



IC5 – An investigation into the feasibility and cost of meeting the requirements set out in TGN M1 in order to ensure compliance with condition 3.5.4.

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1. Terms of reference

The operator, AluK (GB) Ltd, will investigate the feasibility and cost of meeting the requirements set out in TGN M1 in order to ensure compliance with condition 3.5.4.

Condition 3.5.4 states that a permanent means of access shall be provided to enable sampling/monitoring to be carried out in relation to the emission points specified in Schedule 3 Tables S3.1, S3.2 and S3.3 unless otherwise agreed in writing by Natural Resources Wales.

The operator will submit a report for consultation with Natural Resources Wales 12 months from date of permit issue.

2. Methodology

The methodology for this investigation will take into consideration the EPR-BB3790FX-A001 ALUK Permit, the guidance as described in the latest Technical Guidance Note (Monitoring) M1-Sampling requirements for stack emission monitoring and associated legislation, HSE Guidance Notes and Approved Codes of Practice (ACOPs).

The Technical Guidance Note (Monitoring) M1-Sampling relates to the requirements for stack emission monitoring. The methodology will review and establish which emission points as defined in Schedule 3 Tables S3.1, S3.2 and S3.3 relate to this Technical Guidance Note.

3. Executive Summary:

Condition 3 Emissions and monitoring, section 3.5 Monitoring, sub section 3.5.4 of permit EPR/BB3790FX states that a permanent means of access shall be provided to enable sampling/monitoring to be carried out in relation to the emission points specified in Schedule 3 Tables S3.1, S3.2 and S3.3 unless otherwise agreed in writing by Natural Resources Wales.

This investigation has determined that out of the 7 emission points to air only two; A1 and A2 apply to Technical Guidance Note (Monitoring) M1.

The investigation has outlined the feasibility and cost of meeting the requirements set out in TGN M1 for a permanent means of access to enable sampling/monitoring.

Safe Working Loads of roof panels and working loads of both equipment and operators have been determined. With current equipment and operator loads compliance to TGN M1 is achieved.

It is considered that there are too many variables that could affect the working loads and it would be prudent to install access walkways and work platforms to emission points A1 and A2.

This investigation has identified the need to retrofit a permanent means of access and work platform adjacent to existing stacks A1 and A2 at a cost of: £46,600 ex VAT with a provision of £25,000 ex VAT to carry out minor strengthening works to the existing roof structure in order to accommodate any additional load. The installation or extension of fixed ladders and gantries to an existing stack will not be required.

Bradley Associates have been engaged to carry out a design check to ensure that the roof structure is capable of bearing any increased load.

The undertaking of findings of this investigation will meet the requirements for platforms described in TGN M1 and The Work at Height Regulations 2005 (WAHR), Regulation 8 and Schedule 37.

4. Findings

4.1 EPR-BB3790FX-A001 ALUK Permit

Improvement programme requirement IC5 detailed on page 11 of EPR-BB3790FX-A001 ALUK Permit states that “the operator will investigate the feasibility and cost of meeting the requirements set out in TGN M1 in order to ensure compliance with condition 3.5.4. The operator will submit a report for consultation with Natural Resources Wales by the date specified”

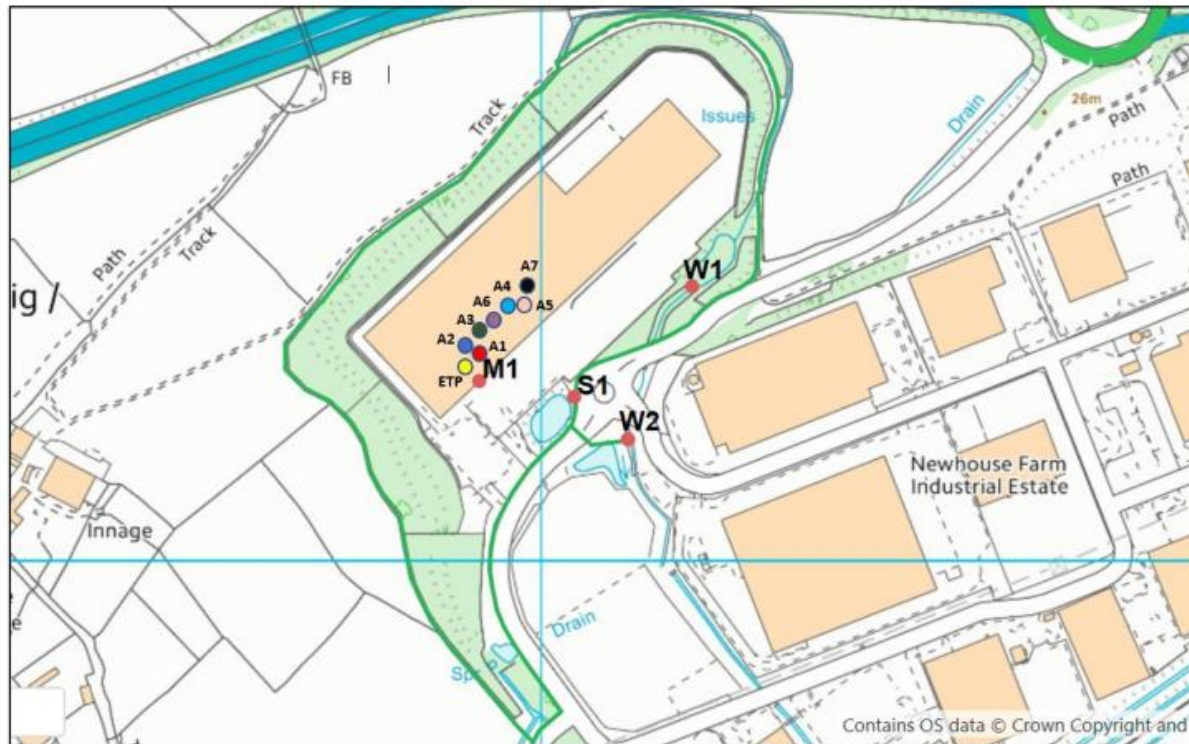
The date specified is 12 months from the date of permit issue. The issue date of permit EPR-BB3790FX-A001 ALUK is 24th June 2020.

Condition 3.5.4 detailed on page 7 of EPR-BB3790FX-A001 ALUK Permit states that a “Permanent means of access shall be provided to enable sampling/monitoring to be carried out in relation to the emission points specified in Schedule 3 Tables S3.1, S3.2 and S3.3 unless otherwise agreed in writing by Natural Resources Wales.”

The emission point references and locations are specified on pages 13 to 16 of EPR-BB3790FX-A001 ALUK Permit Schedule 3 – Emissions and monitoring in tables S3.1, S3.2 and S3.3.

4.2 Emission point locations

The site plan of Schedule 7 page 22 of EPR-BB3790FX-A001 ALUK Permit outlines emission point sources for the site. Please refer to table 1 below.



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Table 1 Schedule 7 – Site plan emission point locations

Emission point ref.	Source
A1	Flash anodising process scrubber stack
A2	Pre-treatment process scrubber stack
A3	<1 MWth input natural gas boiler providing heat to pre-treatment process
A4	<1 MWth input natural gas boiler providing heat to process
A5	<1 MWth input natural gas boiler providing heat to process
A6	Hot air exhaust from drying and curing ovens
A7	Hot air exhaust from drying and curing ovens
W1	Uncontaminated surface water drainage via interceptors into unlined balancing lagoon
W2	Uncontaminated surface water drainage via interceptors into unlined balancing lagoon
S1	Effluent treatment plant
M1	Discharge flow from Effluent Treatment Plant
ETP	Effluent Treatment Plant

4.2.1 S3.1 point source emission to air

S3.1 of Schedule 3 – Emissions and monitoring, refers to point source emissions to air of which there are 7 emission points A1 to A7. Only two of those emission points, A1 and A2 have specified emission limits and monitoring requirements as detailed in Schedule 3.

The A1 point source emission is from the flash anodizing process scrubber stack with the A2 point source emission from the Pre – Treatment scrubber stack. Parameters and limits for these two emission points are detailed on page 13 of permit EPR-BB3790FX-A001. The monitoring frequency of these two emission points is annual. Please refer to images 1 and 2 below and overleaf.

A3 to A7 source emissions are from the natural gas boilers and hot air exhausts associated with the pre-treatment processes, drying and curing ovens. It is noted that there are no parameters or limits set for these emission points within Schedule3 of permit EPR-BB3790FX. Please refer to image 3 overleaf.



Image 1 – emission point A1



Image 2 – emission point A2



Image 3 – emission points A3 to A7

4.2.2 S3.2 point source emission to water

S.3.2 of Schedule 3 – Emissions and monitoring, refers to point source emissions to water of which there are two; W1 and W2. These two source emissions are from uncontaminated surface water drainage via interceptors which in turn discharge into two unlined balancing lagoons. These discharge sample points are at a location that ensures that the sample is representative of the discharge. AluK sampling staff are made aware that manholes and similar confined spaces are dangerous and must not be entered.

W1 and W2 emission points have a permanent safe means of pedestrian access to, and a permanent safe place of work at the sampling position and space for both equipment and AluK sampling staff. Weekly spot sampling is conducted during daylight hours and when the weather conditions permit. The emission points are located away from vehicular activities.

4.2.3 S3.2.1 point source emission W1

W1 is a Saint Gobain Pam Inter-Ax2 EN 124 lift out cover 450x450 rated to Group 4 D400 load classification for use on carriageways and main roads comprising of two half covers loosely coupled and has a safe permanent means of pedestrian access. Weekly spot samples from the discharge are collected using a sample pot connected to a sampling pole.

Contamination of the spot sample by the disturbance of deposits from the cover when the cover is lifted is avoided and contamination of the spot sample from the chamber walls and any bottom deposits is prevented by using the sample pot and sampling pole.

Please refer to image 4 below.

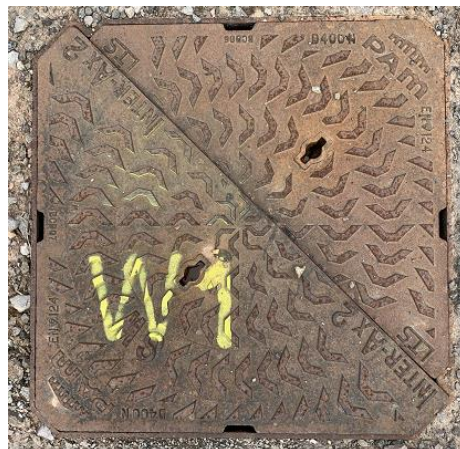


Image 4 emission point W1

4.2.4 S3.2.2 point source emission W2

W2 is a Peter Savage D400 heavy duty double triangular kite marked 600 x 600 KM 45952 class EN 124 access cover of ductile iron rated to Group 4 use on carriageways and main roads and has a safe permanent means of access.

Weekly spot samples from the discharge are collected using a sample pot connected to a sampling pole.

Contamination of the spot sample by the disturbance of deposits from the cover when the cover is lifted is avoided and contamination of the spot sample from the chamber walls and any bottom deposits is prevented by using the sample pot and sampling pole.

Please refer to image 5 below.



Image 5 emission point W2

4.2.5 S3.3 point source emission S1 and M1

S3.3 refers to point source emissions to sewer S1 and M1. S1 and M1 source emissions are from the Effluent Treatment Plant. This discharge sample point is at a location that ensures that the sample is representative of the discharge.

S1 and M1 is a Clark Drain double triangular twin cover EN 124 lift rated to Group 4 D400 load classification for use on carriageways and main roads comprising of two half covers loosely coupled and has a safe permanent means of pedestrian access. Daily spot sampling of S1 is carried out, using a sample pot connected to a sampling pole, during daylight hours and when the weather conditions permit. Continuous flow sampling of M1 is via a fixed flow sensor located within this point.

Please refer to image 6



Image 6 emission points S1 & M1

4.3 Technical Guidance Note (Monitoring) M1

Technical Guidance Note (Monitoring) M1 details the sampling requirements for stack emission monitoring. Version 8 dated August 2017 has been referred to during this report.

Box 3.1 Definitions of important terms in stack emission monitoring, on Page 2 Section 3. Designing a representative measurement location states the following:

“Stack, duct or flue – a structure through which gases pass. Typically, stacks are intended to be of sufficient height to adequately disperse emissions in the atmosphere. The terms duct and flue are synonymous.”

Based on this definition of a stack, S3.1 emission points to air – A1 and A2 will apply to this Technical Guidance Note.

There are 9 sections within this document:

1. Monitoring guidance and MCERTS

This section is the introduction to the Technical Guidance note.

2. EN 15259 – Requirements for measurement sections and sites and for the measurement objective plan and report

This section outlines a summary of EN15259.

3. Designing a representative measurement location

This section refers to the planning of appropriate measurement sections and sites when designing a plant.

4. Principles of representative sampling

This section outlines the principles of representative sampling of gases

5. Periodic sampling using grid measurements

This section makes reference to BS EN 15259 which details the positional requirements for carrying out a grid measurement.

6. Representative sampling of gases

This section makes reference to section 8 of BS EN 15259 which outlines the procedure for assessing spatial and temporal variations in gas concentration.

7. Sampling requirements: continuous emissions monitoring systems

This section briefly outlines the location requirements of continuous emissions monitoring locations.

8. Sampling facilities for stack-emission monitoring

This section explains in detail the sampling facilities for stack emission monitoring covering, permanent platforms, space for equipment and personnel, means of entry, sampling facilities, essential services, installing and upgrading sampling platforms and alternatives to permanent platforms.

9. The risk-management approach to site work

This section outlines the prominent hazards encountered when stack emission monitoring.

4.4 Access to S3.1 emission points A1 & A2 – current status

A permanent means of roof access is provided to enable sampling from emission points A1 and A2.

Initial access to emission points A1 and A2 is via a permanent steel staircase structure comprising of 6 platforms and 55 steps. Please refer to image 7.



Image 7 – Permanent staircase

This staircase leads to a solid intermediate floor, surrounded by fall protection barriers, that in turn lead to a padlocked roof hatch that is accessed via a vertical 9 rung 2m ladder. This ladder has a 7 rung extension to allow safe access to the roof. Please refer to images 8 and 9.



Image 8 showing access
locked access hatch



Image 9 showing extended access ladder

The roof hatch is .76m in both width and length. The roof hatch is secured by a padlock to prevent unauthorized access. The key to this padlock is under the control of the HSE and Maintenance Managers. The design of the access hatch allows it to be fixed into the open position when accessing the roof. This prevents the hatch from closing onto persons when ascending the ladder.

The roof access is a permanent structure that leads out onto the roof. The roof is clad with Kingspan composite KS1000LJ 1000mm x 7500mm insulated roof panels that have a 80mm thick polyurethane and polyisocyanurate (PUR and PIR) approved core with a SWL for foot traffic load per panel per span of 0.9kN/m² (91.77kg). Roof purlin bearing construction spaced at 15000mm intervals support these panels and the panels are secured to the purlins with self-tapping screws spaced at 310mm apart. Ridge detail C506 drawing from Allied Steel Frame Structures indicates the pitch of the roof to be 5°.

A Safeline fall prevention system is in place to allow for safe access and egress to the two stacks; A1 and A2. This system is inspected every 12 months by external competent persons in this case Unique Safety Systems. The Safety harnesses and associated equipment are inspected at 6 monthly intervals. Anchor points are also present to allow safe working when undertaking emissions to atmosphere monitoring. Please refer to image 10 overleaf.



Image 10 showing roof access hatch and start of the Safeline fall prevention system.

Roof lights adjacent to emission points A1 and A2 are covered using roof light GRP protection panels. Please refer to image 11.



Image 11 roof light protection panels and fall prevention system

4.5 Working loads

4.5.1 Sampling equipment loads

The emissions to atmosphere monitoring of emission points A1 and A2 are carried out by Environmental Compliance Ltd (ECL).

The weight of the Manual Stack Sampling Train (MST) used by ECL is described in table 2.

Description of equipment	Weight of equipment		Surface area required for equipment
Manual Stack Sampling Train Console and pump	50Kg		1m ²
Umbilical	15Kg	Combined weight: 55kg	Distributed over 2m ²
Sample train	15Kg		
Sample probe support	5Kg		
Heated line and cold lines	20Kg		
Chiller	15Kg		1m ²
110V leads	5Kg		na

Table 2 – Weight of Manual Stack Sampling Train (MST)

4.5.2 Operator load

Figures released by the Office for National Statistics (ONS) in 20210 show that the average man in England was 5ft 9in (175.3cm) tall and weighed 13.16 stone (83.6kg).

The average woman in England weighed 11 stone (70.2kg) and was 5ft 3in tall (161.6cm).

The actual weight of the operators can be found in table 3 below.

Number of operatives	Weight of operative	Surface area required per person
2	85kg * confirmed verbally by operator	1m ²

Table 3 – Weight of operators

4.5.3 Access and work platform loads

The weight of the proposed access walkway and work platform panels can be found in table 4 below.

Description of proposed walkway and associated equipment	Weight of item
2000mm Panel – No handrail	16KG
2000mm Panel – handrail x 1	23KG
2000mm Panel – handrail x 2	29KG
levelling kit for anything over 3°	2KG

Table 4 – weight of proposed walkway

4.6 Check sheet of sample facility requirements for plant designers and operatives

An audit of the current stack facilities using the check list found on page 19 of Technical Guidance Note (Monitoring) M1 –Sampling requirements for stack emission monitoring has been conducted.

This audit was based on the terms of reference of this investigation which focuses on condition 3.5.4 stating that a permanent means of access shall be provided to enable sampling/monitoring to be carried out in relation to the emission points specified in Schedule 3 Tables S3.1, S3.2 and S3.3 unless otherwise agreed in writing by Natural Resources Wales. Please refer to the table 5 below.

Table 5 – Audit findings

Date of audit: 8 th March 2021 Name of auditor: T.Ambler		
Characteristic	Requirement	Compliance
Identification	Clearly identified and labelled measurement section	Yes – emission points are identified as per site plan of Schedule 7 page 22 of EPR-BB3790FX-A001 ALUK Permit
Load bearing capacity	Permanent and temporary work platforms must have a load bearing capacity sufficient to fulfil the measurement objective	Yes - Mr ----- has confirmed that as a requirement of British Standard BS 6399-3 the roof is designed for a minimum distributed load of 60 kg/m ² or a concentrated load of 90 kg.
	Some measurement objectives may require platforms that support up to six people plus up to 300 kg weight of equipment	Weight of ECL equipment and operatives established. – combined weight of 290kg spread out over 6m ² = 48.33kg/m ²
Position and work area	Sufficient work area to manipulate probe and operate the measuring instruments, without equipment overhanging guardrails	Yes – A1 sample platform width back from the sample port is 1.5m at port B, and >5m at port A. A2 sample platform width back from the sample port is >5m at port B, and >5m at port A. Reference – ECL report P4475
	A sufficient depth of work area is given by the internal diameter or depth of the duct and the wall thickness plus 1.5 m	Yes – work area takes into consideration the depth of the duct and wall thickness plus 1.5m. A1 stack diameter is 0.42m & A2 stack diameter is 0.78m. Reference – ECL report P4475

Characteristic	Requirement	Compliance
	If two opposite measurement ports are installed for one measurement line, a correspondingly smaller work area is required	N/A – measurement ports are not opposite each other.
	It is recommended that ports in vertical ducts are 1.2 to 1.5m above the floor of the platform	Ports in the vertical stacks are: A1 .8m above the floor & A2 .85m above the floor. Reference – ECL report P4475
	Provision of dual level platform. These are necessary if the selected sample plane is located in a horizontal section of a large rectangular duct, and some of the sample points are positioned above a convenient and safe working height (nominally 1.5m maximum for sample probe handling)	N/A – dual level platform not required. Duct located in a vertical plane.
	Removable chains or self-closing gates at the platform to prevent workers falling through access hatches or ladders	Yes – access hatch ladder extension and access hatch prevent workers from falling through hatch. Chain is also available.
	Prevent accumulation of free-standing water and, if necessary, provide drainage	Yes – slope of roof allows for adequate drainage.
Fall prevention	Upper handrails at a minimum of 950mm (910mm allowed for old handrails). Gaps in rail no bigger than 470mm. Toe boards required	N/A – findings identify that toe boards and handrails not required for the current work area. However, an option for this control measure has been costed for.
	Consider installing personal protection systems on vertical ladders	The vertical access ladder is a vertical 9 rung 2m ladder
Access	Easy and safe access available	Yes – access to area is safe and straightforward.
	Consider installing work restraint systems on vertical ladders	Yes - 9 rung 2m vertical access ladder is used to access roof.
Power supply	Single phase 110V electrical power of a suitable current provided by a suitable number of outdoor waterproof sockets at the platform	Yes – sockets available.
Lifting equipment	Lifting systems for raising and lowering of equipment, where access to the sampling platform is by vertical, or steeply inclined, ladders or stairs	Yes – rope attachment is used to lift equipment up and through roof access hatch.

Characteristic	Requirement	Compliance
	Lifting systems (for example, hoists) and attachments (for example, eyes) must be inspected and maintained by a competent person	Yes – Unique Safety Systems inspect the roof restraint system on an annual basis. Next inspection July 2021 Altitude Safety inspect the harnesses on a 6-monthly basis. Next inspection September 2021
	Installation of a support structure for securing portable lifting systems (handrails are not usually suitable for supporting lifting systems)	N/A
Monorails	Consider sampling monorails above the sampling ports to enable certain designs of sampling train to be suspended	N/A sampling monorail not fitted to stack. ECL confirm that work bench is used to support sampling train.
Exposure to gas	Avoid areas of sources which emit unexpectedly, for example rupture discs, overpressure valves and steam discharges	Yes – no rupture discs, overpressure valves or sources of unexpected steam discharges.
Exposure to stack gas	Avoid areas of significant positive pressure	Yes – no significant areas of positive pressure within sampling area.
Awareness	Consider how stack emission monitoring personnel are informed of operating faults that may endanger them?	Yes – site H&S briefings, Risk Assessment and Method Statement available.
Indoor location	Consider locating working platform within a building	Yes – considered – location would be directly above the chemical plant.
Ventilation	Well ventilated	Yes – work area is outside and is well ventilated.
Heat and dust	Protection of the working area from heat and dust	Yes – work area is away from areas of process heat and dust.
Weather protection	Protective measures (for example, weather protection and heating to ensure conditions are appropriate for personnel and equipment)	Yes – sampling will only take place during appropriate weather conditions
Lighting	Artificial lighting or facilities for temporary lighting	N/A – not required due to activities taking place in daylight hours. Adequate daylight present.

4.7 Sampling facilities for stack-emission monitoring

Continuous Emissions Monitoring systems (CEMs) / Automated Measuring Systems (AMS) are not used at AluK.

Temporary platforms such as independent scaffolds and tower scaffolds are not used at AluK when stack-emission monitoring.

At AluK the sample is withdrawn from the stack (extractive sampling) during the annual measurement campaign.

To allow for the transportation of equipment and personnel, sampling is only carried out in periods of calm weather.

4.7.1 Permanent platforms

At present there is no sampling platform and there is a reliance on the 91.177kg SWL load of the Kingspan KS1000 1000mm x 7500m insulated roof panels.

Note - Permanent platforms must be provided with handrails and kick-boards that meet the requirements of the Workplace (Health, Safety and Welfare) Regulations 1992, (Regulation 13) for permanent platforms. If required the proposed platforms and walkways will be mounted to solid nonfragile roof panels. The proposed platforms and walkways comply with EN516:2006, BS7976 and BS EN ISO 14122. Note - handrails and toe boards been costed for.

4.7.2 Space for the equipment and personnel

At AluK the sampling area has sufficient working area to manipulate the sampling probe and to operate measuring instruments without equipment overhanging.

4.7.3 Means of entry into the stack (measurement ports)

Measurement ports at AluK are sufficient for the insertion and removal of the equipment used, and to allow the measurement points to be reached.

4.7.4 Sampling facilities for periodic monitoring using multiphase sampling techniques

At AluK samples are taken from vertical stacks. There is no sampling from horizontal circular or rectangular ducting.

4.7.5 Sampling facilities for periodic monitoring of PM10 and PM2.5

The dimensions of the measurement ports located on stacks A1 and A2 allow for straight insertion of PM10 or PM2.5 sampling equipment without any contact with the inner stack walls.

4.7.6 Sampling facilities for periodic monitoring of gases

Access and facilities requirements for gases alone are usually less demanding than for particulates. In practice, meeting the requirements for particulates at AluK also satisfy the requirements for gases.

4.7.7 Sampling facilities for CEMs

Continuous Emissions Monitoring systems (CEMs) / Automated Measuring Systems (AMS), are not used at AluK.

Note – CEMs have been considered at an indicative cost of £50,000 however there is still a requirement to access the stacks for calibration, periodic monitoring and routine maintenance and operational functional checks of the sampling probes. Therefore, AluK would still require a permanent means of access to emission points A1 & A2.

4.7.8 Essential services

Essential supplies are provided to allow for the operation of the Manual Stack Sampling Train (MST).

4.7.9 Installing and upgrading sampling platforms at existing stacks

This investigation has identified a possible requirement to retrofit new work platforms adjacent to existing stacks A1 and A2.

Should the proposed access walkway and work platform proceed AluK will need to take into consideration the original design of the stack. At present there is no intention to mount any work platform directly to emission points A1 and A2. An appropriately qualified engineer at Bradley Associates has been contacted to ascertain the SWL of the roof.

The installation or extension of fixed ladders and gantries to an existing stack will not be required.

4.7.10 Alternatives to permanent platforms

Industrial processes are regulated by Environmental Permitting Regulations (EPR) issued by Natural Resources Wales (NRW). This places a requirement on AluK to provide a permanent means of access to enable monitoring to be carried out at specified release points A1 and A2.

Note – in exceptional circumstances, at an old installation, where limited access prevents the installation of a permanent platform, temporary structures may be used, provided it is fully justified by the operator and the sampling team. However at AluK this is not the case and no temporary platform or structure is used.

4.8 Health and Safety

4.8.1 Prominent hazards encountered when stack-emission monitoring

Section 9.2 of TGN M1 identifies the most common prominent hazards relating to stack-emission monitoring. Please refer to figure 1.

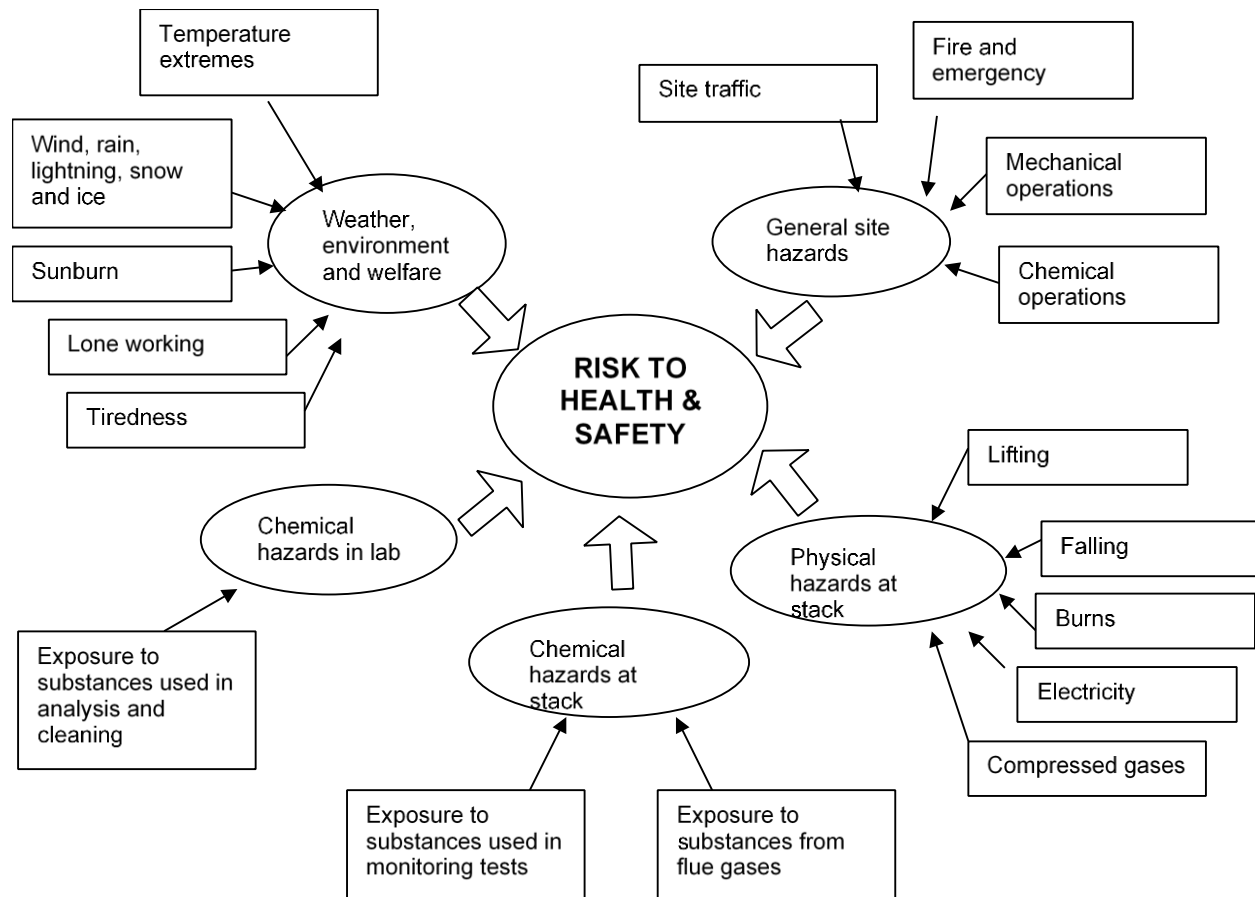


Figure 1 – most common prominent hazards relating to stack-emission monitoring

Section 9.4 of TGN M1 states that it is the responsibility of the monitoring team to carry out a comprehensive risk assessment of the work they carry out on site. Monitoring is contracted out to ECL and both the operator (AluK) and monitoring contractor (ECL) have the responsibility to follow safe systems of work.

On this site ECL carry out specific Risk Assessments, Method Statements and Site-Specific Protocols which are then presented to the HSE Manager for review prior to stack-emission monitoring. The findings of the risk assessment are reviewed and agreed by the members of the monitoring team. At AluK this risk assessment is carried out at the start of every monitoring campaign. This is good practice as it focuses the team's attention on safety as the first issue to address onsite. It also reduces the possibility of the persons becoming complacent after several site visits because they feel they know all the issues.

4.8.2 Working at Height

Due to technical reasons at AluK it is necessary to carry out stack emission monitoring at height. Falls from height are the number one cause of fatalities at work. Falls from heights can occur from steps, ladders, platforms, scaffolding and roofs.

Working at height may also affect persons in the area directly beneath the work being undertaken. Falling objects, such as equipment and tools can strike a person causing serious injuries.

The Working At Height Regulations 2005 are legally binding regulations that must be complied with. A summary of these regulations are provided below:

Organisation –

At AluK we ensure that working at height is properly planned by a competent person, appropriately supervised and carried out in a safe manner.

Note – For the purposes of this investigation ECL Health and Safety risk assessment for Job Number P4475 dated 18th October 2020 has been referred to and used to verify that these regulations are followed.

Rescue plans are discussed and agreed prior to the monitoring campaign.

The Working At Height regulations require the use of the following strict hierarchy of control:

- avoid the need to work at height
- prevent the fall
- mitigate the fall

As mentioned previously and due to technical reasons as described in section 4.14 CEM Solutions, it is not possible to avoid working at height when carrying out stack emission monitoring at AluK. This means the next best hierarchy of control is to prevent the fall.

Engineering control devices employed at AluK comprise of collective passive protection. Stairs leading to the roof have handrails and the use of personal protection (work restraint) systems are installed on a permanent basis.

The work restraint systems used at AluK ensure that the user cannot reach a position from which they can fall.

A 'Double lanyard' fall-arrest system is used when accessing and working at emission points A1 and A2.

The associated harness and equipment is inspected regularly by a competent person. In this case Unique Safety Systems.

The fixed vertical 9 rung 2m ladder, leading to the roof access hatch does not have a protection system in place, and is justified by the risk assessment carried out by the monitoring team. In addition, the operator is connected to the Safeline fall prevention system that terminates immediately adjacent to the hatch entrance.

Individuals accessing the roof are expected to behave in a safe manner. This includes measures such as:

- cleaning footwear adequately
- maintaining three points of contact on the vertical ladder
- resting adequately on midway platforms
- checking rungs are clean and free from oil and grease

Fragile surfaces such as the 1m x 7.5m roof lights adjacent to the sampling points are made safe using protective GRP permanent covers designed and installed by competent persons. In this case by Unique Safety Systems.

The likelihood of falling objects presenting a hazard is unlikely as the roof is clad with solid nonfragile Kingspan KS1000 1000mm x 7500mm insulated roof panels.

Where there is a risk of a person being struck by a falling object, for example during roof access, lifting systems such as ropes are used when transporting MSTs.

Permanent platforms are classed as existing places of work and are covered by section 6 (4) (a) and Schedule 1 of the Work at Height Regulations.

They are defined as a permanent part of the fabric of a building or structure. They are also covered by Section 4 (of the Health and Safety at Work Act 1974), which requires proportionate inspection by a competent person.

Periodic annual inspections are carried out at AluK to assess the structural integrity of supports and attachments of the Safeline fall prevention system. The inspections also take into account the effects of weathering, corrosion and damage. The frequency and comprehensiveness of inspections are commensurate with the risk of failure and serious injury.

Records of inspections carried out by Unique Safety Systems are available for the monitoring team to check before they ascend to the work area.

The following is an inspection regime that is used at AluK:

- after assembly/installation but before use;
- a periodic inspection at suitable intervals, based on exposure to conditions causing deterioration; and
- at each time an exceptional circumstance has occurred, which is liable to jeopardise its safety

A prior to use check is carried out. This is carried out by each person every time they access the area. This is not a formal inspection and does not need to be recorded.

This prior to use check takes into account of factors, such as:

- Ladders: are they secure, with no bolts missing, and free from corrosion and grease?
- Handrails: are they secure, with no bolts missing and free from corrosion?
- Staircase: are they secure, with no bolts missing and free from corrosion?
- Floor plates: are they fixed in place, with no bolts missing and free from corrosion?
- Access hatch: are they closed when not in use?

At AluK temporary scaffolding platforms are not used during the emissions monitoring. In addition, AluK deem it unacceptable to sample from ladders.

Mobile Elevated Work Platforms (MEWPS) are only utilized for as part of the rescue plan and are not used during emissions monitoring. Qualified AluK employees are authorized to operate MEWPs.

4.9 Kingspan roof panels

The KS1000 LJ is a through-fix trapezoidal profiled insulated roof panel which can be used for building applications with roof pitches of 4° or more after deflection. The panel is manufactured with an ECOsafe and FIREsafe polyisocyanurate (PIR) 80mm core.

The KS1000 LJ has a 0.4mm internal and external liner.

Once assembled, the panels can be walked on, used as walkways for maintenance and safety inspections (of the cladding or technical devices on the roof). Nevertheless, AluK acknowledge that the panels are not to be used for regular walking, The Safe Working Load for a KS1000 LJ roof panel for foot traffic load per panel per span is 0.9kN/m² (91.77kg).

4.10 Unique Safety System roof safety system

The Safeline fall restraint system used at AluK is designed to restrict the degree of travel and to prevent the user reaching the point where a fall risk is present. Specific user PPE such as harnesses are used to ensure correct use of this system and to prevent possible injury. Please refer to image 12 showing the route of the system.

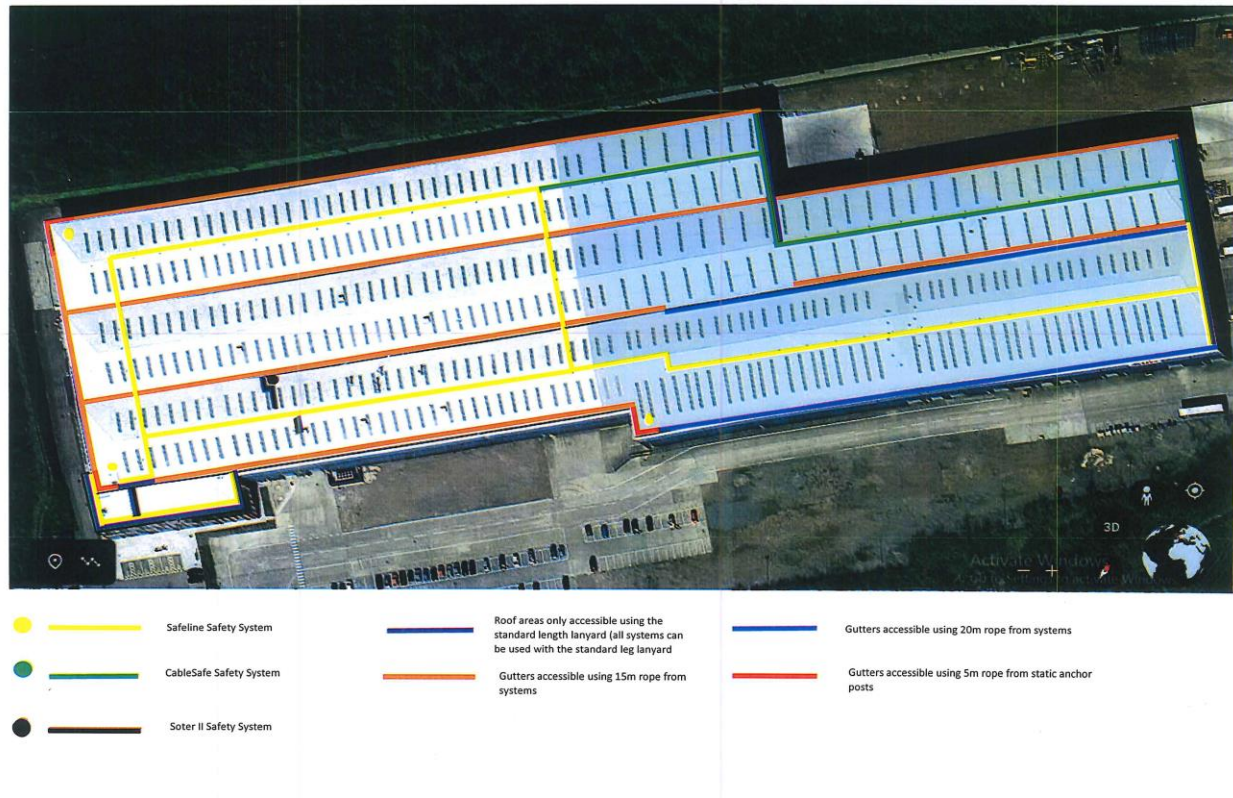


Image 12 showing the layout of the Safeline fall arrest system

The current Safeline System was installed to the main roof and office during 2008 with extensions to the 1st roof and 2nd roofs in 2011 and 2012. During 2020 Soter systems were installed to A1 and A2 emission points.

This system runs along the ridges of the main roof with runs 2m from the roof edges. The Safeline System has been tested to EN 795:1997 with the Soter System having been tested to EN 795:2012 Classes A1 & A2, Classes C and CEN TS 16415:2013.

These systems comprise of travelers, harnesses, lanyards and ropes and a full PPE inspection record is available.

4.11 HSE – Public register of enforcement notices

Below are examples of cases resulting from enforcement notices issued by the Health and Safety Executive relating to working at height.

Case No. 4602550

Failed to ensure that working platforms prevented the fall of any person whereby an employee fell from the roof to the ground below suffering serious injury

Total Fine: £3,400

Case No. 4604035

Prosecution after IP fell from height

Total fine: £30,000

Case No. 4615995

Failed to provide suitable access equipment to allow employees to work safely at height when preparing and painting large container units.

Total fine: £8,000

Case No. 4638025

Prosecution of Improvearoom LLP after failing to provide fall protection for two workers using powerful jet washers on a steeply pitched roof of a domestic property.

Total fine: £20,000

4.12 Site Emissions

Below are the results of the most recent emissions monitoring campaign relating to emission points A1 & A2.

There have been no ELV exceedances.

Please refer to table 6 below.

Emission Point	Substance / Parameter	Emission		Reference Period	Result ^[1]	Test Method ^[2]	Sample Date and Times ^[3]	Uncertainty ^[4]
		Limit Value						
A1	Oxides of nitrogen (NO and NO ₂ expressed as NO ₂)	70 mg/m ³	Periodic (average over hour)		0.09mg/m ³	BS EN 14792: 2017	20/10/2020 11.45 – 12.45	6%
A1	Sulphur dioxide	25 mg/m ³	Periodic (average over hour)		0.71mg/m ³	BS EN 14791:2017	20/10/2020 13.10 – 14.12	13%
A1	Particulate matter	25 mg/m ³	Periodic (average over hour)		.53mg/m ³	BS EN 13284-1:2017 & MID	20/10/2020 13.10 – 14.12	85%
A1	Hydrogen fluoride	2.0 mg/m ³	Periodic (average over hour)		0.03mg/m ³	BS ISO 15713:2006 & MID	20/10/2020 11.30 – 12.30	13%
A2	Oxides of nitrogen (NO and NO ₂ expressed as NO ₂)	70 mg/m ³	Periodic (average over hour)		0.17mg/m ³	BS EN 14792: 2017	19/10/2020 13.45 – 14.45	6%
A2	Sulphur dioxide	25 mg/m ³	Periodic (average over hour)		5.55mg/m ³	BS EN 14791:2017	19/10/2020 13.00- 14.02	13%
A2	Particulate matter	25 mg/m ³	Periodic (average over hour)		0.71mg/m ³	BS EN 13284-1:2017 & MID	19/10/2020 13.00 – 14.02	59%
A2	Hydrogen fluoride	2.0 mg/m ³	Periodic (average over hour)		0.03mg/m ³	BS ISO 15713:2006 & MID	19/10/2020 14.25 – 15.25	13%

Table 6 – report of emissions to air period 01/01/2020 to 31/012/2020

4.13 Proposed walkway and work platform

4.13.1 Unique Safety Systems

If required, Unique Safety System document CE/ENQ UNI/4000.Alt proposes to install four work platforms close to emission stacks A1 and A2.

In addition to these platforms, walkways, 78m in length, lead from the access hatch to the location of the 2 emission stacks will also be installed.

The platforms/walkways will be mill finish aluminium and be either fixed directly to the crowns of the Kingspan roof profile or fixed to the support bars also fixed to the crowns of the roof – the standoff of the walkway will be 56mm from the top of the crown.

The aluminium walkways are tested in accordance with BS EN 516 Class C Type 1 are 600mm wide and have an anti-slip free draining walkway surface.

The manufacturer of this equipment recommends that on any roof pitch over 3 degrees the walkways should be levelled. The roof pitch at AluK is 5 degrees. The proposal has been based upon the platforms and walkways being installed to provide a level walkway where the walkways run across the slopes.

Platforms dimensions are :

Stack A2: Platform 1200 x 2500 Parallel application – levelled

Platform 1800 x 2500 Parallel application – levelled

Stack A1: Platform 1800 x 2500 Parallel application – levelled

Platform 1200 x 600 Parallel application – levelled

Walkway dimensions (approx. 87.8m x 0.6m total) are:

To Stack A2:

Walkway 10500 x 600 Parallel application (running along the crowns of the roof) – laid to falls

To Stack A1:

Walkway 2800 x 600 Parallel application (running along the crowns of the roof) – laid to falls

Along Ridge:

Walkway 40500 x 600 Traverse application (running across the crowns of the roof) – levelled

Walkway 10000 x 600 Traverse application (running across the crowns of the roof) – levelled

Return to Hatch:

Walkway 14000 x 600 Parallel application (running along the crowns of the roof) – laid to falls

Walkway 10000 x 600 Traverse application (running across the crowns of the roof) – levelled

To supply and install both the platforms and walkways during the same visit the combined price will be:

Platforms & Walkways: £23,860.00

Handrails and toe boards: £22,740.00

The weight of the proposed access walkway and work platform panels can be found in table 7 below.

Description of proposed walkway and associated equipment	Weight of item
2000mm Panel – No handrail	16KG
2000mm Panel – handrail x 1	23KG
2000mm Panel – handrail x 2	29KG
levelling kit for anything over 3°	2KG

Table 7 – weight of proposed walkway

4.13.2 Bradley Associates

Mr----- at Bradley Associates has been contacted regarding the minimum and concentrated load of the roof at AluK. Bradley Associates were the original consulting civil and structural engineers for the relocation of Aluk from Newport to Chepstow.

Mr ----- has confirmed that as a requirement of British Standard BS 6399-3 the roof is designed for a minimum distributed load of 60 kg/m² or a concentrated load of 90 kg. Please refer to the BS 6399-3 extract below.

If the load is more than the above SWL requirements, then remedial work will be needed and this will involve re-analysing the main structure to see if there is a spare capacity to support the additional load.

A Purchase Order to the value of £1,500 has been submitted to Bradley Associates requesting a review of the roof structure should the proposed walkways be required.

s_b	Basic snow load (on the ground);	c) a uniformly distributed load of 0.6 kN/m ² measured on plan for roof slopes of 30° or less; or
s_d	Snow load on roof;	a uniformly distributed load
s_0	Site snow load (on the ground);	of 0.6 [(60 - α)/30] kN/m ² measured on plan for
α	Angle of pitch of roof measured from the horizontal;	roof slopes (α) greater than 30° and less than 60°;
β	Equivalent slope for a curved roof;	or zero load for roof slopes equal to or greater than 60°; or
δ	Angle between the horizontal and a tangent to a curved roof at the eaves;	d) a concentrated load of 0.9 kN.
μ_i	Snow load shape coefficient, suffix $i = 1, 2$, etc. to distinguish between shape coefficients at different locations.	

4 Minimum imposed roof loads

4.1 General

In 4.2 and 4.3 "access" means access in addition to that necessary for cleaning and repair and "no access" means access for cleaning and repair only.

The effects of deflection under concentrated loads need only be considered when such deflection would adversely affect the finishes.

All roof slopes are measured from the horizontal and all loads should be applied vertically.

4.2 Minimum imposed load on roof with access

Where access is provided to a roof allowance should be made for an imposed load equal to or greater than that which produces the worst load effect from one of the following:

- a) the uniformly distributed snow load; or
- b) the redistributed snow load; or
- c) a uniformly distributed load of 1.5 kN/m² measured on plan; or
- d) a concentrated load of 1.8 kN.

Where the roof is to have access for specific usages the imposed loads for c) and d) above should be replaced by the appropriate imposed floor load as recommended in 5.1 of BS 6399-1:1996, including any reduction as appropriate as recommended in 6.3 of BS 6399-1:1996.

4.3 Minimum imposed load on roof with no access

4.3.1 General. Where no access is provided to a roof (other than that necessary for cleaning and maintenance), allowance should be made for an imposed load equal to or greater than that which produces the worst load effect from one of the following:

- a) the uniformly distributed snow load; or
- b) the redistributed snow load; or

c) a uniformly distributed load of 0.6 kN/m² measured on plan for roof slopes of 30° or less; or

a uniformly distributed load of 0.6 [(60 - α)/30] kN/m² measured on plan for roof slopes (α) greater than 30° and less than 60°; or zero load for roof slopes equal to or greater than 60°; or

d) a concentrated load of 0.9 kN.

These loads assume that spreader boards will be used while any cleaning or maintenance work is in progress on fragile roofs. The recommendations of this clause may also be used where a ladder is permanently fixed to allow access to a roof for cleaning and maintenance only.

4.3.2 Small buildings. This subclause is an optional alternative to 4.3.1, which means that the detailed calculations using snow load shape coefficients do not have to be carried out. It applies to any building, where no access is provided to the roof (other than that necessary for cleaning and maintenance), which has:

- a) a roof area no larger than 200 m² in plan; or
- b) a width no greater than 10 m and a pitched roof with no parapet;

provided that there are no other buildings within 1.5 m of its perimeter, and provided that the roof configuration also meets one of the following conditions:

- 1) the roof has no abrupt changes of height greater than 1 m, at which drifting could occur;
- 2) the area of a lower part of the roof, on which a drift could form, is not greater than 35 m².

For the purpose of this subclause the roof area is defined as the total covered area, in plan, of the entire building structure. Also, chimneys and dormers whose vertical elevation area, against which a drift could form, is less than 1 m² can be ignored as an abrupt change of height.

Providing the above conditions are met, an allowance should be made for an imposed load equal to or greater than that which produces the worst load effect from one of the following:

- i) a uniformly distributed load of 1.25 times the site snow load s_0 (see 6.2); or
- ii) a uniformly distributed load of 0.75 kN/m²; or
- iii) a concentrated load of 0.9 kN.

For roof slopes (α) larger than 30° and less than 60° the values given by i) and ii) may be reduced by multiplying by [(60 - α)/30]. For roof slopes larger than 60° the minimum uniformly distributed load requirement is zero.

BS 6399-3 extract

4.14 CEM Solutions

In order to eliminate the need to access the two emission points A1 & A2 Continuous Emissions Monitoring has been considered.

Mr ----- at CEM Solutions (UK) has been approached for advice relating to Continuous Emissions Monitoring. CEM Solutions (UK) provide systems and a range of services as well as straightforward technical advice to meet customers' emissions monitoring needs.

An indicative cost to install a CEM at AluK would be upwards of £50,000 plus. --- ----- has pointed out that access to the two emission points would still be required for periodic monitoring, routine maintenance and operational functional checks of the sampling probes.

For the purpose of this investigation the implementation of a CEM at AluK would not eliminate the need to access the two emission points.

It is noted on page 13, of EPR/BB3790FX, section Schedule 3 – Emissions and monitoring that the monitoring frequency of emission points A1 & A2 is annual.

4.15 Conclusion and recommendation

The purpose of this investigation is to investigate the feasibility and cost of meeting the requirements set out in TGN M1 in order to ensure compliance with condition 3.5.4.

Condition 3.5.4 states that a permanent means of access shall be provided to enable sampling/monitoring to be carried out in relation to the emission points specified in Schedule 3 Tables S3.1, S3.2 and S3.3 unless otherwise agreed in writing by Natural Resources Wales.

There are 11 emission points specified in Schedule 3 Tables S3.1, S3.2 and S3.3; 7 emission points to air, 2 emission points to water and 2 emission points to foul sewer.

The emission points to water and foul sewer already have safe permanent access for monitoring.

Out of the 7 emission to air points only 2; A1 and A2 have specified emission limits and monitoring requirements detailed in Schedule 3. These two emission points A1 & A2 relate to TGNM1.

The investigation has identified compliance of the TGN M1 checklist audit, good Health & Safety practices and control measures. Safe Working Loads have been determined for the Kingspan composite KS1000LJ 1000mm x 7500m insulated roof panels of 91.177kg per panel and a minimum distributed load of 60 kg/m² or a concentrated load of 90 kg/m² for the roof.

The weight of each ECL operative has been determined as:

Number of operatives	Weight of operative	Surface area required per person
2	85kg * confirmed verbally by operator	1m ²

The weight of the equipment used during the annual monitoring campaign has been determined as:

Description of equipment	Weight of equipment		Surface area required for equipment
Manual Stack Sampling Train Console and pump	50Kg		1m ²
Umbilical	15Kg	Combined weight: 55kg	Distributed over 2m ²
Sample train	15Kg		
Sample probe support	5Kg		
Heated line and cold lines	20Kg		
Chiller	15Kg		1m ²
110V leads	5Kg		na

The roof distributed load of 60 kg/m² or a concentrated load of 90 kg/m² for the roof can currently accommodate both equipment and persons. However, should this weight increase due to new technology for example then a work platform will be required.

Should this occur it is recommended that AluK consider the installation of both walkways and work platforms in order to satisfy both Health and Safety legislation and the requirements of Technical Guidance Note (Monitoring) M1. The cost to achieve this is: £46,600 exc VAT.

A provision of £25,000 has been made should the roof structure require modification in order to take the additional loading.

Continuous Emissions Monitoring systems (CEMs) / Automated Measuring Systems (AMS), have been considered with an indicative cost of £50,000 however there is still a requirement to access the stacks for calibration by periodic monitoring, routine maintenance and operational functional checks of the sampling probes. Therefore, AluK will still require a permanent means of access and work platform.

Bibliography

Workplace (Health, Safety and Welfare) Regulations 1992, (Regulation 13) for permanent platforms

Health and Safety in Construction Regulations (HS (G) 150)

Work at Height Regulations 2005 (WAHR), Regulation 8

Risk Assessment Guide – Industrial-emission monitoring – Source Testing Association

Technical Guidance Note (Monitoring) M1 – Sampling requirements for stack emission monitoring

Allied Steel Frame Structures Drawing – Ridge detail C506

British Standard BS 6399-3