-style-type: none"> • Strive for constant feed with short feeding intervals; • Feeding rates should be an average of 4kg of oDM per day /m3*; • Be suspicious of the level indicators. Daily compare readings with visual inspection; • Avoid temperature fluctuations of more than 2 degrees C per 24 hours (up or down); • Avoid surfactants like detergents or soaps; • Assess the need for adding additives to aid biology; • Check mixing daily; • Assess biology daily. <p>If there is any sign of elevated levels of foam – stop feeding glycerol immediately.</p> <p>*This is a figure from literature but each digester is different. The most important aspect is to keep the OLR as constant as possible and to set a limit according to your digester and the biology results</p>	<p><i>Use this information to ensure that stages that are critical to HSE&Q are understood. Ensure the trainee understands the consequences of performing the task incorrectly.</i></p> <p>-Ensure correct PPE is worn at all times and your safety and others is taken as a priority.</p>	<input type="checkbox"/>	<input type="checkbox"/>

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Trainer I confirm that the trainee has been observed carrying out this task and I am satisfied that he/she is able to do so safely and effectively.		
Name of trainer:	Signature:	Date:

Activity: Dealing with Foam with it occurs			
Prepared by: Amaya Arias-Garcia	Approved by: Tony Calpin	Revision: 1.2	Dated: 21/08/2017

PURPOSE	To stop a foaming event progressing in case it starts		
CARRIED OUT BY	Operator		
FREQUENCY	Daily		
DURATION	N/A		
Review Date:	03/05/19	Reviewed By:	Ricky Maylin
BACKGROUND	<p>Problems with foam formation are often caused by using inadequate substrates, quick start-up process or when the addition of feedstock is increased suddenly. Heavy foam formation may also indicate suboptimal operating conditions or an unsuitable operation policy.</p> <ul style="list-style-type: none"> • Feeding fluctuations for solids and/or volume • Inadequate or inconsistent mixing • Temperature fluctuations • Surfactants • Excessive loading of easily degradable co-substrates • Overall loading rates too high due to: <ul style="list-style-type: none"> ○ Inadequate design ○ Loading rates greater than design due to processing volume taken up by grit or scum ○ Feeding error <p>Proteins play a major role in the formation of foam. Substrates with high protein content include food waste, grain, grass and poultry manure. During the degradation of proteins in the anaerobic digester, ammonium is produced which can have an inhibiting effect on biogas production and thus facilitates foam formation.</p> <p>Definition of Foam: a mass of small bubbles across most of the surface of the liquid.</p>		

INSTRUCTIONS <i>Demonstrate and explain how each step is carried out. Allow the trainee to practice under supervision where safe to do so. Ensure the trainee understands how to tell if the task is working correctly, the warning signs of it starting to go wrong and what corrective action to take.</i>	HSE&Q INFORMATION <i>Use this information to ensure that stages that are critical to HSE&Q are understood. Ensure the trainee understands the consequences of performing the task incorrectly.</i>	COMPETENCE ASSESSMENT	
		Skills	Knowl edge
<ul style="list-style-type: none"> • If the bubbles are approximately one cm <ul style="list-style-type: none"> ○ reduce the feed by approximately 10% per feed per tank ○ apply antifoam ○ if the bubbles persist but don't get bigger reduce another 10% ○ if the bubbles persist and get bigger stop feeding • If the bubbles are bigger than one cm then stop feeding immediately and don't resume until the bubbling stops. • Once the bubbling disappear start feeding again gradually. 	<p>-Ensure correct PPE is worn at all times and your safety and others is taken as a priority.</p>	<input type="checkbox"/>	<input type="checkbox"/>

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Trainer I confirm that the trainee has been observed carrying out this task and I am satisfied that he/she is able to do so safely and effectively.		
Name of trainer:	Signature:	Date:

Activity: Operating crane to load hoppers with food waste from pits			
Prepared by: Amaya Arias-Garcia	Approved by: Tony Calpin	Revision: 1.3	Dated: 07/10/2019

PURPOSE	To ensure safe operation		
CARRIED OUT BY	Operator		
FREQUENCY	Daily		
DURATION	All Day		
Review Date:	07/10/20	Reviewed By:	
BACKGROUND	<p>The crane is used to move food waste from the pits into the hoppers for further processing.</p> <p>The crane is made up of a hydraulic arm with a scoop attachment. It is controlled from an open seating station attached to the main arm of the crane.</p> <p>A frame with fall arrester has been retro fitted to crane to prevent falls from height when mounting/operating/demounting the crane</p>		

INSTRUCTIONS	HSE&Q INFORMATION	COMPETENCE ASSESSMENT	
		Skills	Knowl edge
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<ul style="list-style-type: none"> • Collect harness from Scada office and put it on • Attached harness to fall arrest system at base of access ladder • Mount crane using access ladder and ensuring three points of contact at all times • Operate crane in accordance to manufacturers guidelines and training received • Keep attached to fall arrest system/harness at all times during operation of crane • Demount crane using access ladder • Disconnect fall arrest system only when returned to floor • Return harness to Scada office 	<ul style="list-style-type: none"> -Ensure correct PPE is worn at all times and your safety and others is taken as a priority. - Operators are fully trained and qualified in the use of the crane - Harness is worn and attached to fall arrestor before mounting operating position of crane - Crane will not operate unless operator is seated 		

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Name of trainer:	Signature:	Date:

Activity: Preventing Crust Formation			
Prepared by: Amaya Arias-Garcia	Approved by: Tony Calpin	Revision: 1.3	Dated: 10/09/2017

PURPOSE	To prevent crust formation which in turn affects biology		
CARRIED OUT BY	Operator		
FREQUENCY	Daily		
DURATION	N/A		
Review Date:	03/05/19	Reviewed By:	Ricky Maylin
BACKGROUND	A floating layer or crust can be formed on top of the substrate inside the digesters. In food waste digesters, this layer is mainly made of plastics. The main root cause for the layer formation is inadequate plastics separation at the front followed by inadequate or no mixing inside the digesters. The consequence of having a crust in the tank is that the biology suffers.		

INSTRUCTIONS	HSE&Q INFORMATION	COMPETENCE ASSESSMENT	
		Skills	Knowl edge
<p><i>Demonstrate and explain how each step is carried out. Allow the trainee to practice under supervision where safe to do so. Ensure the trainee understands how to tell if the task is working correctly, the warning signs of it starting to go wrong and what corrective action to take.</i></p> <ul style="list-style-type: none"> Check daily the biology key performance indicators (Temperature, pH, VFAs); Check daily that the mixing system is working; Check daily inside the tanks using the viewing windows. 	<p><i>Use this information to ensure that stages that are critical to HSE&Q are understood. Ensure the trainee understands the consequences of performing the task incorrectly.</i></p> <p>-Ensure correct PPE is worn at all times and your safety and others is taken as a priority.</p>	<input type="checkbox"/>	<input type="checkbox"/>

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Trainer I confirm that the trainee has been observed carrying out this task and I am satisfied that he/she is able to do so safely and effectively.		
Name of trainer:	Signature:	Date:

Activity: Checking the pH of liquid loads			
Prepared by: Amaya Arias-Garcia	Approved by: Tony Calpin	Revision: 1.1	Dated: 21/08/2017

PURPOSE	To determine the pH of liquid loads prior discharging into the plant		
CARRIED OUT BY	Operator		
FREQUENCY	Daily		
DURATION	N/A		
Review Date:	03/05/19	Reviewed By:	Ricky Maylin
BACKGROUND	Following the waste acceptance procedure SOP001 the contents of liquid tankers should be inspected prior to discharging to the pit. The pH should be more than 4 and less than 10.		

INSTRUCTIONS	HSE&Q INFORMATION	COMPETENCE ASSESSMENT	
		Skills	Knowl edge
<p><i>Demonstrate and explain how each step is carried out. Allow the trainee to practice under supervision where safe to do so. Ensure the trainee understands how to tell if the task is working correctly, the warning signs of it starting to go wrong and what corrective action to take.</i></p> <ul style="list-style-type: none"> Take a sample in a clean container from the tanker sampling tap; Measure the pH using the handheld pH meter; If the pH is more than 4 and less than 10 then the liquid is accepted; If the pH is outside this range the liquid is rejected; Record Date/Name/pH and haulier in the book. 	<p><i>Use this information to ensure that stages that are critical to HSE&Q are understood. Ensure the trainee understands the consequences of performing the task incorrectly.</i></p> <p>-Ensure correct PPE is worn at all times and your safety and others is taken as a priority.</p>	<input type="checkbox"/>	<input type="checkbox"/>

Competence Assessment

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Trainer I confirm that the trainee has been observed carrying out this task and I am satisfied that he/she is able to do so safely and effectively.		
Name of trainer:	Signature:	Date:

Activity: Site Checks			
Prepared by: Amaya Arias-Garcia	Approved by: Tony Calpin	Revision: 1.4	Dated: 30/10/2017

PURPOSE	To list the daily checks to be carried out		
CARRIED OUT BY	Operator		
FREQUENCY	Daily		
DURATION	N/A		
Review Date:	03/05/19	Reviewed By:	Ricky Maylin
BACKGROUND	In order to ensure the effective operation of the plant the operator must perform a number of checks. This is in addition to the activities related to preventative maintenance.		

INSTRUCTIONS <i>Demonstrate and explain how each step is carried out. Allow the trainee to practice under supervision where safe to do so. Ensure the trainee understands how to tell if the task is working correctly, the warning signs of it starting to go wrong and what corrective action to take.</i>	HSE&Q INFORMATION <i>Use this information to ensure that stages that are critical to HSE&Q are understood. Ensure the trainee understands the consequences of performing the task incorrectly.</i>	COMPETENCE ASSESSMENT		
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			Skills	Knowl edge
Check levels on other tanks.	EOS if there is a problem			
Check the fans and ionisation unit is working effectively.	EOS if there is a problem			
Check effectiveness of odour management system.	EOS if there is a problem			
Check Fire Equipment is present and correct.	EOS if there is a problem			
Check door management.	EOS if there is a problem			
Check lighting.	EOS if there is a problem			
Check for leaks.	EOS if there is a problem			
Check pumps.	EOS if there is a problem			
Check the mixing pump gauge pressure	EOS if there is a problem			
Check electrical equipment.	EOS if there is a problem			
Check the security fences.	EOS if there is a problem			
Check pipework integrity, macerator, pumps and Haarslev.	EOS if there is a problem			

INSTRUCTIONS			HSE&Q INFORMATION		COMPETENCE ASSESSMENT																			
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Activity: Applying Antifoam to D1			
Prepared by: Amaya Arias-Garcia	Approved by: Tony Calpin	Revision: 1.3	Dated: 21/08/2017

PURPOSE	To apply antifoam to D1		
CARRIED OUT BY	Operator		
FREQUENCY	Daily		
DURATION	N/A		
Review Date:	03/05/19	Reviewed By:	Ricky Maylin

BACKGROUND	<p>SOP017 details the steps to deal with foam if it occurs. One of the steps is the application of foam. GPC Clear Solutions Ltd, BC Antifoam 96/09. Silicone antifoam emulsion.</p> <p>On the staircase platform between the two digesters there is an 8 litre bucket and a submersible pump for this application.</p>		
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INSTRUCTIONS	HSE&Q INFORMATION	COMPETENCE ASSESSMENT	
		Skills	Knowl edge
<p><i>Demonstrate and explain how each step is carried out. Allow the trainee to practice under supervision where safe to do so. Ensure the trainee understands how to tell if the task is working correctly, the warning signs of it starting to go wrong and what corrective action to take.</i></p> <ul style="list-style-type: none"> • Pour antifoam into the bucket up to the top • Connect the power to the pump • Connect the hose to the tank • Open the valve • Start the pump until the bucket is empty. • Flush pump through with water after use <p>For a volume of ~ 2,000m3 add 0.01m3 (10 litres)</p>	<p><i>Use this information to ensure that stages that are critical to HSE&Q are understood. Ensure the trainee understands the consequences of performing the task incorrectly.</i></p> <p>-Ensure correct PPE is worn at all times and your safety and others is taken as a priority.</p>	<input type="checkbox"/>	<input type="checkbox"/>

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Trainer I confirm that the trainee has been observed carrying out this task and I am satisfied that he/she is able to do so safely and effectively.		
Name of trainer:	Signature:	Date:

Activity: Monitoring Outputs from Carbon Filters			
Prepared by: Amaya Arias-Garcia	Approved by: Tony Calpin	Revision: 1.3	Dated: 13/11/2017
PURPOSE	To Monitor output from carbon filters and avoid odour emissions.		
CARRIED OUT BY	Operator		
FREQUENCY	Daily		
DURATION	N/A		
Review Date:	03/05/19	Reviewed By:	Ricky Maylin
BACKGROUND	<p>There are three carbon filters onsite:</p> <ul style="list-style-type: none"> • TYPESA66/SA70: To treat the gases from the pasteurization displaced air. Before reaching the carbon filter the gases are cleaned with a water scrubber and cooled down with a chiller to remove as many contaminants as possible via condensation; • TYPESA66: To treat the displaced air from the End Storage Tank as it is filled; • TYPESA66: To treat the displaced air from the digester tankers as they are loaded. <p>These carbon filters are procured from CPL. <i>Carbon Link Ltd</i></p> <p>In order to monitor the performance of the carbon filters and change them as soon as trigger levels are reached the output from the carbon filters are measured daily.</p> <p>Triggers:</p> <ul style="list-style-type: none"> ○ More than 5ppm for H2S; ○ More than 20 ppm for ammonia; 		

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		Skills	Knowl edge
<ul style="list-style-type: none"> • Using the hand-held gas analyser place the sampling tube at the outlet of the carbon filter; • Record the readings; • If the reading is below the trigger no action is required; • If the reading is above the trigger check if it is the first day of a reading above trigger level; • If it is the first day wait until the day after to check for consistency; • If two days in a row the level is higher the carbon filter needs replacement. 	<p>-Ensure correct PPE is worn at all times and your safety and others is taken as a priority.</p>	<input type="checkbox"/>	<input type="checkbox"/>

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Name of trainer:	Signature:	Date:

Activity: Surface Water management in Containment area			
Prepared by: Amaya Arias-Garcia	Approved by: Tony Calpin	Revision: 1.1	Dated: 30/10/2017
PURPOSE	To ensure that surface water is properly managed		
CARRIED OUT BY	Operator		
FREQUENCY	Daily		
DURATION	N/A		
Review Date:	03/05/19	Reviewed By:	Ricky Maylin
BACKGROUND	<p>Surface water collecting within the containment area drains via gravity to a catchpit (T1) then via a manhole with shut off valve to the soakaway to the north of the site.</p> <p>The digestion process is fully automated with information on tank volumes, temperatures, any 'failures' are alarmed. The shut off valve is always closed and only manually opened after the operator is satisfied that the area/water is clean.</p> <p>Under normal operating conditions once the valve is open the containment areas drain directly to the soakaway.</p>		

INSTRUCTIONS <i>Demonstrate and explain how each step is carried out. Allow the trainee to practice under supervision where safe to do so. Ensure the trainee understands how to tell if the task is working correctly, the warning signs of it starting to go wrong and what corrective action to take.</i>	HSE&Q INFORMATION <i>Use this information to ensure that stages that are critical to HSE&Q are understood. Ensure the trainee understands the consequences of performing the task incorrectly.</i>	COMPETENCE ASSESSMENT	
		Skills	Knowl edge
<ul style="list-style-type: none"> • Check daily that the shut off valve is closed; • Only open the valve to discharge water surface if no contamination from either spillages or other sources. 	<p>-Ensure correct PPE is worn at all times and your safety and others is taken as a priority.</p>	<input type="checkbox"/>	<input type="checkbox"/>

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Trainer I confirm that the trainee has been observed carrying out this task and I am satisfied that he/she is able to do so safely and effectively.		
Name of trainer:	Signature:	Date:

Site Standard Operating Procedure



Activity:			No: SOP 025
Prepared by: Ricky Maylin	Approved by: Tony Calpin	Revision: 1.2	Dated: 02/03/20

PURPOSE	Changing Roto cut screen		
CARRIED OUT BY	Operator		
FREQUENCY	Checked daily – replace when damaged		
DURATION	1 – 2 hrs		
Review Date:	02/03/21	Reviewed By:	Ricky Maylin

INSTRUCTIONS <i>Demonstrate and explain how each step is carried out. Allow the trainee to practice under supervision where safe to do so. Ensure the trainee understands how to tell if the task is working correctly, the warning signs of it starting to go wrong and what corrective action to take.</i>	HSE&Q INFORMATION <i>Use this information to ensure that stages that are critical to HSE&Q are understood. Ensure the trainee understands the consequences of performing the task incorrectly.</i>	COMPETENCE ASSESSMENT	
		Sk	Kn
<p>Vogelsang Roto cut – models 500 and 1000</p> <p>The roto cut is a process critical step. To guarantee the maximum partial size of 12mm all feedstock goes through the roto cut. This is a requirement from AHBP and PAS110.</p> <p>The screen has to be checked daily for damage to ensure this process critical step is enforced.</p> <p>Before inspecting the screen you must isolate the electric to the unit. Follow the steps below:</p> <p style="text-align: center;">Please note only trained and qualified personal can complete this task.</p>	<p>An isolation permit to work must be issued from the plant manager before task is completed.</p> <p>PPE must be worn - steel top cap boots, hi-vis vest, glasses and gloves.</p> <p>Operative completing this task must have LV training/ plant competence.</p> <p>Gas monitor – blackline device</p>	<input type="checkbox"/>	<input type="checkbox"/>

Main distribution panel needs to be isolated. Please note this isolator will switch off the whole frontend de-packaging equipment.

1.



Isolate

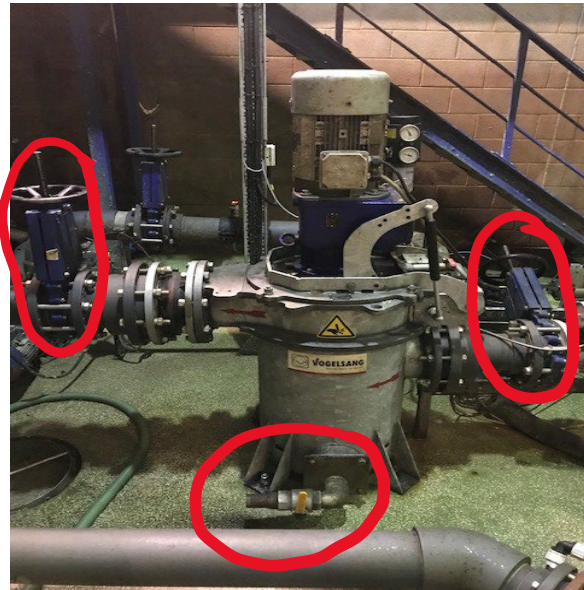
Please log any gas alarms in the gas data sheet. Follow instructions detailed in SOP 030 gas data sheet.

Secondary isolation – local isolation number: MOTOR RF101

2.



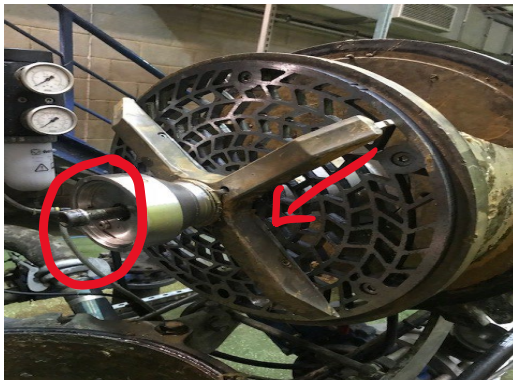
3. Once the electric is isolated, the unit needs to be hydraulically isolated. There are two manual valves each side of the unit. Once these are isolated please use the two inch ball valve at the base of the unit to drain content.



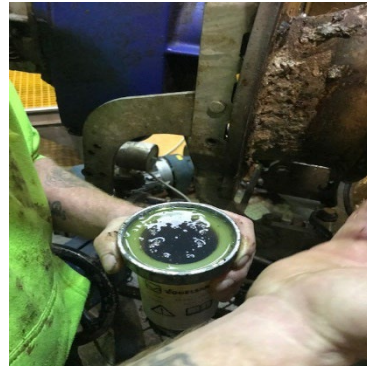
4. Once the valves are isolated the unit can be opened. The bolts need loosening and the head of the unit needs tilting backwards.



5. Once the unit is opened, the central bolt needs to be removed, this will allow the screen and cutters to come free.



6. Once the relevant parts have been changed, the unit needs closing back up and bolting together. The hydraulic oil needs topping up and re-pressurising.



7. To increase the hydraulic pressure you can use the mobile compressor. Before using the mobile compressor, familiarise yourself with SOP 026- using the mobile compressor. Please use the fitting circled above- the top gauge needs to be above 5bar – the bottom gauge needs to be above 2bar.

8. open manual valves once the unit is closed and pressurised. Once the valves are opened the local isolator and the main panel switch can be turned on.

Please note:- Gases present when lid is opened. H2S gas present when maintained. Please allow the gases to vent before work continues. If the gas is persistent please use the water hose to wash down the unit. Record all gas alarms in the gas data sheet (SOP030)

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Name of trainer:	Signature:	Date:

Site Standard Operating Procedure



Activity: Loan working procedure

No: SOP 026

Prepared by: Ricky Maylin

Approved by: Tony Calpin

Revision: 1.1

Dated: 29/04/2019

PURPOSE	Gain knowledge of loan working device and loan working practices		
CARRIED OUT BY	Operator		
FREQUENCY	Daily		
DURATION	N/A		
Review Date:	03/05/19	Reviewed By:	Ricky Maylin

INSTRUCTIONS	HSE&Q INFORMATION	COMPETENCE ASSESSMENT	
		Sk	Kn
<p><i>Demonstrate and explain how each step is carried out. Allow the trainee to practice under supervision where safe to do so. Ensure the trainee understands how to tell if the task is working correctly, the warning signs of it starting to go wrong and what corrective action to take.</i></p> <p>POWER ON How do I turn on my G7c? Press and hold the power button, and wait for the blinking green connectivity light to turn solid. When connected, the green light will remain solid.</p> <p>How do I turn on my G7x? Press and hold the power button on your G7 Bridge to turn it on first, and wait for the blinking green connectivity light to turn solid, It takes approximately two minutes for G7 Bridge to connect to the Blackline Safety Network. When connected the green light will remain solid.</p> <p>Press and hold the power button on your G7x. Wait for the blinking green connectivity light to turn solid. When connected, the green light will remain solid.</p> <p>NOTE: For best results, ensure your G7 Bridge is turned on before your G7x. If you are having difficulties connecting your G7x to G7 Bridge, please refer to your G7 Bridge manual.</p>	<p><i>Use this information to ensure that stages that are critical to HSE&Q are understood. Ensure the trainee understands the consequences of performing the task incorrectly.</i></p> <p>The correct PPE must be worn when attending site even out of hours- steel top cap boots, hi-vis vest and gas monitor.</p> <p>Operative using this device must have complete the black line competence training.</p>	<input type="checkbox"/>	<input type="checkbox"/>

POWER OFF

How do I turn off my G7c?

Press and hold the power button. The device will go into shutdown sequence, once all the lights and vibrations have stopped, you have been logged off from the Blackline Safety Network.

How do I turn off my G7x?

Press and hold the power button of your G7x. The device will go into shutdown sequence, sending your log off status to G7 Bridge.

When suitably powered, G/ Bridge can remain on at all times. When G7 Bridge is off, all connected devices will no longer be monitored. Before powering down, ensure there are no other G7x devices connected. Once confirmed, press and hold the power button on the G7 Bridge. The device will go into shutdown sequence. Your safety is no longer being monitored.

CONNECTIVITY LIGHT

Are you connected to the Blackline Safety Network? G7 lets you know your connection status.

Blinking green light

A blinking connectivity light indicates that your G7 is storing data. It is not currently connected to the network and will send data when the light is solid.

Solid green light

A solid connectivity light indicates that G7 is actively transmitting data and is connected to the Blackline Safety Network.

Sound and vibration

Configurable to sound an alarm if connection is lost after 5 minutes.

NOTE: if you are using real-time features, your safety is only monitored when the connectivity light is solid.

Hardware detail



HOW IT WORKS

Interacting with G7 is easy with its high-visibility LCD display and three-button menu system.



OK button

Press OK to enter the main menu on the LCD screen and to confirm a menu selection.

Up and down arrow buttons

Press up or down to navigate the menu. Press and hold both simultaneously to mute a yellow warning alarm or red alert.



Latch Pull:- Pull down the latch to call for help when assistance is required.

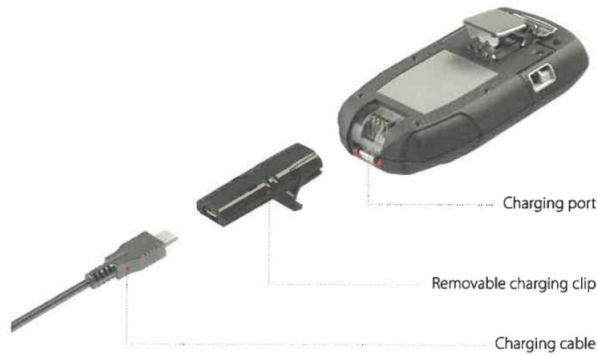
Latch push:- button Push the latch in to check in and tell your G7 that you are safe

CHARGING

How do I charge my G7?

Insert the micro USB plug into the removable charging clip, then slide the clip onto the charging port at the bottom of your G7. A solid red light at the bottom of the device confirms your G7 is charging. The LCD screen will let you know when it is fully charged, which can take up to four hours.

Blackline recommends that you fully charge your device after every shift.



Loan working process

At fernbrook bio we have a call out system in place. There are five key members of the operational staff, there are three operators, a site manager and an operational support worker. There are two systems running a long side each other at fernbrook. The first system is the SCADA system, this sends operational alarms to the operators via a phone call. The operator that is on call can logon to the SCADA system remotely and interoperate if the alarm requires them to attend site.

If the operator is required to attend site, he will liaise with the site manager and communicate the issue. The operator will come to site, go to the site office and retrieve the loan working device. This is the second system that is in place. The loan working devices doubles as a gas monitoring device also.

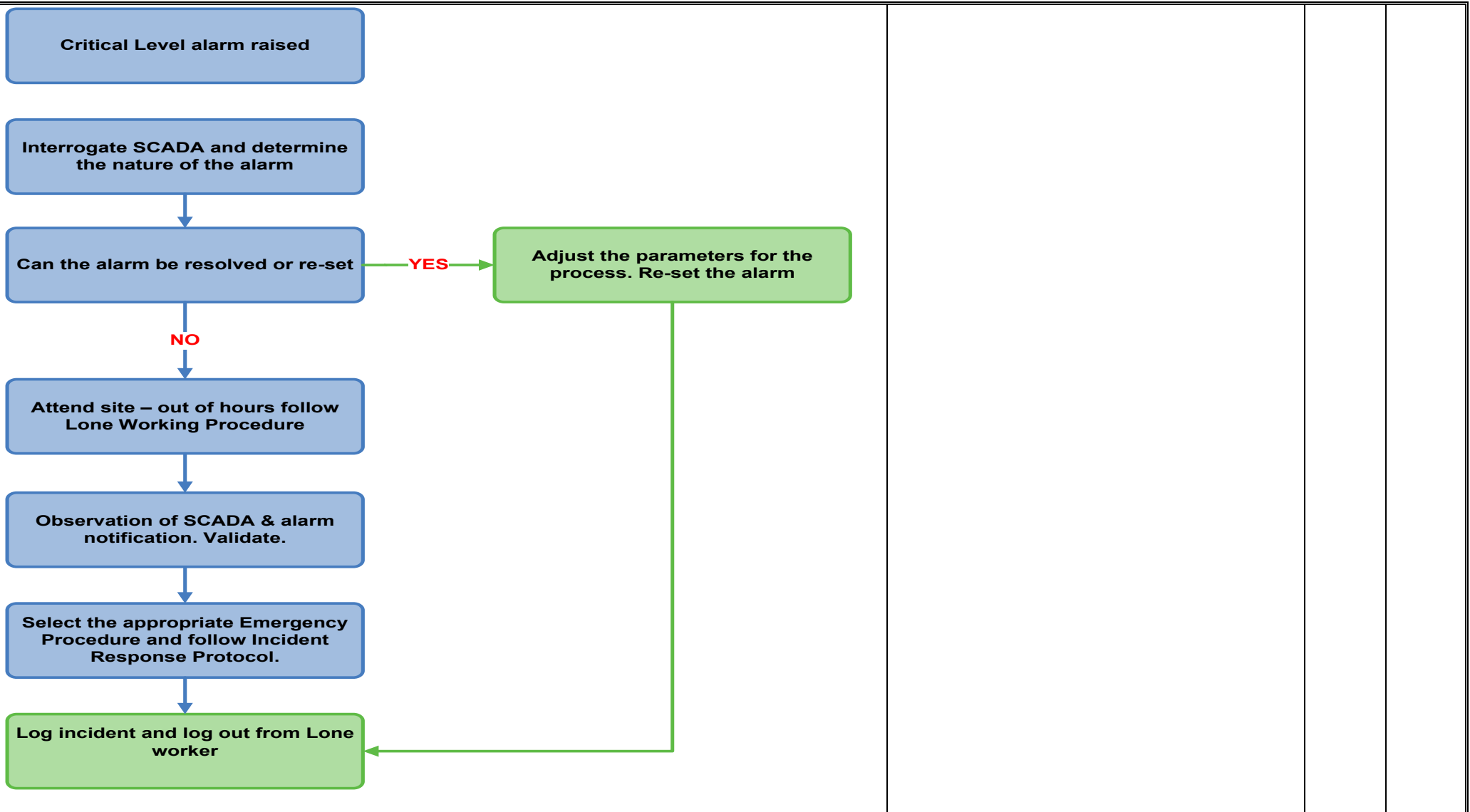
The loan working/ gas monitoring device is referred to as the blackline device, its functions includes an GPS sim card, for location and communication. There is also an alarms system that can txt a designated recipient. The device has a built in sensor that is sensitive to force and can detect a "man down" situation. The Device has pre-programmed gas warning levels and will send a email and call the designated recipient if these levels are achieved.

The site operational support worker will normally receive the call from the blackline device. They can call the device and communicate with the operator if required. If the operational support worker can't communicate with the operator on site they will either view the CCTV system remotely, attend site if possible or make preparations for someone else to attend site. If the operational support worker see's the operator in danger or unconscious they will call the appropriate emergency service.

The site manager also receives an email and explains the alarm, the site manager needs to acknowledge the alarm via the web portal. If the operational support worker doesn't answer the call, the device calls the next pre-programmed name on the system. If the two people on the system don't answer the call, the device calls blacklines remote monitoring centre, if contact cannot be made with the operator on site the blackline operator will call the emergency services.

The on call duties will rotate between the three operators. The site manager and the operational support worker will manage communications between the operational staff when they are on call.

We shall plan to be on site within 30mins of distress call.



Competence Assessment

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Sign this document when the trainee can perform the whole task to the required quality, in compliance with the HSE&Q requirements, within the required time, without assistance and has demonstrated familiarity with the HSE&Q information.

File the completed assessment in the trainee's competence evidence record.

Trainee I confirm that I have received training and have been observed carrying out this task and I am confident that I understand the correct procedures and precautions necessary to complete the task safely and effectively.		
Name of trainee:	Signature:	Date:
Name of trainee:	Signature:	Date:
Name of trainee:	Signature:	Date:
Name of trainee:	Signature:	Date:
Trainer I confirm that the trainee has been observed carrying out this task and I am satisfied that he/she is able to do so safely and effectively.		
Name of trainer:	Signature:	Date:

Site Standard Operating Procedure



Activity: Calibration of PH probe in gas scrubber

No: SOP 027

Prepared by: Ricky Maylin

Approved by: Tony Calpin

Revision: 1.1

Dated: 14/01/19

PURPOSE	Ph probe calibration		
CARRIED OUT BY	Operator		
FREQUENCY	Two weekly		
DURATION	15mins – 30mins		
Review Date:	03/05/19	Reviewed By:	Ricky Maylin

INSTRUCTIONS	HSE&Q INFORMATION	COMPETENCE ASSESSMENT	
		Sk	Kn
<p><i>Demonstrate and explain how each step is carried out. Allow the trainee to practice under supervision where safe to do so. Ensure the trainee understands how to tell if the task is working correctly, the warning signs of it starting to go wrong and what corrective action to take.</i></p> <p>1. Activity The Following should be available for the calibration; -Container (the bottle lid is the right size) with pH buffer 1.68 -Container (the bottle lid is the right size) with pH buffer 4</p> <p>- Close BV 06 & BV 08, -The probe is screwed out of the bracket, the electrode should be cleaned for a few seconds in regular or distilled water, -On the control unit the following steps are followed, -press enter for 3-4s and the calibration menu is opened, -press up 3 times and then down once, you are now in the sub menu and set temperature should now be shown</p>	<p><i>Use this information to ensure that stages that are critical to HSE&Q are understood. Ensure the trainee understands the consequences of performing the task incorrectly.</i></p> <p>PPE must be worn - steel top cap boots, hi-vis vest, glasses and gloves.</p> <p>COSHH Risk assessment for the ph buffers must be read.</p>	<input type="checkbox"/>	<input type="checkbox"/>

- press the down key and standard should appear on the screen, place the electrode in the pH buffer 1.68
- press to the right and you will be able to change the value using the arrow keys to 1.68, make sure the pH is no longer changing and press enter to confirm the reading,
- Now press the down key to the slope menu, now follow the same steps for pH 1.68 with pH 4.01,
- now press up and down simultaneously and you should come back to the main menu, press enter and calibration is now done, to check this place the electrode back in each of the buffers and check it reads correctly,
- Open BV 06 & BV 08.



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Trainer I confirm that the trainee has been observed carrying out this task and I am satisfied that he/she is able to do so safely and effectively.		
Name of trainer:	Signature:	Date:

Standard Operating Procedure SOP028



Isolation of Machinery/Equipment			No: SOP028
Prepared by: Ricky Maylin	Approved by: Tony Calpin	Revision: 1.1	Dated: 26/03/19

PURPOSE	Maintenance/Work required on electrically operated equipment		
CARRIED OUT BY	Site Operators		
FREQUENCY	Routine maintenance, unscheduled unserviceability		
DURATION	As required		
Review Date:	03/05/19	Reviewed By:	Ricky Maylin

INSTRUCTIONS	HSE&Q INFORMATION	COMPETENCE ASSESSMENT	
		Sk	Kn
<p><i>Demonstrate and explain how each step is carried out. Allow the trainee to practice under supervision where safe to do so. Ensure the trainee understands how to tell if the task is working correctly, the warning signs of it starting to go wrong and what corrective action to take.</i></p> <p>If Maintenance is required or a fault occurs on a machine.</p> <ol style="list-style-type: none"> Immediately cease work operations. Shut down (if possible) ensure machine comes to a complete stop. (If not possible use main isolation switch to stop machinery). Close any required water/gas/digestate valves going into machinery and ensure pressure is vented/removed. Seek a work permit before proceeding to address the problem. Fill in the work permit according to instructions from the site manager/site technician. Ensure Isolation Register is completed and signed for. Take personal padlock/key. Safe isolate equipment using relevant isolation switch or distribution board. 	<p><i>Use this information to ensure that stages that are critical to HSE&Q are understood. Ensure the trainee understands the consequences of performing the task incorrectly.</i></p> <p>Ensure at all times all personnel present are aware of the immediate response to an unscheduled breakdown/maintenance and the location of the main isolation point.</p> <p>Ensure correct PPE is worn at all times.</p> <p>Ensure all electrical equipment is maintained and calibrated.</p> <p>Ensure the correct electrical meter reader is used for the safe isolation in accordance with IEE regulations 17th Edition.</p> <p>Ensure personnel are trained in electrical principals.</p>	<input type="checkbox"/>	<input type="checkbox"/>

INSTRUCTIONS <i>Demonstrate and explain how each step is carried out. Allow the trainee to practice under supervision where safe to do so. Ensure the trainee understands how to tell if the task is working correctly, the warning signs of it starting to go wrong and what corrective action to take.</i>	HSE&Q INFORMATION <i>Use this information to ensure that stages that are critical to HSE&Q are understood. Ensure the trainee understands the consequences of performing the task incorrectly.</i>	COMPETENCE ASSESSMENT	
		Sk	Kn
<p>8. Check equipment is dead/offline (no voltage going to equipment) (If possible).</p> <p>9. Insert padlock into isolation switch or key.</p> <p>10. Lock the padlock securely.</p> <p>11. Check equipment is still dead/offline. (If possible).</p> <p>12. Keep the padlock key in your possession (do not give it to anyone else)</p> <p>13. If more than one person is working on the machine ensure that each person uses their own individual padlock (signed for from the site office)</p> <p>14. With your padlock key in possession, proceed to remove any blockages, carry out a repair or maintain equipment.</p> <p>15. When work is completed, check that the machine is safe to operate again, checking connections are made, any closed valves opened and all tools are removed.</p> <p>16. Return to the control panel distribution board and remove the padlock.</p> <p>17. Return work permit to control room along with the padlock and key.</p> <p>18. Place these items on the board and record details on the following time work permit returned, work completed and padlock and keys returned.</p>	<p>Ensure multiple users ALL safe isolate.</p> <p>Ensure at all times all personnel present are aware of the immediate response to an unscheduled breakdown/maintenance and the location of the main isolation point.</p> <p>Ensure correct PPE is worn at all times.</p> <p>Ensure all electrical equipment is maintained and calibrated.</p> <p>Ensure the correct electrical meter reader is used for the safe isolation in accordance with IEE regulations 17th Edition.</p> <p>Ensure personnel are trained in electrical principals.</p> <p>Ensure multiple users ALL safe isolate.</p>		

Competence Assessment

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File the completed assessment in the trainee's competence evidence record.

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Trainer I confirm that the trainee has been observed carrying out this task and I am satisfied that he/she is able to do so safely and effectively.		
Name of trainer:	Signature:	Date:

Site Standard Operating Procedure



Activity: Haarslev isolation – safe access to screen/ hammer mill

No: SOP 029


Prepared by: Ricky Maylin

Approved by: Tony Calpin

Revision: 1.1

Dated: 24/07/19

PURPOSE	Instruction on safe access to the haarslev screens
CARRIED OUT BY	Operator
FREQUENCY	Daily
DURATION	30 mins

INSTRUCTIONS	HSE&Q INFORMATION	COMPETENCE ASSESSMENT	
		Sk	Kn
<p><i>Demonstrate and explain how each step is carried out. Allow the trainee to practice under supervision where safe to do so. Ensure the trainee understands how to tell if the task is working correctly, the warning signs of it starting to go wrong and what corrective action to take.</i></p> <p>To access the Haarslev screens the machine must first be switched off. The main isolator ref (pic 1) must be switched to the off position.</p> <p>(pic 1)</p> 	<p>Use this information to ensure that stages that are critical to HSE&Q are understood. Ensure the trainee understands the consequences of performing the task incorrectly.</p> <p>Ensure at all times all personnel present are aware of the immediate response to an unscheduled breakdown/maintenance and the location of the main isolation point.</p> <p>PPE must be worn - steel top cap boots, hi-vis vest, glasses, gloves and personal gas monitor.</p> <p>An isolation permit to work must be issued from the plant manager before task is completed.</p>	<input type="checkbox"/>	<input type="checkbox"/>

Please also turn the maintenance switch to – ON as shown in pic 2 below.

(pic 2)



The four locking nuts need loosening, with the tool shown below. There are two locking nuts on each side of the haarslev. The purpose made loosening tool will be stored by the unit.



Purpose made tool.

Locking nuts

Ensure all electrical equipment is maintained and calibrated.

Ensure the correct electrical meter reader is used for the safe isolation in accordance with IEE regulations 17th Edition.

Ensure personnel are trained in electrical principals.

Ensure multiple users ALL safe isolate.

Risk Assessment: (HSE 003 machinery and equipment maintenance) must be signed before work commences.

The lever shown below needs to be pushed over to the “service” section, when opening. This lever needs to be pushed back to the “operation” section when maintenance is complete.



Once the locking nuts have been loosened and lever is in the “service” section, the door of the Haarslev can be opened. To do this the lever under the floor, shown below needs to be opened.



Once the door is open, you will have to install the purpose made walk platform as shown below. The walk platform isn't fixed it just slots in place.

(without platform)



(with platform)



Once the maintenance has been completed, the walk platform needs removing.

Competence Assessment

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Trainee I confirm that I have read this document in its entirety and I am confident that I understand the correct procedures and precautions necessary to complete the task safely and effectively.		
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Trainer I confirm that the trainee has been observed reading this document and I am satisfied that he/she is able to do so safely and effectively.		
Name of trainer:	Signature:	Date:

Site Standard Operating Procedure

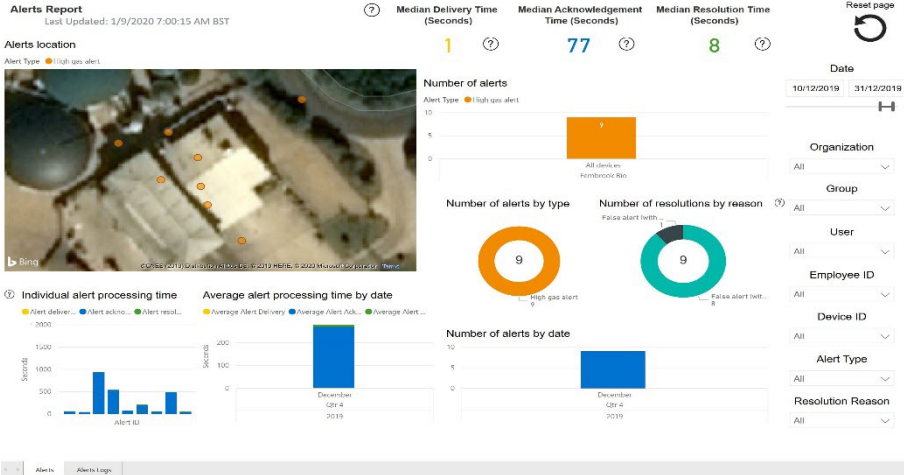


Activity: Gas data log			No: SOP 030
Prepared by: Ricky Maylin	Approved by: Tony Calpin	Revision: V1	Dated: 15.01.20

PURPOSE	Capture data on the activities that release gas
CARRIED OUT BY	Operator
FREQUENCY	undefined
DURATION	N/A

INSTRUCTIONS <i>Demonstrate and explain how each step is carried out. Allow the trainee to practice under supervision where safe to do so. Ensure the trainee understands how to tell if the task is working correctly, the warning signs of it starting to go wrong and what corrective action to take.</i>	HSE&Q INFORMATION <i>Use this information to ensure that stages that are critical to HSE&Q are understood. Ensure the trainee understands the consequences of performing the task incorrectly.</i>	COMPETENCE ASSESSMENT	
		Sk	Kn
<p>The details captured below should allow management to investigate where the operators are being exposed to gas.</p> <p>The logs will be reviewed weekly by the plant manager, but every alarm will be investigated by the plant manager on the day.</p> <p>The logs and investigations will be reviewed in the monthly health and safety meeting.</p> <p>The gas monitors should be calibrated and bump tested in accordance with manufacturing guidelines.</p>	<p>Gas calibration and bump test training must be completed.</p> <p>Risk assessments written in accordance with SOP must be followed.</p> <p>Training on the use of the gas monitors must be provided before you can use a gas monitor.</p> <p>Operators must wear the gas monitors at all times.</p> <p>TBT on gas levels STEL & LTEL must be signed.</p>	<input type="checkbox"/>	<input type="checkbox"/>

Site Standard Operating Procedure



Gas alarm details explained below.



Gas Chart

Gas	Symbol	Toxic Yes/ No	Explosive Yes/ No	Visible Yes/ No	Odour Yes/ No	Heavier lighter than air	Alarm level	STEL	LTEL
Oxygen	O2	NO	YES	NO	NO	N/A	19 – 23%	Low 19%	High 23%
Ammonia	NH3	YES	YES	NO	YES	N/A	25 ppm	35ppm 15 mins	25ppm 8hrs
Hydrogen Sulphide	H2S	YES	YES	NO	YES	HEAVIER	5 PPM	10ppm 15mins	5 ppm 8hrs
Methane	CH4	NO	YES	NO	NO	LIGHTER	1% VOL	LEL 10% = 1.3% vol	5% - 15% explosive with O2
Carbon monoxide	CO	YES	YES	NO	NO	LIGHTER	20 PPM	100 ppm 15 mins	20 ppm 8hrs
Carbon Dioxide	CO2	YES	NO	NO	NO	HEAVIER	5000 PPM	15000 15mins	5000 8hrs

LTEL - LONG TERM EXPOSURE LIMIT

STEL - SHORT TERM EXPOSURE LIMIT

Ref Source: [Ess safety training - CS2 - CONFINED SPACE ENTRY & RESCUE TECHNIQUES WITH ESCAPE SETS \(RQSPA APPROVED\)](#)

REVISION DATE: 30/01/20

Competence Assessment

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Name of trainee:	Signature:	Date:
Name of trainee:	Signature:	Date:
Trainer I confirm that the trainee has been observed reading this document and I am satisfied that he/she is able to do so safely and effectively.		
Name of trainer:	Signature:	Date:

Site Standard Operating Procedure



Activity: Borger operation			No: SOP 031
Prepared by: Ricky Maylin	Approved by: Tony Calpin	Revision: V1	Dated: 16.01.20

PURPOSE	Details of how-to operator the borger
CARRIED OUT BY	Operator
FREQUENCY	Daily
DURATION	N/A

INSTRUCTIONS	HSE&Q INFORMATION	COMPETENCE ASSESSMENT	
		Sk	Kn
<p><i>Demonstrate and explain how each step is carried out. Allow the trainee to practice under supervision where safe to do so. Ensure the trainee understands how to tell if the task is working correctly, the warning signs of it starting to go wrong and what corrective action to take.</i></p> <p>The borger separator is used to remove plastic and contamination from the whole digestate. The digestate is pumped from the main end-storage tank, through the borger separator and discharged into two stand alone tanks that have been designated for separated digestate.</p> <p>To start the borger separator, the flexible pipework has to be connected to the stand-alone tanks with both valves open as shown below. (Ref 1 & ref 2)</p> <p>Once the pipework is connected and the valves open, press the start button on the front of the borger panel. (ref 3)</p> <p>There is a level sensor in the two stand alone tanks. Once the high level is achieved a sounder will go off and the indication light will turn red. (Ref 4)</p>	<p><i>Use this information to ensure that stages that are critical to HSE&Q are understood. Ensure the trainee understands the consequences of performing the task incorrectly.</i></p> <p>PPE must be worn - steel top cap boots, hi-vis vest, glasses, gloves and personal gas monitor.</p> <p>Please ensure anyone operating the borger separator has read and signed the environmental risk assessment for borger operation - RA 1 – BRA.</p>	<input type="checkbox"/>	<input type="checkbox"/>

Please ensure the two valves below are open before starting the borger.

Ref 1



Ref 2



Please ensure the suction and discharge pipes are connected to the endstorage tank and the stand-alone tanks.

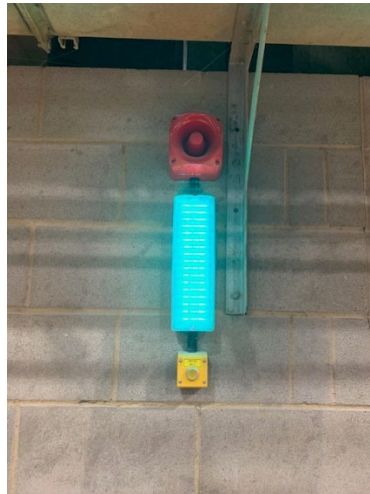
Once the valves are open press the start button on the panel, shown below. (Ref 3)



Ref 3

Start and stop button

Ref 4



The borger should now be pumping, once the light shown in ref 4 goes red please press the stop button on the panel ref 3.

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Name of trainee:	Signature:	Date:
Trainer I confirm that the trainee has been observed reading this document and I am satisfied that he/she is able to do so safely and effectively.		
Name of trainer:	Signature:	Date:

Site Standard Operating Procedure SOP - 032



Activity: FOS/TAC or VOA/TIC Testing			No: SOP 032
Prepared by: Ricky Maylin	Approved by: Chris Rhoden	Revision: 1	Dated: 09/03/21

PURPOSE	Carry out FOS/TAC(VOA/TIC) Testing		
CARRIED OUT BY	Operator		
FREQUENCY	Daily		
DURATION	30 minutes		
Review Date	09/03/21	Reviewed by:	Date:

INSTRUCTIONS	HSE&Q INFORMATION	COMPETENCE ASSESSMENT	
		Sk	Kn
<p><i>Demonstrate and explain how each step is carried out. Allow the trainee to practice under supervision where safe to do so. Ensure the trainee understands how to tell if the task is working correctly, the warning signs of it starting to go wrong and what corrective action to take.</i></p> <p>VOA/TIC is commonly referred to as FOS/TAC which is simply the German name.</p> <p>The VOA/TIC analysis is carried out daily. The purpose is to give a basic overview of the biological health. Mainly it shows if the methane bacteria are underfed, okay, stressed or over fed.</p> <p>When required due to unstable biology, increase or changed feed or multiple other reasons, this test should be carried out more than once a day.</p> <p>The following parameters are determined:</p> <ul style="list-style-type: none"> - pH value - VOA / TIC ratio <p>Note: VOA: Volatile Organic Acids, Also know as FOS. TIC: Total Inorganic Carbon (Alkaline buffer capacity) Also know as Tac.</p>	<p>Use this information to ensure that stages that are critical to HSE&Q are understood. Ensure the trainee understands the consequences of performing the task incorrectly.</p> <p>Please review COSHH relevant documentation before using any chemicals.</p> <p>Also please ensure you have signed the TBT on COSHH</p>	<input type="checkbox"/>	<input type="checkbox"/>

Throughout adding the acid, keep an eye on the titrator reservoir, if it looks like it will run out soon, note down the current amount of acid used, move the nozzle away from the sample and over an empty beaker to catch any drops. Then refill the bottle and then discharge the acid until it comes out of the nozzle to clear any air in the system. Press clear once this is done to zero the titrator. Place it back over the sample and continue the test, adding the noted down amount once complete.

Principle:

The sample is titrated with sulphuric acid from its initial pH (pH_x) to two pH values (pH 5.0 and pH 4.4) on the pH scale. From the amount of acid required to reach these pH values the VOA concentration and TIC are calculated.

Equipment: (Appendix 1)

1. Titrator
2. pH meter with thermometer
3. Speed controlled magnetic stirrer
4. Stirrer bar (Widget)
5. Scales
6. Glass beaker (150 ml - 200 ml)
7. Strainer
8. Squeezy bottle for deionised/distilled water

Required Chemicals, Ensure correct PPE is worn when handling chemicals:

1. Sulphuric Acid (0.05 mol/l = 0.1 N)
2. Distilled or de-ionised water

Calibrating the pH probe, do this every week:

To calibrate the pH probe Pre fill 3 beakers with the pH buffers. Press calibrate on the pH monitor (Appendix 2) and then dip the probe in the buffer requested by the screen. Once it has calibrated to that buffer it will flash up ready, press confirm. Then rinse the probe off with deionised water, wipe, and then repeat with the next buffer. Once again it will flash ready, once confirmed the calibration is completed. Using the final buffer check the probe reads correctly.

Note: If the system fails to calibrate, clean the probe thoroughly with deionised water. If it still fails to calibrate ensure the room is around 20 degrees or above as the probe will not work at low temperature. If it still fails the probe will need replacing.

Sample Preparation:

1. Stir sample well and pour through the strainer/sieve into the beaker on the scales until you have 20 ml/20g in the beaker; push through the strainer with a spoon if the sample is too thick.
2. Measure pH value of the original sample and record value & temperature. Rinse probe with deionised water.
3. Add 80 ml of distilled water so the beaker contains 100ml (20 ml sample + 80 ml deionised water).
6. Place glass beaker on magnetic stirrer and stir.

Titration Procedure

1. Fill the titrator reservoir with 0.05 molar sulphuric acid. Make sure the titrator is set on "0" before starting the titration.
2. Insert pH probe into the diluted sample and record pH-value as "pHx" & temperature
3. Leave the pH probe in the beaker supported by the clamp stand, & add the acid very slowly until the pH = 5.0 (if you overshoot you must start again so go carefully!)
4. Record volume of Sulphuric acid needed to reach pH 5.0; the volume is used to calculate the TIC value
5. Refill burette before starting the next step and reset to 0
6. Continue to add sulphuric acid to the beaker until the pH = 4.4 (This one goes even quicker – be careful!)
7. Record volume of Sulphuric acid needed to reach pH 4.4; the volume is used to calculate the VOA value
6. From the two values the VOA / TIC ratio can be calculated; the calculation is done automatically on the EOS FOS/TAC page.

Calculating FOS/TAC

1. Open the KPI spreadsheet, and go to the FOSTAC tab at the bottom
2. Enter the amount of acid used to reach pH 5 into cell G3
3. Enter the amount of acid used to reach pH 4.4 from pH 5 into cell G2
4. This will then give you the FOS and TAC on in cells H2 and H3 and the ratio in cell I2
5. Put the FOS and TAC details into the KPI spreadsheet rows AQ and AR
6. If there is a change of more than 0.03 on the ratio inform ONM for advice

Rule of thumb for FOS/TAC ratio

Above 0.5 Stop feeding immediately
 Above 0.4 Reduce feed
 Between 0.35 and 0.2 Target value
 Below 0.2 Bacteria may require more feed

For information only – Calculations

VOA and TIC are calculated using the following formulas. Record the result. The values are calculated automatically when the used volumes of acid are entered into the provided excel-sheet.

VOA: $[(20\text{ml}/100\text{ml} \times \text{NH}_2\text{SO}_4 (\text{pH } 5.0 - \text{pH } 4.4) \times 1.66) - 0.15] \times 500 / 200.174$

TIC: $[(20\text{ml}/100\text{ml} \times \text{NH}_2\text{SO}_4 (\text{pH } 0) - \text{pH } 5.0)] \times 250 / 200.174$

VOA/TIC: Ratio of VOA and TIC

NH₂SO₄ (pH 5.0 - pH 4.4): Volume of Sulphuric acid needed from “pH1” to “pH2”

NH₂SO₄ (pH 0 - pH 5.0): Volume of Sulphuric acid needed from “pH0” to “pH1”

Example:

Volume of Sulphuric acid needed to reach pH 5.0: NH₂SO₄ (pH0- pH 5,0) = 56.5 ml

Volume of Sulphuric acid needed to reach pH 4.4. NH₂SO₄ (pH 5,0- pH 4,4) = 4.3 ml

VOA: $[(20/100 \times 4.3 \times 1.66) - 0.15] \times 500 / 200.174 = 3.191$

TIC: $[20/100 \times 56.5] \times 250 / 200.174 = 14.113$

VOA / TIC: $13.64 / 14.11 = 0.226$

Competence Assessment

Sk = Skills. Tick the box when the trainee is able to perform the task to the required quality without assistance or prompting.

Kn = Knowledge. Tick the box when the trainee is able to provide the HSE&Q information when asked relevant open questions.

Sign this document when the trainee can perform the whole task to the required quality, in compliance with the HSE&Q requirements, within the required time, without assistance and has demonstrated familiarity with the HSE&Q information.

File the completed assessment in the trainee's competence evidence record.

Trainee I confirm that I have read this document in its entirety and I am confident that I understand the correct procedures and precautions necessary to complete the task safely and effectively.		
Name of trainee:	Signature:	Date:
Name of trainee:	Signature:	Date:
Name of trainee:	Signature:	Date:
Name of trainee:	Signature:	Date:
Name of trainee:	Signature:	Date:
Trainer I confirm that the trainee has been observed reading this document and I am satisfied that he/she is able to do so safely and effectively.		
Name of trainer:	Signature:	Date:

SOP Reference	Version	Document Title	Issue date	Last Review Date	Next Review Date
FB_SOP001	1.5	Waste Reception & Acceptance	01/02/19	02/09/21	02/09/22
FB_SOP002	1.5	Waste Storage	10/9/17	02/09/21	02/09/22
FB_SOP003	1.2	Pre Digestion Processing	21/8/17	02/09/21	02/09/22
FB_SOP004	1.4	Feedstock Storage	10/9/17	02/09/21	02/09/22
FB_SOP005	1.6	Feeding the Plant	10/9/17	02/09/21	02/09/22
FB_SOP006	1.3	Digester Monitoring	31/10/17	02/09/21	02/09/22
FB_SOP007	1.1	Pasteurisation	10/9/17	02/09/21	02/09/22
FB_SOP008	1.1	Storage of Digestate	10/9/17	02/09/21	02/09/22
FB_SOP009	1.1	PAS110 Sampling of Digestate	10/9/17	02/09/21	02/09/22
FB_SOP010	1.1	Process Control	27/9/17	02/09/21	02/09/22
FB_SOP011	1.1	Process Inspection & Maintenance	27/9/17	02/09/21	02/09/22
FB_SOP012	1.3	Odour Control	20/11/19	02/09/21	02/09/22
FB_SOP013	2	Dry Matter Determination	16/09/21		16/09/22
FB_SOP014	1.1	OLR Determination	21/8/17	02/09/21	02/09/22
FB_SOP015	1.2	VFA Determination	10/9/17	02/09/21	02/09/22
FB_SOP016	1.3	Preventing Foam	06/07/20	02/09/21	02/09/22
FB_SOP017	1.4	Dealing with Foam When it Occurs	16/09/21		16/09/22
FB_SOP018	1.3	Crane Operation	07/10/19	02/09/21	02/09/22
FB_SOP019	1.5	Preventing Crust Formation	16/09/21		16/09/22
FB_SOP020	2	pH Determination of Liquid Loads	16/09/21		16/09/22
FB_SOP021	2	Site Daily Checks	22/10/21		22/10/22
FB_SOP022	2	Dosing Enzymes, Nutrients and Anti foam to Digesters	08/10/21		08/10/22
FB_SOP023	1.3	Monitoring Output from Carbon Filters	27/9/17	03/09/21	03/09/22
FB_SOP024	1.1	Surface Water Management in Containment Area	31/10/17	03/09/21	03/09/22
FB_SOP025	1.2	Changing roto cut screen	02/03/20	03/09/21	03/09/22
FB_SOP026	1.1	Loan working procedure	09/04/19	03/09/21	03/09/22
FB_SOP027	1.1	Calibration of ph probe (gas cleaner)	14/01/19		03/05/21
FB_SOP028	1.2	lock out procedure	26/03/19	03/09/21	03/09/22
FB_SOP029	1.1	Haarslev isolation and safe access	24/07/19	03/09/21	03/09/22
FB_SOP030	1.1	Capture data on the activities that release gas	15/01/20	03/09/21	03/09/22
FB_SOP031	1.1	Details of how-to operator the borger	16/01/20	03/09/21	03/09/22
FB_SOP032	1.1	FOS TAC lab test	09/03/21		09/03/22
FB_SOP033	1	Processing Waste - Haarslev & Runi Start up	10/09/21		10/09/22
FB_SOP034	1	Pumping Liquid Directly To Digesters from Tankers	13/09/21		13/09/22
FB_SOP035	1	Checking pasteurisation temperature probes	16/09/21		16/09/22
FB_SOP036	1	Gas Alarm - General	01/04/22		01/04/23
FB_SOP037	1	H2S Gas Alarm - Reception	01/04/22		01/04/23
FB_SOP038	1	Gas Alarm - Gas Membrane Failure or Large Gas Release	22/10/21		22/10/22
FB_SOP039		Tonnage Movements – Weighbridge			
FB_SOP040	1	Using the Handheld Gas analyser	26/10/21		26/10/22
FB_SOP041		Taking a sample from the Digesters and Buffer Tanks			
FB_SOP043		Pasteurisation batch parameters			
FB_SOP044	1	Forklift inspection recording	10/03/22		10/03/22

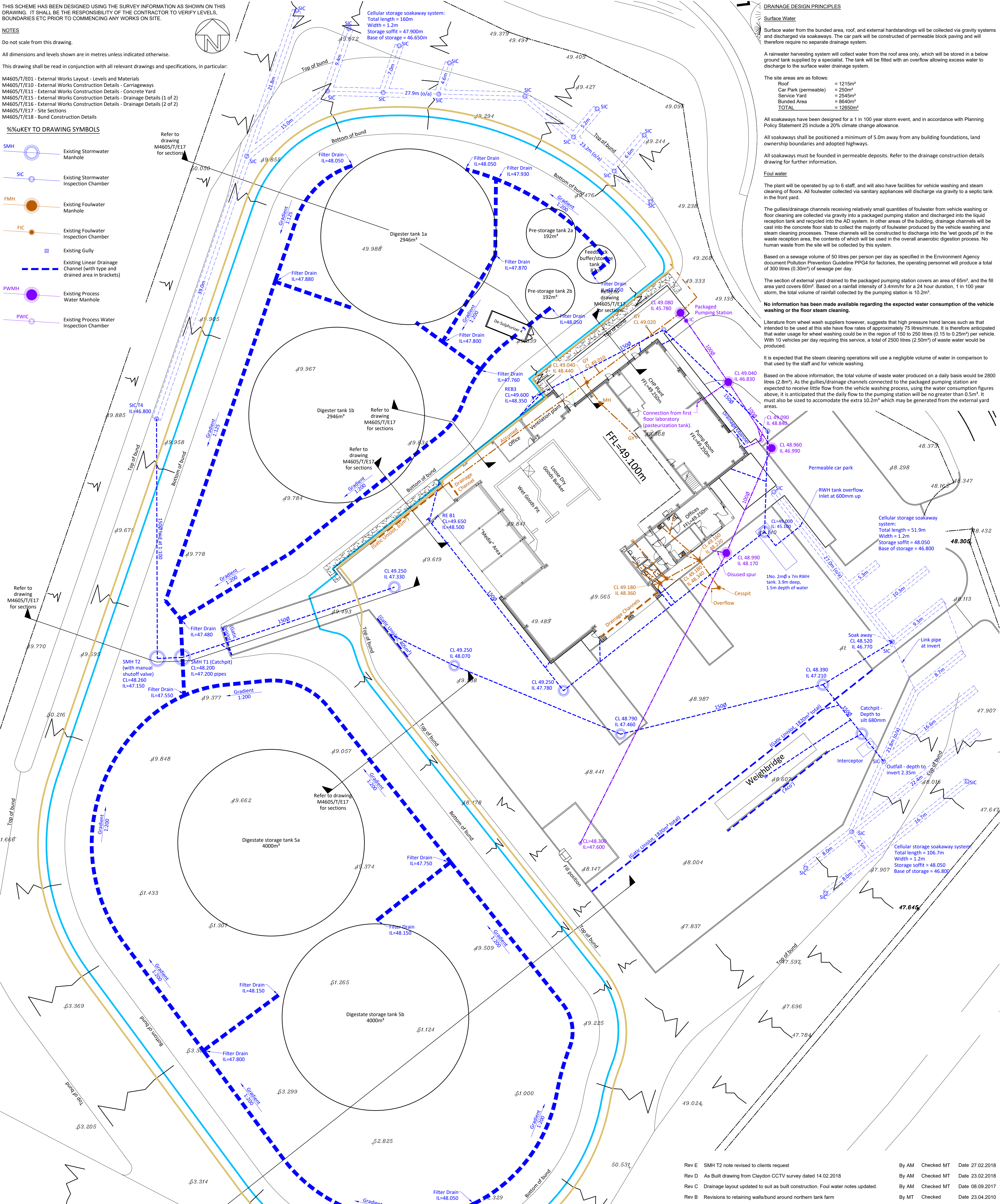
THIS SCHEME HAS BEEN DESIGNED USING THE SURVEY INFORMATION AS SHOWN ON THIS DRAWING. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY LEVELS, BOUNDARIES ETC PRIOR TO COMMENCING ANY WORKS ON SITE.

NOTES

- Do not scale from this drawing.
- All dimensions and levels shown are in metres unless indicated otherwise.
- This drawing shall be read in conjunction with all relevant drawings and specifications, in particular:
 - M4605/T/E01 - External Works Layout - Levels and Materials
 - M4605/T/E10 - External Works Construction Details - Carriageways
 - M4605/T/E11 - External Works Construction Details - Concrete Yard
 - M4605/T/E15 - External Works Construction Details - Drainage Details (1 of 2)
 - M4605/T/E16 - External Works Construction Details - Drainage Details (2 of 2)
 - M4605/T/E17 - Site Sections
 - M4605/T/E18 - Bund Construction Details

%%uKEY TO DRAWING SYMBOLS

- SMH** Existing Stormwater Manhole
- SIC** Existing Stormwater Inspection Chamber
- FMH** Existing Foulwater Manhole
- FIC** Existing Foulwater Inspection Chamber
- Existing Gully
- Existing Linear Drainage Channel (with type and drained area in brackets)
- PWMH** Existing Process Water Manhole
- PWIC** Existing Process Water Inspection Chamber



DRAINAGE DESIGN PRINCIPLES

Surface Water
Surface water from the bunded area, roof, and external hardstandings will be collected via gravity systems and discharged via soakaways. The car park will be constructed of permeable block paving and will therefore require no separate drainage system.

A rainwater harvesting system will collect water from the roof area only, which will be stored in a below ground tank supplied by a specialist. The tank will be fitted with an overflow allowing excess water to discharge to the surface water drainage system.

The site areas are as follows:
 Roof = 1215m²
 Car Park (permeable) = 250m²
 Service Yard = 2545m²
 Bunded Area = 8640m²
TOTAL = 12650m²

All soakaways have been designed for a 1 in 100 year storm event, and in accordance with Planning Policy Statement 25 include a 20% climate change allowance.

All soakaways shall be positioned a minimum of 5.0m away from any building foundations, land ownership boundaries and adopted highways.

All soakaways must be founded in permeable deposits. Refer to the drainage construction details drawing for further information.

Foul water
The plant will be operated by up to 6 staff, and will also have facilities for vehicle washing and steam cleaning of floors. All foulwater collected via sanitary appliances will discharge via gravity to a septic tank in the front yard.

The gullies/drainage channels receiving relatively small quantities of foulwater from vehicle washing or floor cleaning are collected via gravity into a packaged pumping station and discharged into the liquid reception tank and recycled into the AD system. In other areas of the building, drainage channels will be cast into the concrete floor slab to collect the majority of foulwater produced by the vehicle washing and steam cleaning processes. These channels will be constructed to discharge into the 'wet goods pit' in the waste reception area, the contents of which will be used in the overall anaerobic digestion process. No human waste from the site will be collected by this system.

Based on a sewage volume of 50 litres per person per day as specified in the Environment Agency document Pollution Prevention Guideline PPG4 for factories, the operating personnel will produce a total of 300 litres (0.30m³) of sewage per day.

The section of external yard drained to the packaged pumping station covers an area of 65m², and the fill area yard covers 60m². Based on a rainfall intensity of 3.4mm/hr for a 24 hour duration, 1 in 100 year storm, the total volume of rainfall collected by the pumping station is 10.2m³.

No information has been made available regarding the expected water consumption of the vehicle washing or the floor steam cleaning.

Literature from wheel wash suppliers however, suggests that high pressure hand lances such as that intended to be used at this site have flow rates of approximately 75 litres/minute. It is therefore anticipated that water usage for wheel washing could be in the region of 150 to 250 litres (0.15 to 0.25m³) per vehicle. With 10 vehicles per day requiring this service, a total of 2500 litres (2.50m³) of waste water would be produced.

It is expected that the steam cleaning operations will use a negligible volume of water in comparison to that used by the staff and for vehicle washing.

Based on the above information, the total volume of waste water produced on a daily basis would be 2800 litres (2.8m³). As the gullies/drainage channels connected to the packaged pumping station are expected to receive little flow from the vehicle washing process, using the water consumption figures above, it is anticipated that the daily flow to the pumping station will be no greater than 0.5m³. It must also be sized to accommodate the extra 10.2m³ which may be generated from the external yard areas.

RAINWATER HARVESTING TANK

The anaerobic digestion process requires the addition of water at various stages, and it is intended to collect rainfall from roof areas for this purpose, thus reducing the demand on potable supplies.

The Environment Agency document 'Conserving Water in Buildings - A Practical Guide' includes information on the sizing of rainwater harvesting (RWH) tanks. It recommends that the tank be sized for the lesser of 18 days worth of demand (of clean but non-potable water) or 5% of annual yield.

The water consumption for this site, based on the criteria listed in the foulwater drainage design notes, is approximately 2.8m³ per day, requiring a tank volume of 50.4m³ to store 18 days demand.

The Standard Average Annual Rainfall for this site is approximately 650mm. The roof area of the building is 1215m², and thus the annual yield is some 790m³. It must be appreciated that this is a statistical figure and will vary on a yearly basis. Nor will this volume be distributed evenly throughout the year.

Using drainage and filter efficiency factors of 0.9 as recommended in the above document, 5% of the annual yield would be 32m³, and this would therefore be the optimum tank size, equivalent to some 11 days water demand. It has been requested however by the Client that the RWH tank have a nominal volume of no less than 100m³.

The RWH tank shall be a proprietary product complying with all relevant requirements and standards, including but not limited to the following:
 It shall comply with BS 8515 'Rainwater harvesting systems - Code of practice'
 It shall be designed to have a nominal capacity of 100m³, as requested by the Client.

It shall be fitted with integral pumping equipment and an automatic mains water 'top-up' facility, with appropriate air gaps and backflow prevention devices as required by the above British Standard.

It shall be fitted with remote monitoring devices, including equipment to alert staff to disruption in its operation, and be capable of operating between the manufacturers recommended service intervals without attention or inspection.

The location of the control kiosk and alarm system supplied with the RWH tank shall be in accordance with the Architects requirements.

It shall be supplied by a specialist manufacturer to meet the storm drainage requirements as shown on this drawing and installed strictly in accordance with their requirements.

Construction drawings of the RWH tank shall be submitted to the Engineer prior to installation to determine any concrete surround requirements to avoid flotation.

Draft operating instructions and maintenance manuals shall be submitted to the Contractors for approval prior to installation. Working operating instructions and maintenance manuals shall be provided within 3 months of instruction.

PACKAGED PUMPING STATION
 The packaged pumping station shall be a proprietary product complying with all relevant requirements and standards, including but not limited to the following:
 It shall be designed to have a nominal capacity of 10.7m³, to provide 24 hours of storage capacity in accordance with Building Regulations Approved Document H1 Paragraph 2.39, to allow for interruptions in service.

It shall be fitted with remote monitoring devices, including equipment to alert staff to disruption in its operation, and be capable of operating between the manufacturers recommended service intervals without attention or inspection.

The location of the control kiosk and alarm system supplied with the pumping station shall be in accordance with the Architects requirements.

It shall comply with Approved Document H1 of The Building Regulations and BS EN 752.

It shall be supplied by a specialist manufacturer to meet the foul drainage requirements as shown on this drawing and be installed strictly in accordance with their requirements.

Facilities for odour control shall be installed as necessary to suit the location.

Construction drawings of the packaged pumping station shall be submitted to the Engineer prior to installation to determine any concrete surround requirements to avoid flotation.

Draft operating instructions and maintenance manuals shall be submitted to the Contractors for approval prior to installation. Working operating instructions and maintenance manuals shall be provided within 3 months of instruction.

Rev E	SMH T2 note revised to clients request	By AM	Checked MT	Date 27.02.2018
Rev D	As Built drawing from Claydon CCTV survey dated 14.02.2018	By AM	Checked MT	Date 23.02.2018
Rev C	Drainage layout updated to suit as built construction. Foul water notes updated.	By AM	Checked MT	Date 08.09.2017
Rev B	Revisions to retaining walls/bund around northern tank farm	By MT	Checked	Date 23.04.2010
Rev A	Issued for construction	By MT	Checked	Date 04.03.2010

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Client Fernbrook Builders

Project Proposed Anaerobic Digestion Plant Rothwell Lodge Farm

Title External Works Layout Drainage Design

Scale at A1	1:250	Drawn by	Checked by	Date	August 2009
Status	As Built	Project ref	M4605/T	Drawing no.	E02
		Revision			E

WASTE CATEGORIES¹



Rothwell Lodge AD Facility
Permit Number: EP3894SC

Please check specific requirements of Appendix B to the Anaerobic Digestate Quality Protocol²

Table S3.1 Permitted waste types and quantities for anaerobic digestion facility		
	Maximum quantity	The total quantity of waste accepted at the site shall be less than 49,000 tonnes per year.

ABPR	PAS110/ ADQP App B	List of Waste code	Description <i>Italicised text identifies restrictions found in Table B1 of ADQP</i>
		02	WASTES FROM AGRICULTURE, HORTICULTURE, AQUACULTURE, FORESTRY, HUNTING AND FISHING, FOOD PREPERATION AND PROCESSING
		02 01	wastes from agriculture, horticulture, aquaculture, forestry, hunting and fishing
✓	✓	02 01 01	sludges from washing and cleaning – <i>Food processing & food washing waste only</i>
✓	✓	02 01 02	animal-tissue waste
	✓	02 01 03	plant-tissue waste – <i>including husks, cereal dust, waste animal feeds, off-cuts from vegetable and fruit and other vegetation waste.</i>
✓	✓	02 01 06	animal faeces, urine and manure (including spoiled straw), effluent, collected separately and treated off-site
	✓	02 01 07	wastes from forestry – <i>plant tissue only</i>
	✓	02 01 99	wastes not otherwise specified – <i>Spent mushroom compost or discarded mushrooms from commercial mushroom cultivation only</i>
		02 02	wastes from the preparation and processing of meat, fish and other foods of animal origin
✓	✓	02 02 01	sludges from washing and cleaning – <i>Process water & food washing waste only.</i>
✓	✓	02 02 02	animal-tissue waste – <i>Including blood, animal flesh, fish processing waste, fish carcasses and poultry waste.</i>
✓	✓	02 02 03	materials unsuitable for consumption or processing
✓	✓	02 02 04	sludges from on-site effluent treatment
✓	✓	02 02 99	wastes not otherwise specified – <i>sludges from gelatine production and animal gut contents only</i>
		02 03	wastes from fruit, vegetables, cereals, edible oils, cocoa, coffee, tea and tobacco preparation and processing; conserve production; yeast and yeast extract production, molasses preparation and fermentation
	✓	02 03 01	Sludges from washing, cleaning, peeling, centrifuging and separation
		02 03 02	wastes from preserving agents
	✓	02 03 04	materials unsuitable for consumption or processing
	✓	02 03 05	sludges from on-site effluent treatment
	✓	02 03 99	wastes not otherwise specified – <i>sludge from production of edible fats and oil, seasoning residues, molasses residues, residues from production of potato, corn or rice starch</i>
		02 04	wastes from sugar processing
	✓	02 04 03	sludges from on-site effluent treatment – <i>biological sludge only</i>
	✓	02 04 99	wastes not otherwise specified (other biodegradable waste)
		02 05	wastes from the dairy products industry
✓	✓	02 05 01	materials unsuitable for consumption or processing – <i>Including solid and liquid dairy products, milk, food processing wastes, yoghurt, and whey.</i>
✓	✓	02 05 02	sludges from on-site effluent treatment – <i>biological sludge only</i>
		02 06	wastes from the baking and confectionery industry
✓	✓	02 06 01	materials unsuitable for consumption or processing – <i>Including condemned food, food processing wastes, biscuits, chocolate, yeast, bread, bakery wastes.</i>

WASTE CATEGORIES¹



Rothwell Lodge AD Facility
Permit Number: EP3894SC

Please check specific requirements of Appendix B to the Anaerobic Digestate Quality Protocol²

ABPR	PAS110/ ADQP App B	List of Waste code	Description <i>Italicised text identifies restrictions found in Table B1 of ADQP</i>
✓	✓	02 06 03	sludges from on-site effluent treatment – <i>biological sludge only</i>
		02 07	wastes from the production of alcoholic and non-alcoholic beverages (except coffee, tea and cocoa)
	✓	02 07 01	wastes from washing, cleaning and mechanical reduction of raw materials – <i>Including brewing waste, food processing waste, fermentation waste</i>
	✓	02 07 02	wastes from spirit distillations – <i>Spent grains, fruit and potato pulp; sludge from distilleries.</i>
	✓	02 07 04	materials unsuitable for consumption or processing – <i>Including brewing waste, food processing waste, fermentation waste, beer, alcoholic drinks and fruit juice</i>
	✓	02 07 99	wastes not otherwise specified – <i>Malt husks, malt sprouts, malt dust; spent grains, hops; yeast and yeast residues; sludges from the production process.</i>
		03	WASTES FROM WOOD PROCESSING AND THE PRODUCTION OF PANELS AND FURNITURE, PULP, PAPER AND CARDBOARD
		03 03	wastes from pulp, paper and cardboard production and processing
		03 03 02	green liquor sludge (from recovery of cooking liquor)
		03 03 08	wastes from sorting of paper and cardboard destined for recycling
	✓	03 03 10	fibre rejects, fibre-, filler- and coating-sludges from mechanical separation – <i>Only allowed if not mixed with, or does not contain, de-inking sludge.</i>
		04	WASTES FROM THE LEATHER, FUR AND TEXTILE INDUSTRIES
		04 01	wastes from the leather and fur industry
✓	✓	04 01 01	fleshings and lime split wastes – <i>NB Fleshing may also be described as leather shavings. Allowed only if hides and skins, or parts of them, originating from animals that did not show clinical signs of any disease communicable through that product to humans or animals.</i>
✓		04 01 05	tanning liquor free of chromium
✓		04 01 07	sludges, in particular from on-site effluent treatment free of chromium
		04 02	wastes from the textile industry
✓	✓	04 02 10	organic matter from natural products (for example grease, wax)
		07	WASTES FROM ORGANIC CHEMICAL PROCESSES
		07 02	wastes from the manufacture, formulation, supply and use of plastics, synthetic rubber and man-made fibres
		07 02 13	waste plastic – must conform to BS EN 13432 or equivalent standards
		15	WASTE PACKAGING; ABSORBENTS, WIPING CLOTHS, FILTER MATERIALS AND PROTECTIVE CLOTHING NOT OTHERWISE SPECIFIED
		15 01	packaging (including separately collected municipal packaging waste)
	✓	15 01 01	paper and cardboard packaging – <i>Not allowed if any non-biodegradable coating or preserving substance present.</i>
		15 01 02	plastic packaging
	✓	15 01 03	wooden packaging – <i>Untreated wood only.</i>
	✓	15 01 05	composite packaging – <i>Only allowed if comprised of packaging material otherwise allowed by this Quality Protocol.</i>
		19	WASTES FROM WASTE MANAGEMENT FACILITIES, OFF-SITE WASTE WATER TREATMENT PLANTS AND THE PREPARATION OF WATER INTENDED FOR HUMAN CONSUMPTION AND WATER FOR INDUSTRIAL USE
		19 02	wastes from physico/chemical treatments of waste (including dechromation, decyanidation, neutralization)

WASTE CATEGORIES¹



Rothwell Lodge AD Facility
Permit Number: EP3894SC

Please check specific requirements of Appendix B to the Anaerobic Digestate Quality Protocol²

ABPR	PAS110/ ADQP App B	List of Waste code	Description <i>Italicised text identifies restrictions found in Table B1 of ADQP</i>
	✓	19 02 10	combustible wastes other than those mentioned in 19 02 08 and 19 02 09 – <i>Glycerol only.</i>
		19 05	wastes from aerobic treatment of solid wastes
✓	✓	19 05 01	non-composted fraction of municipal and similar wastes ³
✓	✓	19 05 02	non-composted fraction of animal and vegetable waste ³
✓	✓	19 05 03	off-specification compost ³
✓	✓	19 05 99	wastes not otherwise specified (other biodegradable waste) – <i>Allowed only if; liquor/leachate from a composting process that accepts only the waste input types allowed by this Quality Protocol; or digestate from an anaerobic process that accepts only the waste input types allowed by this Quality Protocol.</i>
		19 06	wastes from anaerobic treatment of waste
✓	✓	19 06 03	liquor from anaerobic treatment of municipal waste ³
✓	✓	19 06 04	digestate from anaerobic treatment of municipal waste ³
✓	✓	19 06 05	liquor from anaerobic treatment of animal and vegetable ³
✓	✓	19 06 06	digestate from anaerobic treatment of animal and vegetable waste ³
		19 08	wastes from waste water treatment plants not otherwise specified
	✓	19 08 09	grease and oil mixture from oil/water separation containing only edible oils and fats – <i>Grease and oil mixture containing only edible oils and fats only.</i>
	✓	19 08 12	sludges from biological treatment of industrial waste water other than those mentioned in 19 08 11 – <i>Allowed only of uncontaminated by potentially polluting materials or substances harmful to anaerobic bacteria.</i>
		20	MUNICIPAL WASTES (HOUSEHOLD WASTE AND SIMILAR COMMERCIAL, INDUSTRIAL AND INSTITUTIONAL WASTES) INCLUDING SEPARATELY COLLECTED FRACTIONS
		20 01	separately collected fractions (except 15 01)
✓	✓	20 01 01	paper and cardboard – <i>Not allowed if any non-bio-degradable coating or preserving substance or present.</i>
✓	✓	20 01 08	biodegradable kitchen and canteen waste
✓	✓	20 01 25	edible oil and fat
		20 02	garden and park wastes (including cemetery waste)
✓	✓	20 02 01	biodegradable waste – <i>Including animal faeces, manure, garden waste, green waste, horticultural waste, plant tissue, parks and garden waste, hedge and tree trimmings, grass cuttings and leafy materials.</i>
		20 03	other municipal wastes
✓	✓	20 03 01	mixed municipal waste – <i>Allowed only if separately collected biodegradable wastes otherwise allowed by this Quality Protocol. If former food stuffs are packaged, the restrictions given above on packaging wastes apply.</i>
✓	✓	20 03 02	waste from markets – <i>Allowed only if source segregated biodegradable fractions. Examples are plant material, fruit and vegetables; Packaging waste from a market source is allowed only if it is otherwise allowed by this Quality Protocol.</i>

³ Acceptable only if derived from input types allowed by this Quality Protocol and remains segregated from, and uncontaminated by, any other waste type.

WASTE CATEGORIES¹



Rothwell Lodge AD Facility
Permit Number: EP3894SC

Please check specific requirements of Appendix B to the Anaerobic Digestate Quality Protocol²

Summary of Requirements of Appendix B to the Anaerobic Digestate Quality Protocol

- Input materials shall be biodegradable and may include non-waste biodegradable materials. Non waste biodegradable materials are not listed in this Quality Protocol. Waste input materials may only be accepted if:
 - ◆ they are listed under a 6 digit code in Table B1, meeting any additional requirements and **restrictions** specified in this table.
 - ◆ have been source-segregated (kept separate from any other wastes).
 - ◆ have not been mixed, combined or contaminated with other potentially polluting wastes, products or materials.
- Biodegradable plastic packaging that is independently certified to BS EN 13432 or either of the similar standards DIN V 54900 or ASTM D6400 that is used to collect food waste shall be permitted. It must, however, be removed either prior to or after the digestion process to meet the physical contaminant limit in BSI PAS 110 or other approved standard.
- Animal by-products – some inputs listed in Appendix B are animal by-products. The handling and treatment of animal by-products in anaerobic digestion is subject to both environmental permitting controls and animal by-products controls. Not all animal by-products can be used as a feedstock for anaerobic digestion plants. Anaerobic digestion plants can treat category 3 animal by-products and category 2 animal by-products provided they have been pressure rendered. Some category 2 materials such as manure, digestive tract contents, milk and milk products, eggs and egg products can be used as feedstock for anaerobic digestion plants without prior treatment unless there is a risk of spreading any serious transmissible disease.
- Only untreated wood is allowed. Wood and wood-derived wastes impregnated with preservatives, painted, or with any non-biodegradable layer shall not be permitted.
- If producers have any doubt over whether an input material is compliant, they should discuss the issue with the certification body.

 **Waste Codes highlighted in green have been added Appendix B of the ADQP**

 **Waste Codes highlighted in red have been removed from Appendix B of the ADQP**

END NOTES

¹ Table S3.1 is taken from Notice of variation for Environmental Permit EP3894SC dated 17th April 2012

²The ADQP referred to in this document is the version issued in January 2014

It is the waste producers responsibility to; correctly classify their waste correctly; ensure that the waste is fit for purpose; be aware of the quality requirements of the waste and criteria for rejection, and that any significant change to the quality of the waste will be notified to the Operator prior to the delivery.



Management Plan

FERNBROOK BIO



Helping clients prosper through compliance

SITE DETAILS

Fernbrook Bio Ltd

Rothwell Lodge AD Facility

Rothwell Lodge Farm

Rothwell Road

Kettering

Northamptonshire

NN16 8XF

OPERATOR DETAILS

Fernbrook Bio Ltd

Rothwell Lodge AD Facility

Rothwell Lodge Farm

Rothwell Road

Kettering

Northamptonshire

NN16 8XF

PERMIT REFERENCE

EPR/EP3894SC

DOCUMENT REFERENCE

K114.1~09~006

ISSUE DATE

08/06/2022



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REVISION HISTORY

REFERENCE	DATE	ISSUE:	REVISION SUMMARY
K114.1~09~006	21/08/2009	01	Final draft to accompany Environmental Permit application.
K114.1~09~006	11/02/2010	02	Amendments following discussions with Jane Mossman (EA) & Leanne Maguire (EA); incorporating changes to the Odour Management Plan and amendments to the site drainage & containment system.
K114.1~09~006	15/08/2012	03	Amendments following meeting with Pat Kelly (EA); changes to reflect development of site following commissioning and initial operation of facility. For internal and EA review.
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K114.1~09~006	30/04/2014	05	Amendments following meeting with Pat Kelly (EA) on 05/11/13; changes to Odour Management Plan to include reference to action levels, and to reflect improvements to odour management techniques. Review

REFERENCE	DATE	ISSUE:	REVISION SUMMARY
			against How to comply with your permit. Additional guidance for anaerobic digestion (v1.0, Nov 2013) & ADQP (Jan 2014).
K114.1~09~006	21/10/2014	06	Update to PAS110:2014 references.
K114.1~09~006	14/05/2015	07	Amendments following comments from determining officer during 'Duly Made' stage of permit variation application; changes to Fire Management Plan to Fire Prevention Plan and incorporate requirements of new EA guidance, and to clarify that an increase in annual throughput will have no effect on the risk of odour from the site or the current management techniques.
K114.1~09~006	20/08/2015	07	Amendments following Schedule 5 notice, to incorporate Biomethane upgrading plant process description, Section 7.6 and Appendix F.
K114.1~09~006	07/02/2017	08	Amendments following change of company ownership, improvements to odour abatement and process management, and issue of Regulation 36 Notice.
K114.1~09~006	03/10/2017	09	Changes made following instruction from client; reformatted to current EA guidance; removal of Odour and Accident Management sections as these will be separate documents; removal of Fire Prevention Plan section; insertion of separate section for operating Digester 2 (currently under construction); insertion of revised and updated Standard Operating Procedures and removal from main body text.
K114.1~09~006	01/03/2018	10	Amendments following the issue of the varied (IED) Environment Permit (Nov 2017); re-commissioning of Digester 2; upgrades to Digester 1; revision to Environmental Risk Assessment and Site Drainage Plan.

REFERENCE	DATE	ISSUE:	REVISION SUMMARY
K114.1~09~006	01/12/2018	11	Change made to include use of separator for whole digestate and update company logo.
K114.1~09~006	01/09/2019	12	Amendment to operation of separator prior to whole digestate removal from site.
K114.1~09~006	01/07/2020	13	Minor changes to document references and define limitations on hazardous waste storage and treatment.
K114.1~09~006	01/09/2020	14	Amendment to establish operating parameters for Digester PRVs.
K114.1~09~006	01/03/2021	D15	Amendment to include operational parameters for gas upgrading plant and safety controls.
K114.1~09~006	19/04/2021	D16	Amendment to include operational parameters for thermal oxidiser to treat odourous emissions from the AD process.
K114.1~09~006	25/03/2022	17	Amendment following change in site ownership and issue of varied Environmental Permit (V008).
K114.1~09~006	08/06/2022	18	Amendment to state that Internal Audits are undertaken in accordance with the Audit Programme

QUALITY CONTROL

ACTION	DATE	NAME
Prepared	07/03/2022	Graeme Outridge
Checked	23/03/2022	Andrea Petrolati
Approved	08/06/2022	Graeme Outridge

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FIGURES

FIGURES	TITLE
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APPENDICES

APPENDICES	REFERENCE	TITLE
Appendix A	K114.1 SOP_Index_Fernbrook 2021_V2	Standard Operating Procedure Index
Appendix B	FB/BR/09/007D	Site Layout Plan (Proposed)
Appendix C	E02 Drainage Layout Rev E	Site Drainage Plan
Appendix D	SC01FO2	Permitted Waste Types
Appendix E	K114.1~11~001 ERA v10	Environmental Risk Assessment
Appendix F	K114.1~11~002 AMP v8	Accident Management Plan

1. INTRODUCTION

This document forms the Management Plan that supports the bespoke Environmental Permit operated by Fernbrook Bio Limited at Rothwell Lodge Farm, Rothwell Road, Kettering, Northamptonshire, NN16 8XF.

This Management Plan reflects operations to be conducted in accordance with the Environmental Permitting (England and Wales) Regulations 2016 (as amended), The Animal By-Products (Enforcement) (England) Regulations 2013 and PAS110:2014.

The Management Plan should be read in conjunction with the other supporting Management System documents, specifically the Standard Operating Procedures which can be found in Appendix A.

The site is located at NGR 482384, 280129. Lying approximately 600 m south of Rothwell, 1.1k m northwest of Thorpe Malsor, 1.3 km north east of Loddington, and 1.5 km north east of Orton.

The Rothwell Lodge AD Facility was originally designed and installed by WELTec BioPower and has since been developed and further improved by Fernbrook Bio Ltd with engineering support from White's Recycling Ltd (from June 2016 onwards).

The facility provides anaerobic digestion of organic wastes from a variety of agricultural, commercial and industrial sources. The process involves the breakdown of organic material by bacteria in the absence of oxygen; this provides both a volume and mass reduction of the input materials whilst liberating 'biogas' (methane & carbon dioxide) which is used as a fuel to produce heat energy for use in the process and generates power which is sent to the National Grid.

The resultant nutrient rich whole digestate is produced to be compliant with PAS 110:2014 and the Quality Protocol for Anaerobic Digestate (ADQP) and used as a replacement for artificial fertilisers.

As ABP materials may be received at the site the process is also controlled by an ABPR Approval; fundamental to this is the Hazardous Analysis and Critical Control Point (HACCP) process which identifies specific hazards and the contingencies and corrective actions required should any element of the process deviate from the normal range.

A schematic overview of the anaerobic digestion process is illustrated in Figure 1 below. The main process areas can be identified as:

- Waste reception & acceptance;

- Pre-digestion processing & storage;
- Feedstock storage;
- Digestion;
- Pasteurisation;
- Separation;
- Digestate storage;
- Product dispatch;
- Odour abatement equipment; and
- Biogas storage.

2. SCOPE OF MANAGEMENT PLAN

The site is operated in accordance with an approved Management System which is a set of policies, procedures, practices, plans and other documents describing how the operator will minimise the risk of pollution from the activities covered by the Environmental Permit.

References to other controlled documents within the Management System have been retained for consistency and to ensure that there is no contradiction between the revised SOPs and the certified processes and procedures relating to compliance with the ADQP and PAS110. For example, Customer Satisfaction, Supply Chain & Operational Control Processes are prefixed by "CS", "SC" and "OP" respectively (e.g. *Supply Agreement (SC01/F01)* (the prefix "F" denotes an accompanying Form)).

The aim of this Management Plan is to summarise the management practices and priority Standard Operating Procedures (SOPs) which are implemented and maintained onsite to ensure that the requirements of the site's Environmental Permit are met. A comprehensive list of the SOPs is presented in Appendix A.

The site's SOPs have been reviewed and updated following the change in ownership in 2016, the lessons learnt from the incident in April 2017, and where further changes are identified to either current or future operations the Management Plan will be amended accordingly.

The Management Plan has been produced in accordance with the Environment Agency's environmental management system guidance:

- Best Available Techniques (BAT) Reference Document for Waste Treatment (August 20218);
- Develop a management system: Environmental Permits (August 2021 - <https://www.gov.uk/guidance/develop-a-management-system-environmental-permits>); and
- Control and monitor emissions for your Environmental Permit (May 2021 - <https://www.gov.uk/guidance/control-and-monitor-emissions-for-your-environmental-permit>).

Benefits of operating an effective and efficient management system are to ensure sustainable business practices, reduce risks and losses, reduce operational costs, to help obtain business, maintain good reputation, and to ensure legal compliance.

Internal Audits are undertaken annually and in accordance with the documented procedure (*SM03 Internal Audits*) and *SM03F01 Audit Programme*.

A controlled copy of this Management Plan will be available at the Fernbrook Bio Ltd reception at Rothwell Lodge Farm, Rothwell Road, Kettering, Northamptonshire, NN16 8XF.

Fernbrook Bio Limited will ensure that copies of all relevant permits and approved supporting documents are provided to all people given responsibility for the management or control of the site.

The locations of the documents will be made known to all relevant personnel and will be readily available for inspection by regulatory bodies always when the site is open.

3. SITE INFRASTRUCTURE

The site layout is illustrated on drawing FB/BR/09/007D Site Layout Plan (Proposed) found in Appendix B.

3.1. Site Security

The site is secured by fencing which is supplemented by landscaped bunds and gates at the main entrance.

During operational periods the site is staffed, and entry can only be gained through reporting to relevant personnel at the site offices.

All security measures will be subject to a daily visual inspection (see *SOP021 - Site Daily Checks*) and recorded on the *Daily Checklist (OP03/F01)*. Any defects will be recorded in the Site Diary and rectified in the appropriate manner.

3.2. Access

The site is accessed from J5 of the A14 via a road serving both the site and the associated Rothwell Lodge Farm. The access road is not a through road.

Due to its location there is no pedestrian access to the site.

3.3. Site Information

A durable notice board will be present at the site entrance displaying relevant information including the following:

- The permit holder's name (and the operator's name if different);
- Emergency contact telephone numbers for permit holder/operator;
- A statement that the site is permitted by the Environment Agency;
- The Permit Number; and
- Environment Agency national numbers – 03708 506 506 and 0800 80 70 60 (incident hotline). Or any other number subsequently notified in writing by the Environment Agency.

3.4. Site Office and Welfare

The main building features a site office that is provided with electricity, telephone, fire extinguishers and first aid equipment. A copy of the planning permission, Environmental Permit, and this Management Plan will be kept within this office. This office is available to staff working within the facility.

Appropriate methods e.g. site diary, visitors book, will be used to record any significant event; visits by Environment Agency personnel; engineering works and any other important information relating to compliance with the conditions of the Environmental Permit.

Welfare facilities are provided for both the operational and office-based staff.

3.5. Fuel and Oil Storage

Any fuel and machinery oils for use in site plant and equipment will be stored appropriately and in accordance with the Control of Pollution (Oil Storage) (England) Regulations 2001. Storage tanks will be located over impermeable surfaces with sealed drainage. The bunded area has a volume more than 110% capacity of the largest tank and 125% of the total tank volume, ensuring any spillage is completely contained.

3.6. Surfaces

All waste will be received and initially processed within the reception building which benefits from an impermeable surface and sealed drainage system. Storage of material prior to digestion, the digestion process itself and the storage of whole digestate occurs over a contained area underlain by a geosynthetic clay liner.

3.7. Drainage

All waste reception, storage and pre-processing activities are undertaken within the reception building over on impermeable surface with sealed drainage which drains into the waste reception pits. The pre-storage of material awaiting digestion, the digestion process and storage of whole digestate occurs within a containment area underlain by a geosynthetic clay liner incorporating a manually operated isolation valve to prevent the discharge of contaminated runoff from site. Site drainage is illustrated on drawing E02 Rev E Drainage Design found in Appendix C.

3.7.1. Roadways and Service Yards

Operational roadways and service yards are surfaced in reinforced concrete providing an impermeable surface. These are drained into gullies served by pipes out falling, via catch pits, to a Class 1 bypass separator. The separator is designed, installed, and maintained in accordance with the requirements of *PPG3 Use and design of oil separators in surface water drainage systems (WITHDRAWN)*. The oil separator captures hydrocarbons falling on these areas. Clean water from the separator is discharged to a trench type soakaway to the south east of the site.

3.7.2. Roof Water

Roof water from the reception building drains to three subsurface, rainwater harvesting tanks with a nominal capacity of 100 m³; these are located to the south east of the offices. Any surplus then overflows to a soakaway located to the southeast of the car park. Harvested rainwater will be used, where required, within the process or for dust suppression.

3.7.3. Containment Areas

Containment areas have been designed around the two digester tanks, one digestate storage tank, pre-storage tanks and the buffer tank, and are underlain by a geosynthetic clay liner. The volume that can be retained within these areas exceeds 110% of the largest tank (some 4400 m³) and or 125% of the total tank volume.

Surface water collecting within this area drains via gravity to a catch pit (T1) then via a manhole with shut off valve to the soakaway to the north of the site. Under normal operating conditions the containment areas drain directly to the soakaway. The digestion process is fully automated with information on tank volumes, temperatures, any 'failures' are alarmed and the shut off valve is manually closed to contain any spillages within the containment area. Routine inspections of these areas are undertaken (see *SOP021 – Site Daily Checks*) to ensure only clean water is discharged and recorded in the *Daily Checklist (OP03/F01)*.

Discharge to this soakaway will only be of clean, uncontaminated water from the containment areas. The discharge of clean, uncontaminated water shall only occur under controlled conditions i.e. an appropriately competent member of staff will visually inspect any water held within the catchment pit from the containment areas, prior to opening the shut off valve for discharge and closing the shut off valve immediately once the clean, uncontaminated water is discharged (see *SOP024 - Surface Water Management in Containment Area*).

If the visual inspection shows contamination, there will be no discharge to soakaway and the liquid will be sent for disposal/recovery to a suitably permitted site/or incorporated back into the AD process (only if the material is suitable). This will be recorded in the site diary and an investigation undertaken for the cause of the contamination and this issue rectified immediately.

To prevent stagnation of water in the catch pit the collected water from the containment areas should not be stored for longer than 48 hours prior to discharge to the soakaway. Regular inspections will be undertaken of the catchment pit during periods of heavy rainfall, and subsequent discharge to the soakaway, to ensure that capacity is available within the

containment areas if there is a spillage. Inspections of the catch pit will be recorded in the *Daily Checklist (OP03/F01)*.

3.7.4. Generator Room

Biogas produced by the anaerobic digestion of the feedstock material is used to power two CHP engines to generate power for the National Grid. The heat generated from the engines is utilised to maintain operational temperatures of the two digesters and to pasteurise digestate. The engines are located within the main building, on a concrete floor which can retain 110% of the total oil capacity of the motors.

3.7.5. Foul Water

The plant will be operated by up to 6 staff and will also have facilities for vehicle washing and steam cleaning of floors. All foul water collected via sanitary appliances will discharge via gravity to a septic tank in the front yard.

The gullies/drainage channels receiving relatively small quantities of foul water from vehicle washing or floor cleaning are collected via gravity into a packaged pumping station and discharged into the liquid tank and processed through the AD system.

In other areas of the building, drainage channels are cast into the concrete floor slab to collect most of the foul water produced by the vehicle washing and steam cleaning processes. These channels are constructed to discharge into the 'wet goods pit' (left hand reception pit) in the waste reception area, the contents of which will be used in the overall anaerobic digestion process.

No human waste from the site will be collected by this system.

3.8. Other Design Features

Other site design features can be summarised as follows:

- Security fencing;
- Site office and welfare facilities;
- Car park;
- Service road;
- Desulphurisation unit;
- Carbon filters;
- Ammonia scrubber (using fresh water);
- Thermal oxidiser;
- Condenser (chiller) unit;

- Generator plant room; and
- Pump room.

3.9. Construction Procedures and Supervision

Any construction, infrastructure improvements or replacement at the site is undertaken by specialist contractors. Where necessary, a suitably qualified Engineer will inspect works to ensure that all necessary standards and specifications are met.

3.10. Maintenance and Inspection

Daily inspections of site infrastructure are undertaken by the Technically Competent Manager (TCM) or a person appointed by the TCM, in accordance with *SOP021 – Site Daily Checks* and *SOP011 – Process Inspection & Maintenance*. Inspections are recorded on the *Daily Checklist (OP03/F01)* and all corrective/preventative actions are logged in the Site Diary.

4. OPERATIONS

The scope of the Management Plan extends to all operations associated with the acceptance, handling, storage and treatment of source segregated bio wastes including; liquid, sludge and solid wastes, combustion of the resultant biogas to produce electricity and the dispatch of PAS110 certified whole digestate.

The waste types permitted to be accepted at the facility are detailed in Waste Categories (SC01/F02), Appendix D of this document and Table S2.1 Waste Types and Quantities of the site's Environmental Permit.

All operations and working practices are regularly reviewed and improved where necessary. There are robust mechanisms in place for the investigation of incidents/accidents if they occur.

4.1. Activities

The site will be operated as a waste management facility in accordance with the Environmental Permitting (England and Wales) Regulations 2016 (as amended), The Animal By-Products (Enforcement) (England) Regulations 2013 and PAS110:2014, undertaking the acceptance, handling, storage and treatment of source segregated bio wastes including; liquid, sludge and solid wastes, combustion of the resultant biogas to produce electricity and the dispatch of PAS110 certified whole digestate in accordance with the site's Environmental Permit.

The methods of operation are given in broader detail in the following sections of this Management Plan.

The general objective of the site is to facilitate the diversion from landfill of biodegradable wastes and recover heat, produce renewable biomethane and electricity from the resultant biogas. Biomethane is produced through cleaning and upgrading the biogas for use as a direct replacement of natural gas. Electricity is produced through the combustion of biogas in combined heat and power (CHP) plant and supplement regional power generation.

The permitted processes at the site are listed in Table 1 (below) and in Condition 2.1.1 and Schedule 1, Table S1.1 Activities, of the site's Environmental Permit. Any non-waste activities such as the storage and dispatch of PAS110 certified whole digestate are not encompassed within the permitted activities below.

TABLE 1. Activities

REFERENCE	ACTIVITY LISTED	DESCRIPTION OF ACTIVITIES FOR WASTE OPERATIONS	LIMITS OF ACTIVITIES
AR1	<p>S5.4 A(1) (b) (i) Recovery or a mix of recovery and disposal of non-hazardous waste with a capacity exceeding 75 tonnes per day (or 100 tonnes per day if the only waste treatment activity is anaerobic digestion) involving biological treatment.</p>	<p>R3: Recycling / reclamation of organic substances which are not used as solvents</p>	<p>From receipt of waste through to digestion and recovery of by-products (digestate).</p> <p>Anaerobic digestion of waste in 2 tanks followed by burning of biogas produced from the process.</p> <p>Waste types suitable for acceptance are limited to those specified in Table S2.2.</p>
DIRECTLY ASSOCIATED ACTIVITY			
AR2	<p>Storage of waste pending recovery</p>	<p>R13: Storage of waste pending the operations numbered R1 to R11 (excluding temporary storage, pending collection, on the site where it is produced)</p>	<p>From the receipt of permitted waste to pre-treatment and despatch for anaerobic digestion on site.</p> <p>Storage of residual wastes from pre-treatment to despatch off-site for recovery.</p>

REFERENCE	ACTIVITY LISTED	DESCRIPTION OF ACTIVITIES FOR WASTE OPERATIONS	LIMITS OF ACTIVITIES
			<p>Storage of waste in an enclosed building fitted with appropriate odour abatement and on an impermeable surface with a sealed drainage.</p> <p>Waste types suitable for acceptance are limited to those specified in Table S2.2.</p>
AR3	Physical treatment for the purpose of recycling	R3: Recycling / reclamation of organic substances which are not used as solvents	<p>From the receipt of waste to dispatch for anaerobic digestion or dispatch off site for recovery.</p> <p>Pre-treatment of waste in enclosed building and on impermeable surface with sealed drainage system including shredding, sorting, screening, compaction, baling, mixing and maceration.</p> <p>Post-treatment of digestate in an enclosed building and on an impermeable surface with sealed drainage system, including screening to remove contraries, centrifuge or pressing and addition of thickening agents (polymers) or drying for use as a fertiliser or soil conditioner (drying for the purpose of use as a fuel is not permitted).</p>

REFERENCE	ACTIVITY LISTED	DESCRIPTION OF ACTIVITIES FOR WASTE OPERATIONS	LIMITS OF ACTIVITIES
			<p>Heat treatment (pasteurisation) of waste in two tanks for the purpose of recovery.</p> <p>Gas cleaning by biological or physical (carbon filtration) or chemical scrubbing.</p> <p>Waste types suitable for acceptance are limited to those specified in Table S2.2.</p>
AR4	Steam and electrical power supply	R1: Use principally as a fuel to generate energy	<p>From the receipt of biogas produced at the on-site anaerobic digestion process to combustion with the release of combustion gases.</p> <p>Combustion of biogas in 2 combined heat and power (CHP) engines with an aggregated thermal input of 3.75 MWth.</p>
AR5	Emergency flare operation	D10: Incineration on land	<p>From the receipt of biogas produced at the on-site anaerobic digestion process to incineration with the release of combustion gases.</p> <p>Use of one auxiliary flare required only during periods of breakdown or maintenance of the CHP engines and biogas upgrading plant.</p>

REFERENCE	ACTIVITY LISTED	DESCRIPTION OF ACTIVITIES FOR WASTE OPERATIONS	LIMITS OF ACTIVITIES
AR6	Gas upgrading <i>(currently not in use)</i>	Upgrading of biogas to biomethane (including the removal of moisture and other substances such as carbon dioxide, hydrogen sulphide, volatile organic compounds) for injection into the National Grid.	From the receipt of biogas produced at the on-site anaerobic digestion process to injection into the National Grid. This includes return of off-specification biogas for combustion to the on-site CHP engines and/or emergency flare.
AR7	Raw material storage	Storage of raw materials	From the receipt of raw materials to dispatch for use within the facility.
AR8	Gas storage	R13: Storage of waste pending any of the operations numbered R1 to R12 (excluding temporary storage, pending collection, on the site where it is produced)	Storage of biogas produced from on-site anaerobic digestion of permitted waste in roof space of digesters. From the receipt of biogas produced at the on-site anaerobic digestion process to despatch for use within the facility.
AR9	Digestate storage	R13: Storage of waste pending any of the operations numbered R1 to R12 (excluding temporary storage,	Storage of whole digestate in a storage tank. From the receipt of processed uncertified digestate produced from the on-site anaerobic digestion process to despatch for use off-site.

REFERENCE	ACTIVITY LISTED	DESCRIPTION OF ACTIVITIES FOR WASTE OPERATIONS	LIMITS OF ACTIVITIES
		pending collection, on the site where it is produced).	
AR10	Surface water collection and storage	Collection and storage of uncontaminated roof and site surface water in attenuation pond or storage tank(s).	From the collection of uncontaminated roof and site surface water from non-operational areas only to re-use within the facility or discharge off-site.
AR11	Air treatment	Collection and treatment of air from the buildings or plant using abatement system – carbon filter(s) and water scrubber, prior to release to atmosphere.	From the collection of air from site processes to treatment and release of treated air to atmosphere.

N.B. This Management Plan may incorporate operational procedures which may not fall under the jurisdiction of the Environment Agency.

4.2. Waste Acceptance

The site will be open to accept waste from external sources during the following times:

- 07:00 to 17:00 Monday to Friday
- 07:00 to 13:00 Saturday
- Closed on Sundays and Bank Holidays

The anaerobic digestion process will operate 24 hours a day.

Only those wastes permitted by the site's Environmental Permit (Condition 2.3.4 and Schedule 2, Table S2.2), as presented in Appendix D shall be accepted at the site. All material delivered to the site shall arrive in suitably covered vehicles.

Waste contracts are secured by using the services of food waste brokers (e.g. RUR³ Environmental Ltd and White's Recycling Ltd) to source suitable source-segregated biodegradable wastes in addition to those contracts which are sourced directly by Fernbrook Bio Ltd. Weekly communication with waste brokers allows for the scheduling of pre-booked deliveries.

Prior to delivery, all contracts are secured following the same waste acceptance criteria consisting of pre-acceptance documentation including: *Input Materials Procedure (SC01)*, *Input Material Supply Agreement (SC01/F01)* and *Input Material Waste Categories (SC01/F02)*.

Upon arrival, wastes are accepted in accordance with *SOP001 – Waste Reception and Acceptance*. Liquid wastes are subjected to further assessment prior to acceptance in accordance with *Protocol for Accepting Liquid Waste* and *SOP020 – pH Determination of Liquid Loads* to ensure wastes are suitable for the AD process.

Operational staff are trained in the site's waste acceptance procedures, to ensure that all acceptance criteria are met and maintained.

Where waste is found to not comply with the waste acceptance criteria they shall be rejected, and either:

- a) Removed from the site; or
- b) Moved to the designated quarantine area pending removal.

Records of all waste transfers/rejection, feedstock analysis results and pH readings from liquid wastes, will be maintained onsite.

4.3. Annual Waste Quantities

The Environmental Permit allows the acceptance of up to 49,000 tonnes of waste per annum.

5. STORAGE OF WASTE

The storage of waste is outlined below and is carried out in accordance with *SOP002 – Waste Storage*. No more than 50 tonnes of hazardous waste (e.g. glycerol EWC 07 01 08*) will be stored at any one time.

Palletised waste is stored in a designated area within the reception building and manually depackaged prior to being discharged into the reception pit.

Bulk deliveries of loose waste are tipped directly into the reception pits. Bulk deliveries of glycerol will not be accepted. Glycerol will only be accepted in 1 m³ containers (IBCs) and stored separately within the reception building.

Liquid is discharged into the depackaging unit from the liquid tank in a controlled manner to ensure feedstock material is of the desired consistency to avoid blockage prior to being macerated and distributed to one or both buffer tanks.

Digestate produced to the AD Quality Protocol (ADQP) and PAS110 is no longer considered to be waste and storage capacity for this material is excluded from the figure above. However, allowance has been made for the storage of digestate that does not comply with the BCS. Figures in Table 2 below are approximations only.

Table 2. Storage Capacity

LOCATION	DESIGN CAPACITY	DESCRIPTION
Reception	300 m ³	Palletised waste storage; packaged and loose reception pit.
Buffer Tank	384 m ³	Capacity of 2 tanks
Liquid Storage	75 m ³	Capacity of 1 tank
Digestion	5400 m ³	Capacity of 2 digesters
Whole Digestate (Biofertiliser)	4200 m ³	Capacity of 1 tank
Separated Fibre	N/A	<i>At time of writing separated fibre is not being produced on site.</i>

5.1. Waste Storage Plan

All wastes are discharged and stored either within a building on an impermeable surface or contained in sealed vessels or enclosed pipework to prevent accidental spillages and minimise the risk for the uncontrolled release of emissions.

Bio-waste treatment (wet anaerobic digestion) is explicitly excluded from the scope of the Environment Agency's Fire Prevention Plan guidance and therefore no separate Fire Prevention Plan has been produced.

5.2. Waste Treatment

The site is currently operating with a single digester whilst the second is under re-construction. Section 4.7 describes the enhanced monitoring and control infrastructure installed on this new tank and the difference in process management philosophy.

5.2.1. Pre-Digestion Processing

Feedstock preparation prior to interim storage is carried out in accordance with *SOP003 – Pre-Digestion Processing*.

Packaged waste from the reception pit is loaded into the hopper of the depackaging unit using a crane with a clam-shell bucket (see *SOP018 – Crane Operation*).

Depackaged waste is blended with liquid waste returned from the liquid tank (BV300) to achieve a homogenous 'soup' consisting of approx. 15% dry matter, whilst ensuring that the particle size has been reduced to <12 mm in any one plane to comply with the Animal By-Products (ABP) Regulations 2013 (as amended).

Particle size checks are completed daily (see *SOP021 – Site Daily Checks*) and recorded in the *Site Diary* in accordance with the approved *Hazard Analysis and Critical Control Point Plan (OP01/F01)*. 'Soup' is then pumped into one or both Buffer tanks (BV100 & BV200) where it is stored until required as feedstock for the Digester(s).

5.2.2. Feedstock Storage

To ensure that the digestion process has a constant supply of feedstock 'soup' available, this homogenised material is stored in Buffer tanks (BV100 & BV200) in accordance with *SOP004 – Feedstock Storage*.

Feedstock tanks may be stirred, but sedimentation of grit is encouraged. The tanks are degrittied every 8 months to prevent excessive grit being transferred to the digester(s). The tanks are not heated. Daily samples are taken to enable the calculation of the Organic Loading

Rate (OLR) (see *SOP014 – OLR Determination*) and readings are entered on the *Key Performance Indicators spreadsheet* and saved electronically.

5.2.3. Feeding the Plant

The digestion process at Rothwell Lodge AD Facility is mesophilic with digester temperature maintained at 40°C. Retention times will vary according to the levels in the tanks and the volumetric feed rate but is around 45 days under normal operating conditions.

Feed rates are determined by the Site Manager twice daily in accordance with *SOP005 – Feeding the Plant*, *SOP006 – Digester Monitoring* and *SOP016 – Preventing Foam*. No more than 10 tonnes per day of glycerol will be fed to the digesters. Data is recorded in the *Key Performance Indicators spreadsheet*.

The Digester is fed 12 times per day every other hour and hydraulically mixed. The Site Manager adjusts the feed rate by using the Supervisory Control and Data Acquisition (SCADA) system. Any preventative or corrective actions are recorded in the Site Diary.

5.2.4. Digester Monitoring

Key operational parameters (listed below) are monitored within the Digester to highlight potential process instability and maintain good biological health in accordance with *SOP006 – Digester Monitoring* and *SOP019 – Preventing Crust Formation*.

- **Temperature** – mesophilic conditions maintained at 40°C within digester. Temperature readings are manually recorded from two temperature probes retrospectively installed on Digester 1.
- **Methane** (CH₄ % v/v) – a typical range is 50% - 70% v/v
- **Pressure** (biogas mB) - 7 mB (upper) and 0 mB (lower). Pressure transducer and methane sensor have been installed between the inner and outer membranes of the biogas storage dome above Digester 1, to measure the volume of biogas stored and biogas pressure. Both measurement devices are linked to the SCADA system, where records can be viewed and trended.
- **pH** – optimal range is pH7 – 8.5
- **Volatile Fatty Acids (VFAs)** – intermediate molecules produced as a precursor to methane formation. High VFAs (indicative of high OLR or Digester feed rate) will lower the pH and reduce buffering capacity (alkalinity).

- **Alkalinity Buffer** – methanogenic bacteria will only operate effectively within an alkaline (i.e. elevated pH) environment. An alkalinity concentration of at least 2,000 mg/l above background VFA concentration is desirable.
- **Trace Elements** – a tailor made solution of bio-available micronutrients required by the micro-organisms to grow and function properly. Improved performance of the Digester is measured by increase in biogas production, increase in methane concentration in biogas and reduced Digester VFAs.
- **Carbon : Nitrogen (C:N) Ratio** – for optimum biogas efficiency a C:N ratio of between 20:1 and 30:1 is desirable.

5.2.5. Pasteurisation

The Animal By-Products (Enforcement) (England) Regulations 2013 requires that if food waste is treated in an AD plant, then the process must be operated to strict standards. The maximum particle size of the waste must be 12 mm (one of the reasons for the shredding operations in the reception hall) and the material must be held at a minimum temperature of 70°C for a minimum period of one hour in a pasteurisation step either before or after the digester (post-digestion in this AD plant) to denature potentially harmful pathogens such as *salmonella*, *E.coli* and *faecal streptococci* in accordance with *SOP007 – Pasteurisation*.

Batches of up to 10 tonnes of digested material are pumped to each pasteuriser. The AD plant has two pasteurisers. The frequency and volume of these batches will be dependent upon the daily operations, specifically the current feed rate, level in the digester and the available capacity in the digestate storage tank.

The control of the Critical Limits (temperature and residence time) is set, monitored and recorded by the SCADA system (see *SOP010 – Process Control*). Digestate in the pasteuriser cannot be discharged to the storage tank until the Critical Limits have been achieved and manual verification of the dataset. To ensure that the temperature is achieved the Critical Limit for temperature is set to 71°C to achieve additional level of assurance.

Temperature probes are to be checked monthly and calibrated annually with calibrated replacement temperature probes held as critical spares in accordance with *SOP011 – Process Inspection & Maintenance*.

5.2.6. Screening

Whole digestate is pumped from the storage tank (BE100), via enclosed pipework, to a screen located on an elevated platform within the reception building. The screen is operated manually, during daylight hours only, and has a maximum flow rate of 40 m³/h. The operator enters the

required volume into the interface screen and a measured volume is processed. This operation is undertaken in accordance with *SOP031 – Borger Operation*.

Any oversize items (>2 mm) are screened from the whole digestate and the screenings drop into a dedicated container beneath. Containers are removed, as required, and whole digestate is then pumped to one of two bunded storage tanks located on the empty concrete plinth adjacent to the storage tank (BE100).

Although a permitted activity under the site's Environmental Permit, the separation of whole digestate into liquid and fibre fractions is not currently undertaken by the operator at Rothwell Lodge AD Facility.

5.2.7. Power Generation

Biogas produced by digestion, will be used to generate heat and power. A desulphurisation unit is located on the gas line between the digesters and the Combined Heat and Power (CHP) units. This removes sulphur from the biogas, which increases the operational life of the engines.

The engines are housed within the process building with walls constructed to achieve specific sound reduction ratings. The biogas powers the engines producing electricity that can be fed into the National Grid providing a source of renewable energy.

Heat produced during power production is transferred via a heat exchanger and is used to heat the digesters, and to pasteurise the digestate.

5.2.8. Product Storage

The screened material is stored in the final storage tanks until dispatched from site. High level probes prevent overfilling and limit the actual volume to 80% of the combined total capacity of both tanks (200 m³). The area is fully bunded and provides 110% capacity of the combined storage tank volume.

Whole digestate is stored prior to off-site use as a biofertiliser in accordance with *SOP008 – Storage of Digestate*.

As the digestate is produced in compliance with the ADQP and PAS 110, it will no longer be subject to waste management controls.

5.3. Pressure Relief Valve and Burst Disc Operation

Pressure Relief Valves (PRVs) and Burst Discs are fitted to the head space above each Digester as a failsafe mechanism to enable the emergency release of excess biogas and digestate (or foam) from the Digester, to prevent primary containment failure.

5.3.1. Pressure Relief Valve (PRV)

SCADA system alarms for the PRVs: 7 mB (upper) and 0 mB (lower).

If the upper limit is triggered, biogas is immediately diverted to the emergency flare for controlled combustion. If the emergency flare fails to ignite or gas pressure within the Digester exceeds 8 mB, the PRV is tripped and opens, the excess biogas is vented to atmosphere to reduce the pressure to 5 mB. When this is achieved the PRV closes.

Any such 'event' is logged on the SCADA system including details of date, time and duration. Records of the subsequent investigation and any remedial actions taken, are maintained in the Site Diary.

5.3.2. Burst Disc

SCADA system alarm for the Burst Discs: 10 mB.

In an emergency, such as a foaming incident, where the pressure within the Digester exceeds 10 mB, the Burst Disc will be automatically 'blown' to relieve excess liquid pressure within the Digester and to prevent primary containment failure. Any spillages will be cleaned up and the incident reported to the Environment Agency in accordance with the Accident Management Plan.

Any such 'event' is logged on the SCADA system including details of date, time and duration. Records of the subsequent investigation and any remedial actions taken, are maintained in the Site Diary.

5.4. Sampling of Digestate

To meet the criteria of the Biofertiliser Certification Scheme, the digestate must be compliant with the requirements of PAS110 and of the Quality Protocol for Anaerobic Digestate. PAS 110:2014 requires producers to take and send representative samples of digested materials to suitable laboratories for testing. The sampling of digestate for these tests is carried out in accordance with *SOP009 – Sampling of Digestate*.

Digestate also needs to be sampled to verify compliance with The Animal By-Products (Enforcement) (England) Regulations 2013 and supplements regular samples taken from the pasteuriser and storage tank by representatives of the Animal & Plant Health Agency.

5.5. Waste Treatment (Digester 2 Only)

5.5.1. Digester Monitoring

The operational capacity of Digester 2 is controlled with level sensors; a low level, a high level and a high-high level probe (situated at 500 mm from the top of the tank). All three level probes are linked to the SCADA system, where records can be viewed and trended.

In addition to the biological health parameters stated in Section 4.5.4, temperature is monitored from six separate probes located at 'top', 'middle' and 'bottom' on either side of Digester 2. These temperature probes are linked to the SCADA system, where records can be viewed and trended. *SOP006 – Digester Monitoring* will be updated accordingly.

A pressure transducer and methane sensor have also been installed between the inner and outer membranes of the biogas storage dome above Digester 2, to measure the volume of biogas stored and biogas pressure. Both measurement devices are linked to the SCADA system, where records can be viewed and trended.

5.5.2. Feeding the Plant

Digester 2 is hydraulically mixed and is fed at the same OLR of 4 – 5 kg/ODM/day/m³ as Digester 1.

Automated dosing systems are to be installed for the addition of key nutrients and anti-foam solutions. These dosing systems will be controlled through the SCADA system but will also have the option of a manual override in case of emergency. *SOP005 – Feeding the Plant* and *SOP016 – Preventing Foam* will be updated accordingly.

5.6. Product Dispatch

Digestate produced to the AD Quality Protocol (ADQP) and PAS110 is no longer considered to be waste and can be beneficially applied to land as a nutrient rich biofertiliser.

The dispatch of PAS110 certified biofertiliser is managed in accordance with the procedure for *Dispatch, Labelling, Marking and Use of Digestate (SC02)*.

All relevant information will be recorded on the *Product Supply Form (SC02/FO1)* and *Product Dispatch Note (SC02/F02)*. Records are maintained onsite.

6. SITE AND EQUIPMENT MAINTENANCE PLAN

Daily inspections of plant and equipment are carried out in accordance with *SOP021 – Site Daily Checks* and recorded on the *Daily Checklist (OP03/F01)* with all corrective/preventative actions logged in the Site Diary.

All site equipment will be maintained, and records kept, as a minimum, in accordance with the manufacturer's instructions and *SOP011 – Process Inspection & Maintenance*.

7. CONTINGENCY PLAN

If the site suffers a breakdown in equipment or machinery, the Site Manager or Duty Manager will contact the manufacturer or equipment supplier to arrange for inspection and repair. Where a significant incident occurs which results in a major spillage (e.g. following a loss of primary containment), the site's *Digester Tank Rupture Emergency Response* and *Disaster Escalation Procedure* (see *Incident Response Plan, K114.1~09~011*) will be initiated. Incoming loads will be diverted, where required, and feedstock levels will be managed to further reduce any potential environmental impact.

8. ACCIDENT PREVENTION AND MANAGEMENT

Potential accidents and incidents have been identified and a detailed risk assessment accompanies the standalone Accident Management Plan (Appendix F) which includes the *Incident Response Plan* referred to above. Where residual risk remains, SOPs will be developed, as required, to provide further controls to mitigate the risk to an acceptable level. The SOP Index (K114.1 SOP_Index_Fernbrook 2021_V2) will be maintained in Appendix A.

Accident prevention and management will be reviewed on an annual basis along with the Management Plan or following an accident.

9. COMPLAINTS

All complaints are dealt with in accordance with the *Complaints (CS01)* procedure and recorded on the *Complaints Form (CS01/F01)* with all corrective/preventative actions are logged in the Site Diary.

10. STAFF COMPETENCE AND TRAINING RECORDS

Staff competence and training requirements are reviewed and managed by senior management and records retained.

Records of competence and training are held in the site office which is managed and maintained by a competent person.

10.1. Management

The site is operated by the Site Manager, supervised and supported by a Technically Competent Manager who is a person qualified through schemes approved under the Environmental Permitting (England and Wales) Regulations 2016 (as amended).

Details of Technically Competent Manager(s) (TCM) will be provided to the Environment Agency and will be displayed on the site's noticeboard. At times where the specified TCM(s) is/are unavailable, an alternative TCM will be brought in as management cover; the Environment Agency will be made aware of these changes.

Site Manager and TCM responsibilities include day to day operations and activities at the site, ensuring compliance with Permit and planning conditions, ensuring compliance with Health and Safety Policy, and liaison with the Environment Agency and other regulatory bodies.

10.2. Operations Staff

The duties of operational personnel will be to control incoming and outgoing vehicles, inspect materials to ensure compliance with Permit conditions, control vehicle movements, maintain the site in a tidy condition, and report any problems to management.

Staff are available at the site during daily operating times, and are responsible for checking Duty of Care documentation, keeping and maintaining all automated weight records, checking in all visitors to the site and issuing Health and Safety instruction.

Additional persons are brought to the site as necessary to assist with maintaining tidy conditions, upkeep of infrastructure, training of personnel, performing compliance audits and any other duties necessary to ensure the efficient operation of the site.

10.3. Competence and Awareness Training

All site staff and drivers are given relevant training and supervision on the plant and equipment used at the site. They are also given instruction on the relevant parts of the planning permission; conditions of the Permit; the Management Plan; and the Standard Operating Procedures, to effectively and efficiently carry out their job function.

Outside agencies may also be used, as appropriate, for training. Training will be documented, and records kept onsite.

11. KEEPING RECORDS

11.1. Records and Reporting

The Permit requires the creation and retention of specific records; Condition 4.1 details how these must be retained and how long for.

Records must be retained for at least 6 years unless they relate to off-site environmental effects, matters which affect the condition of the land and groundwater when they shall be retained until permit surrender. Table 3 (below) outlines the records required by the permit.

Table 3. Records Required by the Permit

CONDITION	REQUIREMENT	RECORD
1.1.2	Records to demonstrate activities are managed in accordance with a written management system.	<ul style="list-style-type: none"> This Management Plan and associated management system documents.
1.1.2	Records to demonstrate activities are managed by sufficient competent persons and resources.	<ul style="list-style-type: none"> Evidence of technical competence. Staff training records.
1.3.1	Maintain records of raw materials and water used in the activities.	<ul style="list-style-type: none"> Raw Materials consumption Water usage (Mains and grey)
3.1.3	Periodic monitoring shall be carried out at least once every 5 years for groundwater and 10 years for soil, unless such monitoring is based on a systematic appraisal of the risk of contamination.	<ul style="list-style-type: none"> Taking and analysis of groundwater and soil samples.
3.5.1	Records of all monitoring required by Schedule 3, Table S3.1, S3.2 & S3.3	<ul style="list-style-type: none"> Taking and analysis of samples; Instrument measurements (periodic and continual); Calibrations; Examinations; Test and surveys; Assessment or evaluation made based on such data
4.2.2	Records of all monitoring required by Schedule 4, Tables S4.2, S4.3 & S4.4	<ul style="list-style-type: none"> Annual production / treatment Performance parameters

CONDITION	REQUIREMENT	RECORD
		<ul style="list-style-type: none"> Reporting Forms
4.2.5	<p>A quarterly summary report relating to the site and the waste accepted and removed from it during the previous quarter.</p> <p>Q1 Jan – Mar by 30th April</p> <p>Q2 Apr – Jun by 31st July</p> <p>Q3 Jul – Sep by 31st October</p> <p>Q4 Oct – Dec by 31st January</p>	<ul style="list-style-type: none"> Waste Return

11.2. Notifications

Condition 4.3 specifies under what circumstances the Environment Agency must be notified. Whilst Table 4 below summarises these, reference should always be made to the current Environmental Permit to confirm exact requirements.

Table 4. Notifications Required by the Permit

CONDITION	REQUIREMENT	RECORD
4.3.1	Detection of any malfunction, breakdown or failure of equipment or techniques, accident or emission of a substance not controlled by an emission limit which has caused, is causing or may cause significant pollution.	<ul style="list-style-type: none"> Without delay Contact EA Officer or call National Incident Hotline on 0800 80 70 60
4.3.1	Any significant adverse environmental effects.	<ul style="list-style-type: none"> Without delay Contact EA Officer or call National Incident Hotline on 0800 80 70 60
4.3.2	Written confirmation of actual or potential pollution incidents and breaches of emission limits.	<ul style="list-style-type: none"> Within 24 hours using information listed in Schedule 6 of the Environmental Permit.
4.3.3	If the Environment Agency has requested in writing that it shall be notified when the operator is to undertake monitoring and/or spot sampling, the operator shall inform	<ul style="list-style-type: none"> At least 14 days before the date the monitoring is to be undertaken.

CONDITION	REQUIREMENT	RECORD
	the Environment Agency when it is to take place.	
4.3.4	Changes to the operator's trading name, registered name or registered office address.	<ul style="list-style-type: none"> • Within 14 days • Submit an Admin Variation for the Permit.
4.3.4	Any steps taken with a view to the operator going into administration, entering into a company voluntary arrangement or being wound up.	<ul style="list-style-type: none"> • Within 14 days • Written notification to EA.
4.3.4	Death of any of the named operators.	<ul style="list-style-type: none"> • Within 14 days • Submit an Admin Variation for the Permit.
4.3.4	Change of the operator's names(s) or addresses(s).	<ul style="list-style-type: none"> • Within 14 days • Submit an Admin Variation for the Permit.
4.3.4	Steps taken with a view to the operator, or any one of them, going into bankruptcy, entering into a composition or arrangement with creditors, or, in the case them being in a partnership, dissolving the partnership.	<ul style="list-style-type: none"> • Within 14 days • Written notification to EA.
4.3.5	Where the operator proposes to make a change in the nature or functioning, or an extension of the activities, which may have consequences for the environment and the change is not otherwise the subject of an application for approval under the Regulations or this permit.	<ul style="list-style-type: none"> • Within 14 days • Apply to vary the Permit including a description of the proposed change in operation.

11.3. Security

Records shall be kept securely within the site office. Where held electronically these shall be backed up on a regular basis and a copy held off site.

11.4. Availability

In accordance with Condition 4.1.1, all records required under the terms of the Permit shall:

- Be legible;
- Be made as soon as reasonably practicable;
- If amended, be amended in such a way that the original and any subsequent amendments remain legible or are capable of retrieval; and
- Be retained, unless otherwise agreed with the Environment Agency, for at least 6 years from the date when the records were made, or in the case of the following records until Permit surrender:
 - off-site environmental effects; and
 - matters which affect the condition of land and groundwater.

All records, plans and the management system required to be maintained by the Permit shall be held on site.

12. ENVIRONMENTAL MANAGEMENT

The following sections should be read in conjunction with the Environmental Risk Assessment (K114.1~11~001) and Accident Management Plan (K114.1~11~002) both presented at Appendices E & F.

13. LITTER CONTROL

Due to the nature of the materials to be stored, handled and treated on site, and the operation conducted thereon, litter and debris is unlikely to be generated by the permitted activities.

Litter and debris management practices are detailed within the Environmental Risk Assessment presented in Appendix E. In summary the following measures ensure effective litter and debris control:

- Wastes received unlikely to contain loose litter and other light fractions;
- All reception and sorting activities conducted indoors;
- Reception area fully enclosed with rapid closing doors;
- Incoming materials will be discharged directly to place of processing within the reception building;
- Controlled discharge of loads;
- Packaging removed by the Haarslev “Hammermill” (depackaging unit) and discharged directly into container for collection and removal offsite;
- Digestion process is fully enclosed;
- Liquid digestate held in tanks and discharged directly into tankers for use off site
- Vehicles bringing materials to site will be covered; and
- Vehicles removing solid digestate from the site will be covered.

14. ODOUR CONTROL

A revised and updated Odour Management Plan (K114.1~09~013) has been developed that outlines the management practices and control measures employed to reduce, and where possible, prevent odour being released from the site. This document has been accepted by the Environment Agency and will be updated as necessary.

Any odour complaints received at the site will be recorded on the *Odour Complaint Form* (K114.1~19~002) and investigated by the TCM or Site Manager in accordance with the approved Odour Management Plan and *SOP012 Odour Control*. The findings of any investigation will be recorded on the *Odour Report Form* (K114.1~19~001) with all corrective/preventative actions logged in the Site Diary.

14.1. Thermal Oxidiser

A DEO™ 100 Thermal Oxidiser (TO) has been permanently installed. The regenerative catalytic system is used to effectively remove >95% of the gaseous compounds such as reduced sulphur compounds (e.g. hydrogen sulphide and mercaptans), aromatics, ammonia and other types of VOCs from the AD process.

The DEO™ system is based on regenerative catalyst technology utilising patented wire-mesh catalysts and advanced heat regeneration to minimise energy consumption.

- Parts are made of corrosion resistant material such as aluminium, stainless steel and nickel-alloys.
- The system comprises the following main components:
 - a frequency-controlled fan;
 - a plate heat exchanger;
 - heating elements; and
 - a catalyst reactor.
- The system is controlled by a PLC with integrated operator panel. The electrical cabinet is sealed to prevent corrosion on electrical components.
- The DEO™ unit is connected to 16A, 3-phase via standard glove.
- The inlet process gas is preheated in the heat exchanger by the treated, hot outlet gas. The preheated gas then passes through the electrical heater which, if needed to maintain desired catalyst temperature of 300-350°C, further heats the process gas. In the wire-mesh catalyst reactor, the undesired compounds in the process gas are oxidised whereby odour is also eliminated. Any energy in the process gas

released in the oxidising reactions is utilised by the system to maintain the catalyst temperature and will further reduce the need for preheating by the electrical heater. The hot treated gas passes through the heat exchanger to preheat the inlet process gas and leaves the system at a temperature of around 60-80°C higher than the inlet process gas temperature.

- DEO™ 100 is equipped with a communication module allowing for remote access and control through Internet, bus or hard-wire.

15. DUST CONTROL

Due to the nature of the materials used for the process the possibility of dust and particulate matter generation is limited. Nevertheless, operations are conducted to ensure that risk is negligible and trafficked areas will be swept when required.

16. NOISE CONTROL

Noise management practices are detailed within the Environmental Risk Assessment presented at Appendix E. In summary the following measures ensure effective noise control:

- Deliveries & collections are limited to normal daytime hours associated with industrial use;
- Reception of waste activities conducted indoors;
- Reception area fully enclosed with rapid closing doors;
- Machinery will be operated in accordance with manufacturer's instructions and subject to regular maintenance;
- Limits on operational hours;
- Operation of external vehicles & equipment is limited to normal daytime hours associated with industrial use;
- Process machinery contained within process building;
- Plant operated in accordance with manufacturer's instructions and subject to regular maintenance;
- Building designed to provide acoustic attenuation;
- Equipment with greater potential noise source located within built enclosures sited away from sensitive receptor;
- Machinery and equipment will be fitted with noise reduction devices as appropriate;
- White noise reversing alarms used where necessary;
- Enforced site speed limit; and
- Landscaping of site incorporates bunds which aid noise attenuation.

17. PESTS, VERMIN, BIRDS

The nature of the material accepted at the site has a limited potential to attract birds, vermin and insects.

Management practices are detailed within the Environmental Risk Assessment presented at Appendix E. In summary the following measures ensure effective control of birds, vermin and insects:

- Reception area fully enclosed with rapid closing doors;
- Efficient and prompt unloading of delivery vehicles;
- Frequent inspection of operational areas;
- Appropriate use of insecticides/bait stations, etc., as necessary;
- Contract with pest controller/contractor as necessary;
- Pre-storage & digestion undertaken in sealed tanks preventing access or suitable harbouring locations;
- Liquid digestate stored in sealed tanks; and
- All vehicles will be covered.
- Delivery vehicles may contain waste that is attractive to pests; all vehicles will be covered, delivery and off-loading undertaken within the reception building

Routine inspections of the site area and immediate site surrounds will be conducted daily to assess for the presence of pests. Findings will be recorded in the Site Diary and actions taken as appropriate.

18. MUD AND DEBRIS

Routine inspections of the trafficked areas and access road will be conducted daily to assess for the presence of mud/debris. Findings will be recorded in the Site Diary and actions taken as appropriate.

19. EMISSIONS AND MONITORING

19.1. Emissions of Substances Not Controlled by Emission Limits

Appropriate measures have been taken to control emissions of substances not controlled by emissions limits.

These are specified within this Management Plan (specifically within Sections 8 & 9), the approved Odour Management Plan (K114.1~09~013) and the associated Environmental Risk Assessment (K114.1~11~001) and Accident Management Plan (K114.1~11~002), both presented at Appendices E & F.

20. EMISSIONS TO AIR, WATER OR LAND

In line with Condition 3.1 of Environmental Permit: EPR/EP3894SC, no point source emissions to air, water or land will take place except from the sources and emission points listed in Tables 5, 6 & 7 (as a summary of Schedule 3 Tables S3.1, S3.2 & S3.3 of Environmental Permit EPR/EP3894SC) below. Schedule 3 also outlines, where applicable, the monitoring requirements for these point source emissions.

Table 5. Point Source Emissions to Air

EMISSION POINT REF. & LOCATION	SOURCE	PARAMETER	LIMIT (INCLUDING UNIT)	REFERENCE PERIOD	MONITORING FREQUENCY	MONITORING STANDARD OR METHOD
ENGINES 1 & 2 located in the combined heat and power plant room marked on “External Works Layout Drainage Design” drawing reference EO2 revision P6 dated August 2009.	Exhaust stack of the gas engine (Note 1)	Oxides of Nitrogen (NO and NO ₂ expressed as NO ₂)	500 mg/m ³	Hourly average	Annual	• BS EN 14792
		Sulphur dioxide	350 mg/m ³			• BS EN 14791
		Carbon monoxide	1400 mg/m ³			• BS EN 15058
		Total VOCs	-			• BS EN 12619:2013
FLARE 1 located to the west of the digester tanks marked on “Proposed Site Plan” reference FB/BR09/007D dated 25/03/09	Emergency flare (Note 2)	Oxides of Nitrogen (NO and NO ₂ expressed as NO ₂)	150 mg/m ³	Hourly average	(Note 3)	• BS EN 14792
		Carbon monoxide	50 mg/m ³			• BS EN 15058
		Total VOCs	10 mg/m ³			• BS EN 12619:2013
EXHAUST STACK 1 Biogas upgrading plant	Exhaust stack of biogas upgrading plant	VOCs including methane	No limit set	Leak detection and repair	In accordance with written	• BS EN15446

EMISSION POINT REF. & LOCATION	SOURCE	PARAMETER	LIMIT (INCLUDING UNIT)	REFERENCE PERIOD	MONITORING FREQUENCY	MONITORING STANDARD OR METHOD	
				(LDAR) programme	management system		
WATER SCRUBBER	Channelled emissions such as odour abatement stack or vents	Hydrogen sulphide	No limit set	Average over sample period	Once every 6 months	<ul style="list-style-type: none"> • CEN TS 13649 for sampling • NIOSH 6013 for analysis 	
		Ammonia	20 mg/m ³			<ul style="list-style-type: none"> • EN ISO 21877 	
		Odour concentration	No limit set	-		<ul style="list-style-type: none"> • BS EN 13725 	
CARBON FILTERS		Channelled emissions such as odour abatement stack or vents	Hydrogen sulphide	No limit set	Average over sample period	Once every 6 months	<ul style="list-style-type: none"> • CEN TS 13649 for sampling • NIOSH 6013 for analysis
			Ammonia	20 mg/m ³			<ul style="list-style-type: none"> • EN ISO 21877
			Odour concentration	No limit set	-		<ul style="list-style-type: none"> • BS EN 13725

EMISSION POINT REF. & LOCATION	SOURCE	PARAMETER	LIMIT (INCLUDING UNIT)	REFERENCE PERIOD	MONITORING FREQUENCY	MONITORING STANDARD OR METHOD
Pressure relief valves	Digesters /Digestate storage tank(s)	Biogas release and operational events	No limit set	Recorded duration and frequency	Daily inspection	-
Vents from tank(s)	Oil/Fuel Storage tank(s)	No parameter set	No limit set	-	-	-
<ul style="list-style-type: none"> • Note 1 - These limits are based on normal operating conditions and load - temperature 0°C (273K); pressure: 101.3 kPa and oxygen: 5 per cent (dry gas). The measurement uncertainty specified in LFTGN08 v2 2010 shall apply. • Note 2 - These limits are based on normal operating conditions and load - temperature 0°C (273K); pressure: 101.3 kPa and oxygen: 3 per cent (dry gas). The measurement uncertainty specified in LFTGN05 v2 2010 shall apply. • Note 3 - Monitoring to be undertaken in the event the emergency flare has been operational for more than 10 per cent of a year (876 hours). Record of operating hours to be submitted annually to the Environment Agency. 						

Table 6. Point Source Emissions to Water

EMISSION POINT REF. & LOCATION	SOURCE	PARAMETER	LIMIT (INCLUDING UNIT)	REFERENCE PERIOD	MONITORING FREQUENCY	MONITORING STANDARD OR METHOD
Soakaway (marked on drawing External Works Layout Drainage Design Drawing reference EO2, revision P6 dated August 2009)	Uncontaminated surface drainage from external hardstanding areas via an oil interceptor (non-operational areas only)	Oil or grease	No visible oil or grease	-	Weekly	<ul style="list-style-type: none"> Visual assessment
	Uncontaminated drainage from the building roof (non-operational areas only)					
Soakaway (marked on drawing External Works Layout Drainage Design Drawing reference EO2, revision P6 dated August 2009)	Surface drainage from containment area	Oil or grease	No visible oil or grease	-	Weekly	<ul style="list-style-type: none"> Visual assessment
		Total organic carbon (TOC) [Note 4]	60 mg/l	Spot sample or flow-proportional composite sample	Once month every	<ul style="list-style-type: none"> BS EN 1484
		Chemical oxygen demand (COD) [Note 4]	180 mg/l			<ul style="list-style-type: none"> BS EN ISO 15705

EMISSION POINT REF. & LOCATION	SOURCE	PARAMETER	LIMIT (INCLUDING UNIT)	REFERENCE PERIOD	MONITORING FREQUENCY	MONITORING STANDARD OR METHOD
		Total nitrogen	25 mg/l			<ul style="list-style-type: none"> • BS EN ISO 11905-1 or BS EN 12260
		Total phosphorus	2 mg/l			<ul style="list-style-type: none"> • EN ISO 5681-1 and -2 or EN ISO 6878 or EN ISO 11885
		Total suspended solids	60 mg/l			<ul style="list-style-type: none"> • BS EN 872
<ul style="list-style-type: none"> • <i>Note 4 - Clean surface water from roofs, or from areas of the site that are not being used in connection with storing and treating waste can be discharged directly to surface waters, or to groundwater by seepage through the soil via a soakaway.</i> 						

Table 7. Process Monitoring Requirements

EMISSION POINT REFERENCE OR SOURCE OR DESCRIPTION OF POINT OF MEASUREMENT	PARAMETER	MONITORING FREQUENCY	MONITORING STANDARD OR METHOD	OTHER SPECIFICATIONS
Digester feed (digestion process)	pH	As described in site operating techniques	As described in site operating techniques	<ul style="list-style-type: none"> Process monitoring to be recorded using a SCADA system where relevant.
	Alkalinity			
	Temperature			
	Hydraulic loading rate			
	Organic loading rate			
	Volatile fatty acids concentration			
	Ammonia			
	Liquid /foam level			
Biogas in digester	Flow	Continuous	In accordance with EU weights and measures Regulations	<ul style="list-style-type: none"> Process monitoring to be recorded using a SCADA system where relevant. Gas monitors to be calibrated every 6
	Methane	Continuous	None specified	
	CO ₂			

EMISSION POINT REFERENCE OR SOURCE OR DESCRIPTION OF POINT OF MEASUREMENT	PARAMETER	MONITORING FREQUENCY	MONITORING STANDARD OR METHOD	OTHER SPECIFICATIONS
	O ₂			months or in accordance with the manufacturer's recommendations
	Hydrogen sulphide	Daily		
	Pressure	Continuous		
Digestate batch	Volatile fatty acids concentration	One sample at the end of each batch (hydraulic retention time) cycle.	As described in site operating techniques	-
Digesters and storage tanks	Integrity checks	Weekly	Visual assessment	-
Digesters	Agitation /mixing	Continuous	Systems controls.	<ul style="list-style-type: none"> Records maintained in daily operational records.
	Tank capacity and sediment assessment	Once a year	Yearly lithium or thermal imaging	<ul style="list-style-type: none"> In accordance with design specification and tank integrity checks.
Waste reception building or area; Digesters and storage tanks	Odour	Daily	Olfactory monitoring	<ul style="list-style-type: none"> Odour detection at the site boundary.

EMISSION POINT REFERENCE OR SOURCE OR DESCRIPTION OF POINT OF MEASUREMENT	PARAMETER	MONITORING FREQUENCY	MONITORING STANDARD OR METHOD	OTHER SPECIFICATIONS
Diffuse emissions from all sources identified in the Leak Detection and Repair (LDAR) programme	VOCs including methane	Every 6 months or otherwise agreed in accordance with the LDAR programme	In accordance with the LDAR programme	<ul style="list-style-type: none"> Leak detection and repair (LDAR) programme in accordance with permit condition 3.2.4.
CHP engine stacks	VOCs including methane	Annually	BS EN 12619	<ul style="list-style-type: none"> Total annual VOCs emissions from the CHP engines to be calculated and submitted to the Environment Agency.
	Exhaust gas temperature		Traceable to National Standards	
	Exhaust gas pressure		Traceable to National Standards	
	Exhaust gas water vapour content		BS EN 14790-1	<ul style="list-style-type: none"> Unless gas is dried before analysis of emissions.
	Exhaust gas oxygen		BS EN 14789	
	Exhaust gas flow		BS EN 16911-1	

EMISSION POINT REFERENCE OR SOURCE OR DESCRIPTION OF POINT OF MEASUREMENT	PARAMETER	MONITORING FREQUENCY	MONITORING STANDARD OR METHOD	OTHER SPECIFICATIONS
Meteorological conditions	Wind speed, air temperature, wind direction	Continuous	Method as specified in management system	<ul style="list-style-type: none"> • Conditions to be recorded in operational diary and records. • Equipment shall be calibrated on a 4 monthly basis, in accordance with manufacturer's recommendations or as agreed in writing by the Environment Agency.
Emergency flare	Operating hours	Continuous	Recorded duration and frequency. Recording using a SCADA system or similar system	<ul style="list-style-type: none"> • Date, time and duration of use of auxiliary flare shall be recorded.
	Quantity of gas sent to emergency flare			<ul style="list-style-type: none"> • Quantity can be estimated from gas flow composition, heat content, ratio of

EMISSION POINT REFERENCE OR SOURCE OR DESCRIPTION OF POINT OF MEASUREMENT	PARAMETER	MONITORING FREQUENCY	MONITORING STANDARD OR METHOD	OTHER SPECIFICATIONS
				assistance, velocity, purge gas flow rate, pollutant emissions.
Pressure relief valves and vacuum systems	Re-seating	Weekly inspection	Visual and gas pressure	<ul style="list-style-type: none"> • Continuous gas pressure shall be monitored. • Operator must ensure that valves are re-seated after release in accordance with the manufacturer’s design.
	Maintenance	Written scheme of examination in accordance with condition 1.1.1	Written scheme of examination in accordance with condition 1.1.1	
	Inspection calibration and validation report	In accordance with design and construction specifications or after over topping or foaming event		<ul style="list-style-type: none"> • Operator must ensure that valves are re-seated after release, after a foaming event or sticking, build-up of debris, obstructions or damage.

EMISSION POINT REFERENCE OR SOURCE OR DESCRIPTION OF POINT OF MEASUREMENT	PARAMETER	MONITORING FREQUENCY	MONITORING STANDARD OR METHOD	OTHER SPECIFICATIONS
				<ul style="list-style-type: none"> Operator must ensure that PRV function remains within designed operation gas pressure in accordance with the manufacturer's design by suitably trained/qualified personnel.
Storage tanks	Volume	Daily	Visual or flow metre measurement	-
Water scrubber	Gas temperature – inlet and outlet	Continuous	Temperature probe / Traceable to national standards	<ul style="list-style-type: none"> Odour abatement plant shall be regularly checked and maintained to ensure appropriate
	Gas flow rate – inlet and outlet		Gas flow meter	

EMISSION POINT REFERENCE OR SOURCE OR DESCRIPTION OF POINT OF MEASUREMENT	PARAMETER	MONITORING FREQUENCY	MONITORING STANDARD OR METHOD	OTHER SPECIFICATIONS
	Moisture content or humidity – inlet and outlet (for dry scrubbers only)	Daily	Moisture meter	temperature and moisture content. <ul style="list-style-type: none"> • Odour abatement plant shall be managed in accordance with permit condition 3.3, the odour management plan and manufacturer’s recommendations. • Equipment shall be calibrated on a 4 monthly basis, or as agreed in writing by the Environment Agency.
	Moisture content or humidity – outlet (for wet scrubbers if used before other abatement systems)			
	Back pressure	Weekly	Pressure differential using sensors	
	Efficiency assessment	Annual	Emission removal efficiency (BS EN 13725 for odour removal)	
	pH scrubber solution (pre-abatement)	Continuous	pH meter	
	pH scrubber solution (post-abatement)			
	Hydrogen sulphide – inlet and outlet gas stream	Every 6 months or as agreed in writing by the Environment Agency.	CEN TS 13649 for sampling	<ul style="list-style-type: none"> • Action levels to be agreed on completion of IC8 as

EMISSION POINT REFERENCE OR SOURCE OR DESCRIPTION OF POINT OF MEASUREMENT	PARAMETER	MONITORING FREQUENCY	MONITORING STANDARD OR METHOD	OTHER SPECIFICATIONS
			NIOSH 6013 for analysis	approved in writing by the Environment Agency. <ul style="list-style-type: none"> Action levels to be achieved in accordance with permit condition 3.2 and the odour management plan. Action levels to be agreed on completion of IC8 as approved in writing by the Environment Agency.
	Odour concentration – inlet and outlet gas stream	Every 6 months or as agreed in writing by the Environment Agency.	BS EN 13725	
	Ammonia – inlet	Every 6 months or as agreed in writing by the Environment Agency.	EN ISO 21877	
Carbon filters	Carbon bed temperature – inlet and outlet	Continuous	Temperature probe	<ul style="list-style-type: none"> Odour abatement plant shall be managed in accordance with permit condition 3.3, the odour
	Gas flow rate – inlet and outlet	Continuous	Gas flow meter	
	Moisture or humidity	Daily	Moisture meter	

EMISSION POINT REFERENCE OR SOURCE OR DESCRIPTION OF POINT OF MEASUREMENT	PARAMETER	MONITORING FREQUENCY	MONITORING STANDARD OR METHOD	OTHER SPECIFICATIONS
	Back pressure	Weekly	Recognised industry method	management plan and manufacturer's recommendations.
	Efficiency assessment	Annual	Emission removal efficiency (BS EN 13725 for odour removal)	<ul style="list-style-type: none"> Carbon filters to be replaced in accordance with manufacturer's recommendations. Equipment shall be calibrated on a 4 monthly basis, or as agreed in writing by the Environment Agency.
	Hydrogen sulphide – inlet and outlet gas stream	Every 6 months or as agreed in writing by the Environment Agency.	CEN TS 13649 for sampling NIOSH 6013 for analysis	<ul style="list-style-type: none"> Action levels to be agreed on completion of IC8 as approved in writing
	Ammonia – inlet		EN ISO 21877	

EMISSION POINT REFERENCE OR SOURCE OR DESCRIPTION OF POINT OF MEASUREMENT	PARAMETER	MONITORING FREQUENCY	MONITORING STANDARD OR METHOD	OTHER SPECIFICATIONS
	Odour concentration – inlet and outlet gas stream		BS EN 13725	by the Environment Agency. <ul style="list-style-type: none"> Action levels to be achieved in accordance with permit condition 3.2 and the odour management plan.

21. REVIEW THE MANAGEMENT SYSTEM

The Management Plan will be reviewed at least annually or following any substantial change in site operations.

Other activities which may prompt review of the Management Plan are variations to the Environmental Permit, accident, complaint, breach or a change in the site setting or sensitive receptors.

Where the review results in required changes this will be documented and maintained with the site records, for example, waste storage volumes, changes to abatement measures, new or altered equipment.

22. SITE CLOSURE

During the lifetime of Fernbrook Bio Limited's operation of the permitted site they will maintain records pertaining to the condition of the site. This will include information regarding any environmental incidents, improvements or changes to containment or abatement features, records of monitoring events, or any other details which may have impact on the site's condition.

This information will be used to support a permit surrender application when the site operations cease.

23. AVAILABILITY OF THE MANAGEMENT PLAN

All site operational staff will be trained in the contents of the Management Plan to ensure compliance and consistent operation of the site.

A copy of the Management Plan will be made available at the Company's site office for reference purposes and is available on request to interested parties.



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