

ACCIDENT PREVENTION AND MANAGEMENT PLAN

Whitwick Manor, Herefordshire

STL Energy Limited

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Review Log:

Version	Issue date	Author	Checked	Description	Date of Next Review of Document
1.0	27/04/2023	DY	--	Initial Draft	
1.1	22/05/2023	DY	STL Energy Ltd	Updated in response to client comment	22/05/2024

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Drawing No. 2102-006-02 – Site Layout Plan

Drawing No. 01113-00-E – Site Plan

Appendix II - Details of SCADA System

1 Introduction

- 1.1 This Accident Prevention and Management Plan (APMP) has been prepared as part of an Environmental Permit Application for the operation of a facility for the recovery of non-hazardous wastes within an Anaerobic Digestion Facility at Whitwick Manor, Herefordshire.
- 1.2 The site will be operated by STL Energy Limited in accordance with a fully comprehensive Environmental Management System (EMS) and Environmental Permit (EP). The wastes/feedstocks to be handled and treated on site may include the following:
- Manure;
 - Digestate;
 - Apple pomace; and,
 - Liquid based agricultural wastes.
- 1.3 An operational layout of the facility is shown on Drawing No. 2102-006-02 and 01113-00-E in Appendix I of this AMP.
- 1.4 This document primarily considers environmental risks associated with accidents and outlines appropriate mitigation. This has been prepared to meet permitting requirements and does not aim to provide detailed Health and Safety risk assessments as required separately through the necessary legislation.
- 1.5 Reference is made to the site EMS.

2 Emergency and Key Contacts

2.1 Emergency and key contacts are outlined within the table below.

Table 2.1 – Key Contacts

Site Address:	Whitwick Manor, Herefordshire		
Site Operator:	STL Energy Limited	National Grid Ref:	360660, 245744

CONTACT	DESCRIPTION	OFFICE HOURS	OUT OF HOURS
Nick Layton	Operator	TBC	TBC
The County Hospital Stonebow Road, Hereford, Herefordshire, HR1 2BN	Main NHS Hospital	01432 355444	999 or 112
The Bodenham Surgery Brockington Road, Hereford, Herefordshire, HR1 3LR	Local Doctor Surgery (GP)	01568 797000	111, 999 or 112
West Mercia Police Bromyard Police Station, 26 New Road, Bromyard, HR7 4AJ	Local Police Non- Emergency	101	999
	Police Emergency	999	999
Hereford and Worcester Fire and Rescue Service Bromyard Station, New Road, Bromyard, Herefordshire, HR7 4AJ	Fire and Rescue Service (in Emergency Dial 999)	01432 347049	999
Environment Agency	Environmental Regulator	03708 506506	0800 80 70 60
<u>Herefordshire Council</u> Plough Lane, Herefore, HR4 0LE	Council Enquiries	01432 260000	

Dwr Cymru Welsh Water	Local Water Supplier / Sewerage Provider	0800 0520130	
<u>Oaktree Environmental Ltd</u> Lime House, 2 Road Two, Winsford, Cheshire, CW7 3QZ	Specialist Advisor (Waste and Planning Issues)	01606 558833	

3 Potential Environmental Hazards

3.1 Potential environmental hazards and mitigation is outlined in the table below.

Table 3.1 – Potential environmental hazards and mitigation

Hazard	Pathway	Receptor	Mitigation Measures
Inadequate waste acceptance procedures	Airborne, land	Site operatives, visitors and local residents.	<ul style="list-style-type: none"> - The site will only accept conforming wastes onto the site. - The site has strict waste acceptance procedures which have been detailed within the site's EMS
Waste Storage	Airborne, land and water	Site operatives, visitors and local residents.	<ul style="list-style-type: none"> - Waste will be stored on the site no longer than 14 days unless in an enclosed tank - Wastes will be stored for no longer than 2 calendar months within enclosed tanks and no longer than one calendar month within the enclosed negative pressure manure store
Transfer of Substances, (liquids)	Airborne, land and water	Site operatives, visitors and local residents.	<ul style="list-style-type: none"> - The tanks will be situated within a bunded area and on an impermeable concrete surface. - The transfer of liquid substances will be done so in accordance with the procedures detailed in the management plans.
Release of Biogas	Airborne	Site operatives, visitors, local residents and atmosphere.	<ul style="list-style-type: none"> - The operator will undertake daily visual monitoring and have a preventative maintenance schedule in place. - The SCADA system will monitor the entire site process (Details of the SCADA system are shown in Appendix II of this document).
Uncontrolled Release of Biogas	Airborne	Site operatives, visitors and local residents.	<ul style="list-style-type: none"> - The biogas levels are continuously monitored via the Control Cabinet. The SCADA system will monitor the entire site process (Details of the SCADA system are shown in Appendix II of this document).
Operational failure of plant, equipment and infrastructure	Airborne, land and water	Site operatives, visitors and local residents.	<ul style="list-style-type: none"> - The operator will undertake daily visual monitoring and has a preventative maintenance schedule in place. - Operational failure procedures are detailed in the site's EMS

Hazard	Pathway	Receptor	Mitigation Measures
Emissions from Plant and equipment	Airborne, land and water	Site operatives, visitors, local residents and atmosphere.	- The operator will undertake daily visual monitoring and have a preventative maintenance schedule in place to ensure that plant and equipment are maintained in accordance with manufacturers recommendations.
Breach of the Plant and Storage Tank(s)	Airborne, land and water	Site operatives, visitors, local residents, surface water, groundwater, soils.	- The tanks will be situated within a bunded area and on an impermeable concrete surface which provides the required containment for digestate.
Loss of Containment of Waste Liquors or Digestate	Airborne, land and water	Site operatives, local residents, surface waters, groundwater and soils.	- The tanks will be situated within a bunded area and on an impermeable concrete surface which provides the required containment for digestate.
Failure of Flare	Airborne	Site operatives, visitors, Local residents and atmosphere	<ul style="list-style-type: none"> - The operator will undertake daily visual monitoring and have a preventative maintenance schedule in place. - Operational failure procedures are detailed in the site's EMS - The flare is controlled by a gas buffer level to prevent over and under-pressure. - The SCADA system will monitor the entire site process (Details of the SCADA system are shown in Appendix II of this document). - All digester tanks will have biogas pressure relief valves which would take over should the flare fail
Use of Pressure Release Valves	Airborne	Site operatives, visitors, local residents and atmosphere	<ul style="list-style-type: none"> - The operator will undertake daily visual monitoring and have a preventative maintenance schedule in place. - Operational failure procedures are detailed in the site's EMS - The plant is fitted with over and under-pressure valves for biogas
Incompatible Substances	Airborne, land and water	Site operatives, visitors, local residents, surface water, groundwater, atmosphere and soils.	<ul style="list-style-type: none"> - The site will only accept conforming wastes onto the site. - The site will have strict waste acceptance procedures which have been detailed within the site's EMS.
Failure of Main Services, i.e electricity.	Airborne	Site Operatives, visitors, local residents and atmosphere.	- Operational failure procedures are detailed in the site's EMS

Hazard	Pathway	Receptor	Mitigation Measures
Over Filling of Vessels	Airborne, land and water	Site operatives, visitors, local residents, surface water, groundwater, soils.	<ul style="list-style-type: none"> - The primary digester is completed with an over- and under pressure protection. The SCADA system will monitor the entire site process (Details of the SCADA system are shown in Appendix II of this document).
Explosion Arising from the storage of Gas (biogas and propane)	Airborne	Site operatives, visitors, local residents, surface water, groundwater, soils and atmosphere.	<ul style="list-style-type: none"> - The operator undertakes daily visual monitoring and has a preventative maintenance schedule in place. - Operational failure procedures are detailed in the site's EMS - The plant is fitted with over and under-pressure to prevent the tanks from becoming over-pressurised. - All equipment in areas with risk of explosion, will be installed in accordance with ATEX, DSEAR and COMAH regulations
Site Security Failures/Vandalism	Airborne, land and water	Site operatives, visitors, local residents, surface water, groundwater, soils.	<ul style="list-style-type: none"> - Please refer to the EMS for details of the site security. - The site security will be inspected on a daily basis and any defects which impair the effectiveness of the security will be repaired to the same or better standard within a suitable timescale. All repairs will be noted on the site diary or daily inspections forms and repaired as soon as practically possible. - The security measures at the site are under constant daily review under the site's inspection regime. If unauthorised access becomes apparent as a problem at the site the security measures will be reviewed and improvements implemented.
Operator/Human Error	Airborne, land and water	Site operatives, visitors, local residents, groundwater, surface water, soil, and atmosphere.	<ul style="list-style-type: none"> - All staff are trained and undergo toolbox talks to reduce the impact of human error. - In instances of a human error, the site may suspend operations until the issue has been rectified and the member of staff will be re-trained accordingly.

Hazard	Pathway	Receptor	Mitigation Measures
Dust from waste handling operations and from traffic on internal roads.	Airborne	Site operatives, visitors, local residents, and atmosphere.	- Procedures for the control of dust are detailed within the site EMS.
Mud and debris on the public highway	Airborne	Local residents, road users, atmosphere.	- Procedures for the control of mud and debris are detailed within the site EMS.
Vehicle Collision	Airborne, land and water	Site operatives, visitors and local residents.	- All vehicle movements will be carried out under the supervision of an on-site operative.

4 Substances stored on Site

4.1 The following table provides an outline of all substances to be stored on site, storage quantities and arrangements.

Table 4.1 – Substances stored on site

Substance	Nature of Substance and Storage Arrangements On-Site	Max Quantity Stored
Propane	Stored in tanks sealed tanks. Loaded/unloaded via an enclosed line.	20,000 litres
Ferrous Chloride	Integrated desulphurization unit within the digester.	24,000 litres
Diesel	Stored in appropriately bunded tank(s)	20,000 litres
Sulphuric acid	Stored in appropriately bunded tank(s)	60,000 litres
Magnesium Chloride	Stored in appropriately bunded tank(s)	20,000 litres
Ad blue	Stored in sealed containers/tank, in accordance with Health and Safety requirements for substance	5,000 litres
Maintenance oils/lubricating oils	Stored in sealed containers, in accordance with Health and Safety requirements for substance	1,000 litres
Centrifuge coagulant / organic polymer	Stored in sealed containers/tank, in accordance with Health and Safety requirements for substance	20,000 litres

5 Accident Risk and Mitigation

5.1 The following table outlines potential accidents that could occur and an outline of appropriate mitigation to avoid the accident occurring and in the event an accident should occur, measures to minimise the impact.

5.2 In accordance with the relevant guidance, the likelihood and consequences of each accident/incident have been outlined using the definitions described within the following tables.

Table 5.1 – Likelihood of Accident/Incident

Abbreviation	Probability	Evaluation
1	Very likely	Could occur during any working day
2	Likely	Could occur regularly
3	Possible	Event possible
4	Unlikely	Event very unlikely

Table 5.2 – Consequences of Accident/Incident

Abbreviation	Consequences
A	Minor Injury
B	Major Injury
C	Death
D	Air Pollution
E	Water Pollution
F	Pollution of Land

5.3 In order to quantify the level of risk and identify the appropriate management procedures, the potential effects must be considered, as outlined in the table below:

Table 5.3 – Potential Effects

Abbreviation	Effect of Consequences	Management Required?
S	SEVERE	In all cases
Mo	MODERATE	In most cases
Mi	MILD	Occasionally
N	NEGLIGIBLE	No

Table 5.4 - Resultant Risk Matrix (Colour-Coded)

		Consequence			
		S	Mo	Mi	N
Probability	1	High	High	Medium	Low
	2	High	Medium	Low	Near-Zero
	3	Medium	Low	Near-Zero	N/A
	4	Low	Near-Zero	N/A	N/A

Accident/Incident Description	Likelihood of Accident/ Incident	Environmental Consequences of Accident/Incident	Potential Effects	Assessment Risk Outcome (Prior to Mitigation)	Measures to Prevent Accident/Incident Occurring	Assessment Risk Outcome (with mitigation)	Measures to be Taken in Event of Accident/Incident Occurring to Reduce Harm
Fire causing the release of fire and polluting materials to air (smoke or fumes). Incident could occur as a result of arson or other incidents	3	A,B,C,D	S	Medium	<ul style="list-style-type: none"> Site will be monitored 24-hours per day to prevent unauthorised access 	Near-Zero	<ul style="list-style-type: none"> Reference should be made to the site EMS for procedures to be taken in the event of fire to reduce harm.
Vandalism	3	A,B,C,D	Mi to S	Medium to Near-Zero	<ul style="list-style-type: none"> Site to be monitored 24-hours per day to prevent unauthorised access as detailed within the sites EMS 	Near-Zero	<ul style="list-style-type: none"> Inspection of all plant and machinery on-site for damage In the event that damage to plant and machinery identified which may lead to pollution, operation of equipment will cease until damage is rectified/repared In the event of spillages/leaks as a result of equipment damage, spill response procedure within site EMS will be followed Should spillages be considered likely to result in significant off-site impacts, the EA will be informed immediately. In the event of more serious event such as fire, the fire response procedures within the site EMS will be followed.

Accident/Incident Description	Likelihood of Accident/ Incident	Environmental Consequences of Accident/Incident	Potential Effects	Assessment Risk Outcome (Prior to Mitigation)	Measures to Prevent Accident/Incident Occurring	Assessment Risk Outcome (with mitigation)	Measures to be Taken in Event of Accident/Incident Occurring to Reduce Harm
Equipment malfunction/ breakdown	3	A,B,C,D,E,F	Mi	Near-Zero	<ul style="list-style-type: none"> Planned Preventative maintenance schedules to be in place for all plant and machinery to be used. Plant and equipment to be inspected regularly to ensure they remain in good working order. 	Near-Zero	<ul style="list-style-type: none"> In the event of equipment malfunction/breakdown please refer to the site EMS which has detailed emergency and contingency procedures outlining how the site will deal with equipment failure, breakdown and spillage. Use of plant/machinery will cease until fault can be rectified.
Spillages of wastes/fuels	3	A,B,E,F	Mo	Low	<ul style="list-style-type: none"> The site has procedures in place for fuel/oil storage on site. The containers used for the storage of hazardous fluids will be surrounded by a bund capable of containing a minimum of 110% of the volume of fuel stored in the tank. All pipework and associated infrastructure will be enclosed within the bund. A lock will be fitted to the tank valve to prevent unauthorised operation. Any storage of oil will comply with the Control of Pollution (Oil Storage) (England) Regulations 2001 SI No.2954 or any subsequent legislation. All valves and gauges on the tank will be constructed to prevent damage caused by frost. The tanks will be clearly marked showing their capacity and product within. 	Near-Zero	<ul style="list-style-type: none"> In the event of spillages, please refer to procedures within the site EMS.

Accident/Incident Description	Likelihood of Accident/ Incident	Environmental Consequences of Accident/Incident	Potential Effects	Assessment Risk Outcome (Prior to Mitigation)	Measures to Prevent Accident/Incident Occurring	Assessment Risk Outcome (with mitigation)	Measures to be Taken in Event of Accident/Incident Occurring to Reduce Harm
Flooding/abnormal weather such as heavy rainfall	3	A,B,C,D,E,F	Mo	Low	<ul style="list-style-type: none"> Site has drainage system in place to manage clean and foul drainage. Site is located within Flood Zone 1 and therefore at lowest risk of flooding. The operator will set up a notification alert with the Met office which ensures mitigation can be put in place prior to an extreme weather event. 	Near-Zero	<ul style="list-style-type: none"> Please refer to the site EMS which details the procedures taken in the event of high winds, poor visibility, droughts and high rainfall or flood events.
Explosions arising from the storage of gas	3	A,B,C,D,E,F	Mo to S	Medium	<ul style="list-style-type: none"> The propane tanks and digesters will be subject to daily visual inspections and a preventative maintenance regime which involves checking for structural integrity. The digesters will be fitted with over-pressure valves to ensure that an over-pressure can never occur in the tank that could lead to structural failure. The SCADA system will monitor the entire site process (Details of the SCADA system are shown in Appendix II of this document). All equipment in areas with risk of explosion will be installed in accordance with ATEX and DSEAR regulations 	Low	<ul style="list-style-type: none"> In the event of an emergency i.e. an explosion please refer to the site EMS which has detailed emergency and contingency procedures outlining how the site will deal with an emergency. Please refer to Section 6.0 of this AMP document; If necessary, operations will cease and the site will be evacuated to an area which is away from the hazard.

Accident/Incident Description	Likelihood of Accident/ Incident	Environmental Consequences of Accident/Incident	Potential Effects	Assessment Risk Outcome (Prior to Mitigation)	Measures to Prevent Accident/Incident Occurring	Assessment Risk Outcome (with mitigation)	Measures to be Taken in Event of Accident/Incident Occurring to Reduce Harm
Transferring of substances	3	A,B,C,D,E,F	Mo	Low	<ul style="list-style-type: none"> As stated above, the tanks and digesters will be subject to daily visual inspections and a preventative maintenance regime which involves checking for structural integrity. The transfer of liquid substances and removal of digestate will be carried out using an enclosed line. 	Near-Zero	<ul style="list-style-type: none"> In the event of spillages, please refer to the site EMS
Release of Biogas	3	A,B,C,D,E,F	Mo to S	Medium	<ul style="list-style-type: none"> As stated above, the entire AD plant will be subject to daily visual inspections and a preventative maintenance regime which involves checking for structural integrity. The digesters will be fitted with over-pressure valves to release biogas. The SCADA system will monitor the entire site process (Details of the SCADA system are shown in Appendix II of this document). 	Low	<ul style="list-style-type: none"> In the event of an emergency i.e. the release of biogas please refer the site EMS which has detailed emergency and contingency procedures outlining how the site will deal with an emergency. Please refer to Section 6.0 of this AMP document; If necessary, operations will cease and the site will be evacuated to an area which is away from the hazard.

Accident/Incident Description	Likelihood of Accident/ Incident	Environmental Consequences of Accident/Incident	Potential Effects	Assessment Risk Outcome (Prior to Mitigation)	Measures to Prevent Accident/Incident Occurring	Assessment Risk Outcome (with mitigation)	Measures to be Taken in Event of Accident/Incident Occurring to Reduce Harm
Explosion Zones	3	A,B,C,D,E,F	Mo to S	Medium	<ul style="list-style-type: none"> Given the nature of the process, certain areas of the site are designated as explosion zones; potential sources of ignition are strictly prohibited. Within the designated explosion zone, the only equipment permitted for use are items of plant and equipment which meet the requirements of the 'Equipment and Protective Systems Intended for use in Potentially Explosive Atmospheres Regulations 1996'. Signs are to be erected on site to notify staff of explosion zones. All equipment in areas with risk of explosion, will be installed in accordance with ATEX and DSEAR regulations 	Low	<ul style="list-style-type: none"> In the event of an emergency i.e. an explosion please refer to the site EMS which has detailed emergency and contingency procedures outlining how the site will deal with an emergency. Please refer to Section 6.0 of this AMP document; If necessary, operations will cease and the site will be evacuated to an area which is away from the hazard.

6 Reporting

6.1 All incidents/ accidents are responded to promptly with a clear step by step procedure. This includes informing the site management and the emergency services of the incident.

6.2 In addition to obligations imposed by RIDDOR '13 (Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 2013) the permit holder will notify the EA of any serious injuries to employees of STL Energy Limited, other site users or members of the public arising as a result of operations on site. Minor injuries such as cuts and grazes etc. will be recorded in the accident book on site. Separate procedures will be used for different types of emergency. An emergency at the site is defined by the site management as follows:

“Any incident which is likely to result in harm to human health or pollution of the environment or serious breach of permit conditions and serious detriment to the amenities of the locality.”

6.3 For all emergency situations, the deposit of any further waste will be suspended where necessary to allow action to be taken safely. If necessary, staff and other users of the site will be evacuated to an area which is a safe distance away from the hazards. Staff handling the emergency will be provided with and trained to use the necessary PPE (personal protective equipment) unless the manager instructs them that the hazard is too severe and outside help is needed from the emergency services or specialist waste contractors. A visitor's book will be kept to check who is on site at all times.

7 Training

7.1 Staff Training

7.1.1 Operational staff will be subject to site inductions which includes basic emergency procedures by site management. If necessary, a third-party consultant will be contacted to carry out additional training.

7.1.2 A full test (drill) of the controls and procedures in this document will be carried out every 12 months to test that the plan works. The outcome and any follow up training for staff will be documented in the site diary and relevant forms in the EMS.

7.1.3 Further details on training are detailed within the site EMS.

7.2 Toolbox talks

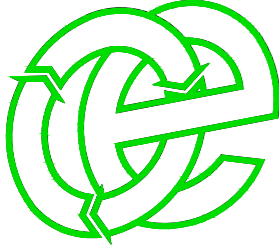
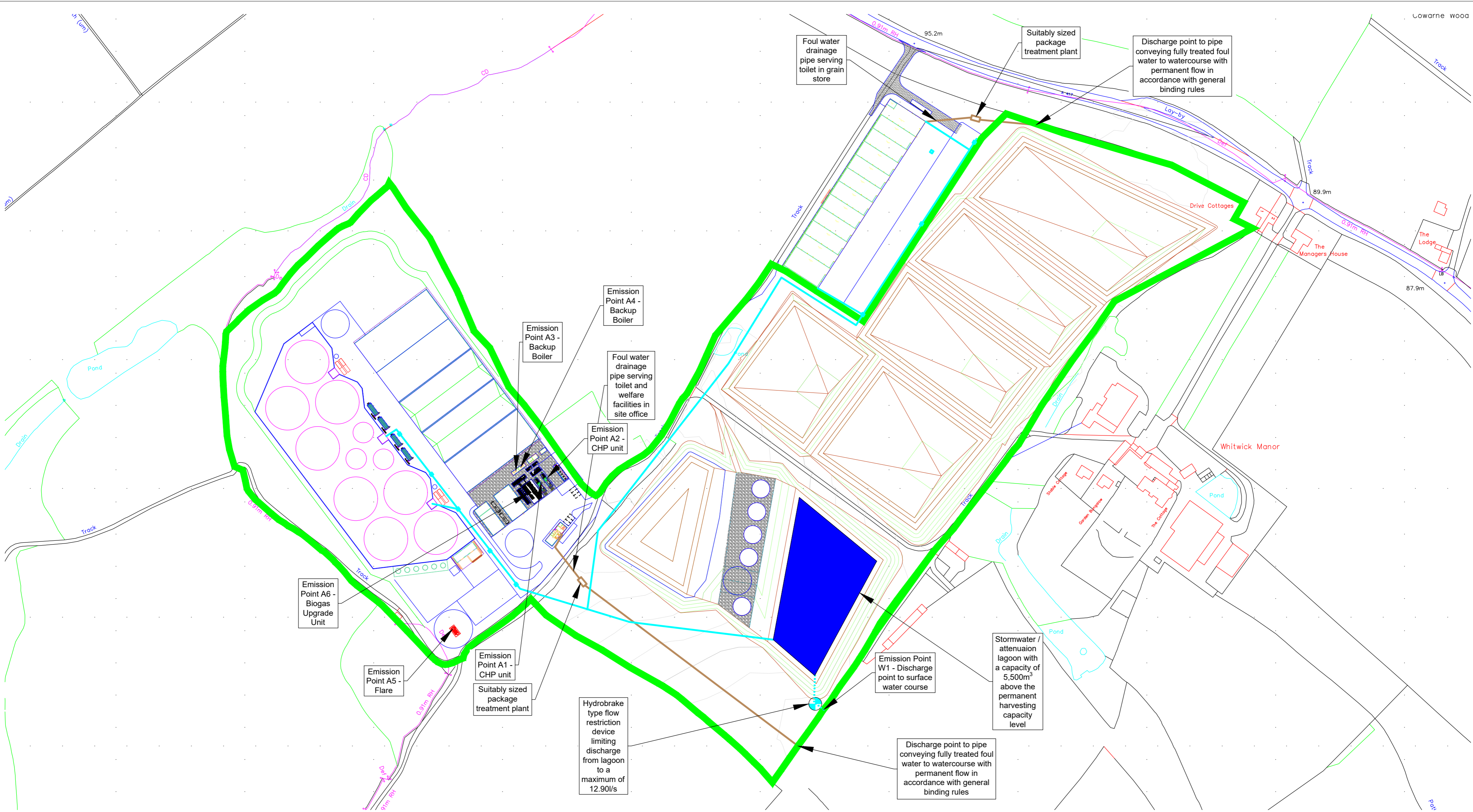
7.2.1 All operational staff including will receive training / toolbox talks by trained site management to minimise the chance of an accident occurring, which will also include the procedures within other management plans.

8 Review of AMP

- 8.1 This AMP will be reviewed annually, or sooner in the event of significant accident/incident.

Appendix I

Drawings



DRAWING TITLE SITE DRAINAGE PLAN		
CLIENT STL Energy Ltd		
PROJECT/SITE Whitwick Manor, Lower Eggleton, Herefordshire, HR8 2UE		
SCALE @ A2 1:2,000	CLIENT NO 2102	JOB NO 006
DRAWING NUMBER 2102-006-02	REV B	STATUS Issued
DRAWN BY CG	CHECKED -	DATE 27.04.23

- KEY:**
- ▬ Site boundary
 - ▬ 575mm diameter HDPE pipe with fall of at least 1 vertical in 50 horizontal
 - ⋯ 150mm diameter HDPE pipe with fall of at least 1 vertical in 50 horizontal

NOTES
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REVISION HISTORY			
Rev:	Date:	Init:	Description:
-	25.11.22	CG	Initial drawing
A	28.11.22	CG	Minor amendment
B	27.04.23	IA	Boundary amendment



- Key
1. Digester Tank 1
 2. Digester Tank 2
 3. Feed Stock/Water Storage Tank
 4. Secondary Tank 1
 5. Pasteuriser Tank
 6. Hydrolyser Tank
 7. Ammonia Recover Tank
 8. Pump Room
 9. Feeders
 10. Vehicle Turning
 11. Open Feed Stock Storage Clamps
 12. Covered Feed Stock Storage Clamps
 13. Open Feed Stock Storage Clamps
 14. Process Containers & Tank
 15. Secondary Tank 2
 16. Digester Tank 3
 17. Storage Tank
 18. Digester Tank 4
 19. 6 x Nitrogen & Phosphate Bunded Recovery Tanks
 20. Control Room
 21. Solids Recovery Separator & Centrifuge
 22. Flare
 23. Dry Ice Plant & Control Room
 24. 4 x CO2 Tanks
 25. CO2 Plant
 26. Bio Methane Plant
 27. 2 x CHP's
 28. 6 x Propane Tanks
 29. Chiller Units
 30. 2 x Back up Boilers
 31. NEF Unit
 32. Compressor Unit
 33. Office & Welfare Building
 34. Weighbridge
 35. Storm Water Lagoon
 36. Process Water Lagoon
 37. Reed Beds
 38. Grain Store
 39. Site Access
 40. Gas Pipe to Grid
 41. Tank Bund
 42. Phosphate stripping and polishing tanks
 43. Wash down & wheel wash area

NUMBER - REV - CLIENT - PROJECT 01113-00 - E - N Layton - Whitwick Manor			
TITLE Site Plan		BOURNE VALLEY ASSOCIATES ANDOVER LANE FARM FABERSTOWN ANDOVER HAMPSHIRE SP11 9PE Tel: 01264 850159 Email: info@bournevalley.co.uk	
DATE 08.08.22	SHEET 02	SCALE 1:1000	PAPER SIZE A1
DRN BY AW	CHK BY AW		

Rev No.	Revision Note	Date	Drawn	Checked
A	Pre App Drawings	12.11.19	AW	AW
B	Wetlands system added to the site	01.04.20	AW	AW
C	Grain store updated	07.10.20	JB	AW
D	Red line site amended	07.09.22	AW	AW
E	Grain store and storage building revised	28.03.23	AW	AW



Appendix II

Details of the SCADA System

STL2 – SCADA Control System Summary

The complete installation will have an integrated control system relying on a top level SCADA (Supervisory Control And Data Analysis) system linked to several individual PLCs (Programmable Logic Controllers) through the LAN (Local Area Network). The system will be primarily Siemens PLCs and using Siemens ProfiNET for I/O (input / output) to sensors and drivers such as motor inverters.

1 Critical Components

The critical components with their own PLC control systems linked to the SCADA will include:

- Feeding Systems
- AD Plant (Tanks hydrolysis and digesters, pumps digestate control, gas control)
- Nitrogen recovery plant
- Centrifuges and phosphate recovery
- Reed bed / phosphate filters
- CHPs and Backup boiler
- Biomethane plant
- CO2 plant
- Network Entry Facility
- Biomethane compressor

2 SCADA System Description

The SCADA system is a top level software based system with the following key levels:

2.1 The HMI - Human Machine Interface

The HMI which comprises the navigation screens where the plant operators can view and enter values for the key parameters that control the plant. This will send set points to the separate components such as Feed rate for poultry manure or set speed for the CHPs. The logical control such as the sequence of startup is handled by the individual PLCs such as: Start CHP would initiate extract fan, start water pumps, set throttle before starting a CHP for instance. The HMI is comprised of several screen layouts which the operator can typically navigate to through a menu such as the component list above or on more complex areas through clicking on sub-systems on the screen. In addition to the key areas listed above the HMI would also include some other critical areas such as:

- Overall summary page with key component status
- Operator log on so that alarms are also texted to operators
- Alarms page with logging and history
- Warning / alarm set points
- Utilities such as electrical meters, air pressure, water usage, lighting etc.
- Maintenance pages such as component running hours

2.2 The TAG (operating parameters and values) database

The HMI would reference/address many individual TAG (refers to a dataset describing a parameter or sensor value) identifiers such as a valve position, pump parameter, or sensor value. The SCADA would either read the value from the PLCs such as a gas pressure, or it could be a set point in the SCADA which is then addressed to the PLC such as motor speed.

2.3 Data Acquisition and Graphing

The TAG values are then tracked over time to create a very comprehensive database that can be used for monitoring performance and diagnosis for maintenance.

This data can be linked to Graphing packages or KPI (Key Performance Measurement) dashboard as required.

3 PLC Control

Whilst the SCADA system contains much of the data and provides the operator control inputs critical system logic is controlled by the PLC which is a very robust and industrialised logic controller. The hardware is controlled by the PLC 'ladder logic' and signals sent and received through a series of I/O interface blocks distributed around the main equipment components. Larger items of hardware such as inverters can be addressed directly by the PLC through ProfiNET (Siemens) or TCP/IP to other devices.

3.1 PLC Programming

The preferred system is the Siemens Portal development environment where in addition to defining TAGs and the logic that controls them static parameters such as all inverter parameters can be addressed and maintained from the development environment giving a high degree of control and conformity.

3.2 Safety

All critical control parameters such as temperatures, pressures, flows will typically be given 6 values in the PLC. These can be hard coded by manufacturers or set via the SCADA.

Hi-Hi This would typically set off an automated response such as an equipment shut down

Hi Normally this would send a warning to the alarm system

Set Point The desired value input from the SCADA

Actual Value The actual value achieved at the current point in time

Lo Normally this would send a warning to the alarm system

Lo-Lo Again this would set off an automated response such as an equipment shut down

The main systems and sub-systems are programmed to fail 'safe' such as a valve might fail open to prevent a buildup of pressure or closed such as a gas inlet when a CHP is shut down. As well as Hi/Lo warnings being sent to the alarm system, Hi-Hi or Lo-Lo alarm events are sent to the alarm system as well as being texted to the operator on duty.

4 Conclusion

In addition to the SCADA / PLC control being designed for safety and performance control, the plant itself has many mechanical fail safe features and emergency stop systems such as spring closed gas valves, automatic Hi-Hi / Lo-Lo gas pressure relief valves specified, fully designed and tested by the manufacturers of the key components of equipment.