Environmental Protection Agency
Office of Environmental Enforcement (OEE)

Guidance Note on Site Safety Requirements for Air Emissions Monitoring (AG1)

Revision 4

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Johnstown Castle Estate
Wexford, Ireland.

Contents

Preface

The Environmental Protection Agency (EPA) is at the front line of environmental protection and policing. We ensure that Ireland's environment is protected, and we monitor changes in environmental trends to detect early warning signs of neglect or deterioration.

The organisation is managed by a full-time Board, consisting of a Director General and five Directors. The work of the EPA is carried out across five operational units (Offices), each reporting to a Director. The Office of Environmental Enforcement (OEE) functions include the regulation of activities licensed under the EPA and WMA Acts. It is the policy of the OEE to provide information and advice via published guidance to those it regulates to secure environmental improvements while ensuring value for money.

This *Guidance Note on Site Safety Requirements for Air Emissions Monitoring (AG1)* is one of a series of guidance notes that the OEE has published on the general theme of air pollution monitoring (stack testing). It describes the facilities and work practices that must be in place for the safe and effective monitoring of emissions. Other guidance notes in this series are listed below. They may be downloaded at http://www.epa.ie:

- Air Emissions Monitoring Guidance Note (AG2)
- AG2 Index of Preferred Methods
- Air Guidance Note on the Implementation of I.S. EN 14181 (AG3)
- Air Dispersion Modelling (AG4)
- Odour Impact Assessment Guidance Note for EPA Licensed Sites (AG5)
- Surface VOC Emissions Monitoring on Landfill Facilities (AG6)
- Guidance Note on Landfill Flare and Engine Management and Monitoring (AG7)
- Air Guidance Note for In-house Air Monitoring Teams (AG8)
- Odour Emissions Guidance Note (AG9)

This guidance note is intended for use by the licensed operator, the environmental monitoring service provider and Agency staff that have an involvement in air emissions monitoring. It provides guidance on:

- Safety considerations
- Access, facilities and services required
- The selection of a suitable sampling location

The Health and Safety aspects of stack testing must always receive priority. The importance of monitoring environmental emissions should never be placed ahead of the health and safety of personnel whose job it is to conduct the monitoring.

Revision of this document.

This guidance note may be the subject of periodic review and amendment. The most recent version of this note is available on the Agency website: http://www.epa.ie/ if you have any particular queries on this document then please contact the EPA Air thematic unit (airthematic@epa.ie)

Changes to previous version:

- Change in the order of chapters to reflect the logic sequence in which air emission monitoring is carried out;
- Update of the relevant H&S legislation;
- Recommendation for escape routes;
- Compliance of EX rated areas;
- Further clarification on monitoring location and sampling ports requirements;
- Extended clarification on homogeneity requirements;
- Monitoring from Biofilters

1 Introduction

A standard condition is included in all IE, Waste and IPC licenses which requires the licensee to provide safe and permanent access to all sampling and monitoring points. This document provides guidance on the sampling facilities, which the licensee should provide to permit the safe and effective measurement of their emissions to air. It focuses primarily on the provisions that the licensee is expected to have in place when the EPA or its contractors are carrying out monitoring at the licensee's site. However, these facilities will be of equal relevance to the licensee's own staff and its contractors under the self-monitoring arrangements

Chapter 2 provides an overview to Irish Safety, Health and Welfare law. The various parties involved in the monitoring exercise have discrete legal responsibilities in relation to the Safety, Health and Welfare.

Chapter 3 describe some aspects of Safety, Health and Welfare that are particularly relevant to stack testing. Links are provided to sources of training and further information.

Chapter 4 deals with risk assessment which is a prerequisite of all emission monitoring activities.

Chapter 5 deals with access to the sampling location, the services that need to be present, the need for the host site to make staff available to assist with the monitoring activity and the importance of conducting a site review in advance

Chapter 6 describes how the types of pollutants to be monitored will influence the required lay out of the sampling location and the design of sampling ports

Chapter 7 provides information on the EPA independent monitoring programme, the powers of authorised persons and the arrangements that the licensee must have in place in anticipation of an unannounced Agency visit.

1.1 This Guidance note and I.S. EN 15259:2007

This document is a revision of the Agency's 2010 publication "*Guidance Note No. 1 Air Emissions Sampling Facilities"*. The Agency requires that all existing plants shall, as a minimum, conform to the criteria set out in this document.

The standard I.S. EN 15259:2007[a] is a publication by the National Standards Authority of Ireland (NSAI) that deals with some of the subjects addressed in this document. The standard does not address Safety, Health and Welfare but it does represent current best practice on topics such as sampling location, sampling ports, representative sampling, etc. The importance of the standard has increased and it is cited as a reference in new and revised CEN standard methods for the measurement of air pollutants. The Agency requires that all new plant and changes to existing plant that affect the facilities for Air Emissions monitoring must have regard to I.S. EN 15259:2007[a] in addition to this document. A number of footnotes have been included in this document where further reference to I.S. EN 15259:2007 is recommended.

[a] The full title of this standard is; *I.S. EN 15259:2007 Air Quality – Measurement of stationary source emissions – Requirements for measurement sections and sites and for the measurement objective, plan and report.* The standard is intended to ensure reliable and comparable results when used in conjunction with reference methods such as those that have been developed by CEN/TC 264.
The standard is one of a group of three documents that were prepared by CEN/TC 264 Working Group 19 on the measurement of stationary source emissions. The other two documents deal with the elaboration of standardized methods and the application of EN ISO/EC 17025:2017 to periodic measurements. All three are available from the NSAI online service.

2 Safety, Health and Welfare Law

It is a condition of all IE/Waste/IPC licenses issued by the Agency that safe and permanent access is provided to all sampling and monitoring points. This condition has in the past and will continue to be the focus of inspector's site visits and audits and failure to comply will result in enforcement action.

If persons involved in stack testing at Agency licensed sites have any concerns regarding Safety, Health and Welfare they should raise the matter with the company immediately, and if their concerns are not adequately addressed within a reasonable time-frame, then they should contact the Agency for assistance. The Agency will seek to enforce the appropriate condition of the licence to effect the necessary improvements.

The following sections give an overview of Irish Safety, Health and Welfare law as it pertains to stack testing, the reader should consult directly with guidance issued by the Safety, Health and Welfare regulator.

2.1 Irish H&S law generally

The Health and Safety Authority (HSA) is the national body in Ireland with responsibility for securing Safety, Health and Welfare at work. It is a state-sponsored body, operating under the Safety, Health and Welfare at Work Act, 2005 (as amended). The HSA provide a Guide to the 2005 Act on their web site together with many other useful publications.

The law requires that premises, equipment, systems of work and articles for use at work (including tools, chemicals, etc.) are all safe and without risk to health. Employers are responsible for creating and maintaining a safe and healthy workplace and employees (including full or part-time, permanent or temporary) must be consulted on any matters dealing with their Safety, Health and Welfare in the workplace. The Health and Safety Authority monitors compliance with legislation at the workplace and can take enforcement action (including prosecutions).

2.2 Irish H&S law most relevant to stack testing

In a typical stack testing scenario, staff from a testing house will visit a licensed site by prior arrangement with the licensee to conduct sampling/measurement procedures, most often to fulfil the self monitoring conditions of an IE/Waste/IPC licence. Monitoring visits are also conducted by Agency staff or their contractors and these visits will generally be unannounced.

The duration of a monitoring visit can range from a few hours to a few days. During the visit the stack tester will transport, set up and operate monitoring equipment at designated emission locations (these locations are frequently at height).

Selected sections of the SH&W at work Act 2005 (as amended) that are most relevant to this scenario are summarised in the following section which describes the legal responsibilities of the parties involved.

- The stack testing organisation (test house)
- The organisation on whose site the testing is being conducted (the licensee)
- The field staff conducting the tests

The following is a summary interpretation of selected sections of the Act, the reader should refer directly to the SH&W at Work Act 2005 (as amended) for full details. A comprehensive collection of Acts, Orders, Regulations and Codes of Practice, etc. can be obtained from the Safety, Health and Welfare Legislation link on the HSA website.

2.3 General duties of stack testing organisation as an employer

Section 8 of the SH&W at work Act requires the test house to ensure, so far as is reasonably practicable, the safety, health and welfare at work of all of its field staff. The general duties of the test house include (but are not limited to):

- the management and conduct of work activities
- providing safe systems of work
- providing adequate instruction, training and supervision
- preparing risk assessments and safety statements as required by Sections 19 and 20 of the Act that taking account of the general principles of prevention as required in Schedule 3 to the Act
- Provision and maintenance of suitable personal protective equipment where risks cannot be eliminated, or where such equipment is prescribed.

Section 9 sets out the types of information on safety, health and welfare that are required to be given by the test house to its field staff.

Section 10 sets out the specific requirements that compel the test house to provide instruction, training and supervision of field staff;

In assigning a field technician to a specific task, the test house must take account of his or her capabilities in relation to safety, health and welfare. Field staff must not be put at risk by being given work that they do not have the competence to undertake.

Training must be provided to employees on recruitment, in the event of transfer or change of task, and when new work equipment, systems of work, or new technology, is introduced.

Section 12 requires the test house to manage and conduct their undertakings in a manner to ensure that other individuals at the place of work (not being his or her employees) are not exposed to risks.

Section 18 sets out the requirement for the test house to appoint competent persons. In this context "competent person", could include a person who is able to give informed and appropriate general advice on Safety, Health and Welfare to management as well as a person with specialised technical knowledge of matters such as, working at heights, electrical work, lifting operations, etc. The appointment of a competent person does not absolve the test house of its responsibilities under the legislation.

Section 19 requires that the test house identify the hazards under its control at the host site, assess the risks from those hazards and have a written risk assessment of those risks as they apply to the test house employees and other individuals at that work location. When identifying hazards and carrying out a risk assessment, account should be taken of the general principles of prevention set out in **Schedule 3** to the **Act**.

Section 21 requires the test house and the host organisation to co-operate in complying with and implementing Safety, Health and Welfare provisions. The two parties must coordinate their preventive activities and keep each other informed about the risks arising from the work, including the exchange of safety statements or relevant extracts of them.

2.4 General duties of field staff as employees

Section 13 The field technician has a duty under this section to co-operate with other duty holders (e.g. the licensee's safety representative, his/her own employer and other colleagues with whom they work). They must co-operate so far as is necessary to enable those persons to comply with the relevant statutory provisions. The general duties of field staff as individuals include (but are not limited to):

- take reasonable care to protect their own safety, health and welfare and that of any other person who may be affected by their acts or omissions at work,
- if reasonably required by their employer, submit to any appropriate, reasonable and proportionate tests, by or under the supervision of a registered medical practitioner, as may be required by Regulations,
- co-operate with their employer or any other person, as necessary, to assist that person in complying with safety and health legislation as appropriate,
- not engage in improper conduct or other behaviour such as violence, bullying or horseplay, which could endanger another person at work or themselves,
- taking account of the training and instructions given by the employer, correctly use any article or substance and protective clothing and equipment provided for use at work or for their protection.

The field technician is required to report to their employer, or other appropriate person, as soon as they become aware of any instance:

- where work being carried on, or likely to be carried on, in a manner which may endanger them or another person,
- of any defect in the place of work, the systems of work or in any article or substance likely to endanger them or another person, and
- a breach of safety and health legislation likely to endanger them or another person which comes to their attention.

Section 14 prohibits any person from intentionally or recklessly interfering with, misusing or damaging any thing provided under safety and health legislation. For example the field staff has a responsibility to refrain from misusing personal protective equipment supplied to them or their colleagues.

2.5 General duties of the licensee as a host site.

Section 12 sets out the duty that licensees have to test house field staff who are not their employees but who may be exposed to risks while visiting their site. The duties include (but are not limited to):

- Attending to visiting field staff in the event of an emergency situation at the site.
- Ensuring that field staff receive appropriate instruction in any risks associated with the site. Short induction presentations may be a suitable way of giving this information.
- Making an assessment of the competence of the visiting field staff. The licensee may decide to seek details of experience, training and competencies of the field staff prior to the site visit.

The licensee will characteristically retain a high degree of control over the field staff during the course of their visit (e.g. the use of permitting systems for hot work, enclosed spaces and work at height).

Section 15 require the licensee to ensure, so far as is reasonably practicable, that the place of work, the means of access, or egress, and any article or substance provided for use in the place of work, are safe and without risk to health.

Section 19 requires the licensee to conduct a risk assessment on the proposed activities of the visiting field staff. In so doing they should fulfil their statutory duty to persons other than their own employees (Sec. 12) and their duty as a person in control of a place of work (Sec. 15), to the extent that they are in control of a workspace occupied by the test house field staff.

Section 21 requires the licensee and the test house to co-operate in their respective approaches to Safety, Health and Welfare.

2.6 Work at height regulations

The statutory instrument which applies to work at heights is the Safety, Health and Welfare at Work (General Application) Regulations 2007 (S.I. No. 299 of 2007). They require an employer to ensure that work at height is properly planned, appropriately supervised and carried out in a manner that

is, so far as is reasonably practicable, safe and without risk to health. The regulations also indicate that work should not be carried out at height where it can practicably be carried out safely by other means.

The topics covered by the regulations include:

- Requirement for existing places of work and means of access or egress at height
- Requirements for guard rails, toe boards etc.
- Requirements for working platforms.
- Additional requirements for scaffolding.
- Requirements for collective safeguards for arresting falls.
- Requirements for personal fall protection systems.
- Additional requirements for work positioning systems.
- Additional requirements for rope access, fall arrest, work restraint systems, ladders.
- Inspection of work equipment (i.e. working platforms) cf: 5.2.

The reader should refer to www.hsa.ie for further details on the regulations. The HSA publish a useful guide that sets out the key requirements for safe working at height and provides guidance on the main types of work equipment available for work at height[iii] .

3 Safety, Health and Welfare for Stack Testing

This chapter introduces some aspects of Safety, Health and Welfare that are particularly relevant to stack testing. Table 1 sets out some fundamental rules.

Table 1 Stack testing Safety, Health and Welfare

1	The importance of monitoring environmental emissions should never be placed ahead of the Safety, Health and Welfare of personnel whose job it is to conduct the monitoring.
2	The provision of safe monitoring facilities should be an inherent part of the design, costing and construction of new emission points.
3	Existing stacks should be assessed for compliance with the requirements of this note and related Safety, Health and Welfare guidance. Monitoring should not proceed until all parties are satisfied that the risks are low as reasonably practical
4	The time and support structures necessary to do the job safely must be factored when the stack testing contractor is costing the monitoring programme.
5	Should any person, stack tester, licensee or regulator, identify an unacceptable risk then monitoring should be immediately suspended pending an assessment by qualified personnel.
6	Inadequate safety provisions should be communicated immediately to the licensee and where necessary to the Agency. Communication with the Agency may be conducted anonymously.

3.1 Escape routes

Air emissions monitoring is often carried out in remote areas (roofs) directly above parts of the premises where there are risks of fire and/or explosion (boiler houses, production buildings using solvents or fuels, etc). In such cases, an alternative escaping route should be an essential part of the site H&S management system, as anyone working by the monitoring location may find himself trapped, if during an emergency, the only way in and out has been compromised (fire, smoke, destruction of walkways, etc).

Under no circumstances should the escape route involve re-entering the area or building where the emergency originated. Stairways would be a preferred option over ladders, as they can evacuate more than one person at a time. Escape routes should be part of site inductions, where relevant, as they represent a critical safety feature during emergencies.

3.2 Lone working

Due to the complexity and physical requirements of air emission monitoring (long hours, driving, lifting, climbing, equipment setup, operation and handling) it is highly recommended to avoid lone working at all times. An air monitoring team should consist of at least 2 technicians who can share the tasks, this is especially relevant at the end of the day when tiredness would increase risks on the road.

3.3 Safe Pass Programme

The SOLAS Safe Pass Health and Safety Awareness Training Programme is aimed at the construction industry but it has relevance for the stack testing community. The training course provides a basic knowledge of Safety, Health and Welfare, so that contractors can work on-site without being a risk to themselves or others. Many industrial facilities have adopted Safe Pass as an integral part of their contractor safety programme and visiting staff are bound to hold a valid Safe Pass card before being admitted onto site. Safe Pass training covers the following topics:

- Introduction to Site Safety
- Legislation and Site Safety
- Site Accident Reporting
- Introduction to Risk Assessment
- Risk Assessment for Electricity
- Risk Assessment for Excavations
- Risk Assessment for Heights
- Behaviour-Based Safety
- Site Safety and Construction Equipment
- Site Safety and Construction Vehicles
- Personal Health and Welfare
- Noise and Vibration
- Personal Protective Equipment

Details of training courses are available at SOLAS – The Further Education and Training Authority

3.4 PAT testing

PAT testing or portable appliance testing is scheme for the in-service inspection and testing of portable electrical appliances and it is a requirement under the SH&W General Application Regulations 2007. It has particular relevance to stack testing because a variety of electrically powered devices are used for sampling and on-site measurement. PAT involves a systematic and regular program of maintenance, inspection and testing. The Code of Practice for PAT testing[iv] and details of qualified electrical contractors who conduct this type of testing can be obtained from the Register of Electrical Contractors of Ireland whose web link is www.reci.ie.

3.5 Compressed gases

Compressed gases are frequently brought to the test site for the calibration and fuelling of portable monitoring devices. Gas cylinders are safe only if used correctly and transported safely. Information on the transport of compressed gases by road can be obtained from The European Communities (Carriage of Dangerous Goods by Road and Use of Transportable Pressure Equipment) Regulations (DRA), the British Compressed Gases Association www.bcga.co.uk and from the European Industrial Gases Association www.eiga.be. The Source testing association has published a safety bulletin that deals with the hazards associated with the use of compressed gases during stack testing (cf: section 3.7).

3.6 Lifting

Lifting equipment to an elevated sampling location should only occur where there are safe systems for raising and lowering the load and the area below is adequately cordoned off. Safe systems will involve trained personnel and the use of motorised hoists (particularly above 25 meters) or jibs and pulleys at lower levels. The load should be lifted to a sufficient height (2 metres above waist level) such that equipment can be pulled onto the platform without having technicians stretching over platform rails. Lifting infrastructure and equipment must be subject to regular inspection by qualified personnel as required by the Safety, Health and Welfare at Work (General Application) Regulations 2007. The STA supply a kit comprising ropes, pulleys, snaphooks and other fittings that reduce the risk of the lifting operation. The hoisting by hand using general ware ropes is not best practice and should be avoided if possible.

Items of stack testing equipment are frequently heavy and awkward to carry so manual lifting presents another hazard to personnel. Manual handling training is covered as part of the Safe Pass programme (cf: 3.3) however more detailed training can be obtained from a number of training institutions that have courses which are dedicated to the topic.

Gas cylinders shall never be lifting using the valves or vales guards as anchor points. Allocated gas cylinder lifting bags shall be used.

3.7 The Source Testing Association

The Source Testing Association (STA) was set up in 1995 and has grown to a membership of over 210 companies, which include regulators, plant operators, equipment suppliers and stack testing companies from the UK, Ireland and other countries.

The STA has produced a Health and Safety Manual for stack testers that has become an industry standard. The manual is entitled *Risk Assessment Guide: Industrial-Emission Monitoring* but is known colloquially as the “STA yellow book”, it was written by qualified safety professionals that have many years of stack testing experience. The book, which is reviewed and updated annually, is available free of charge from the STA.

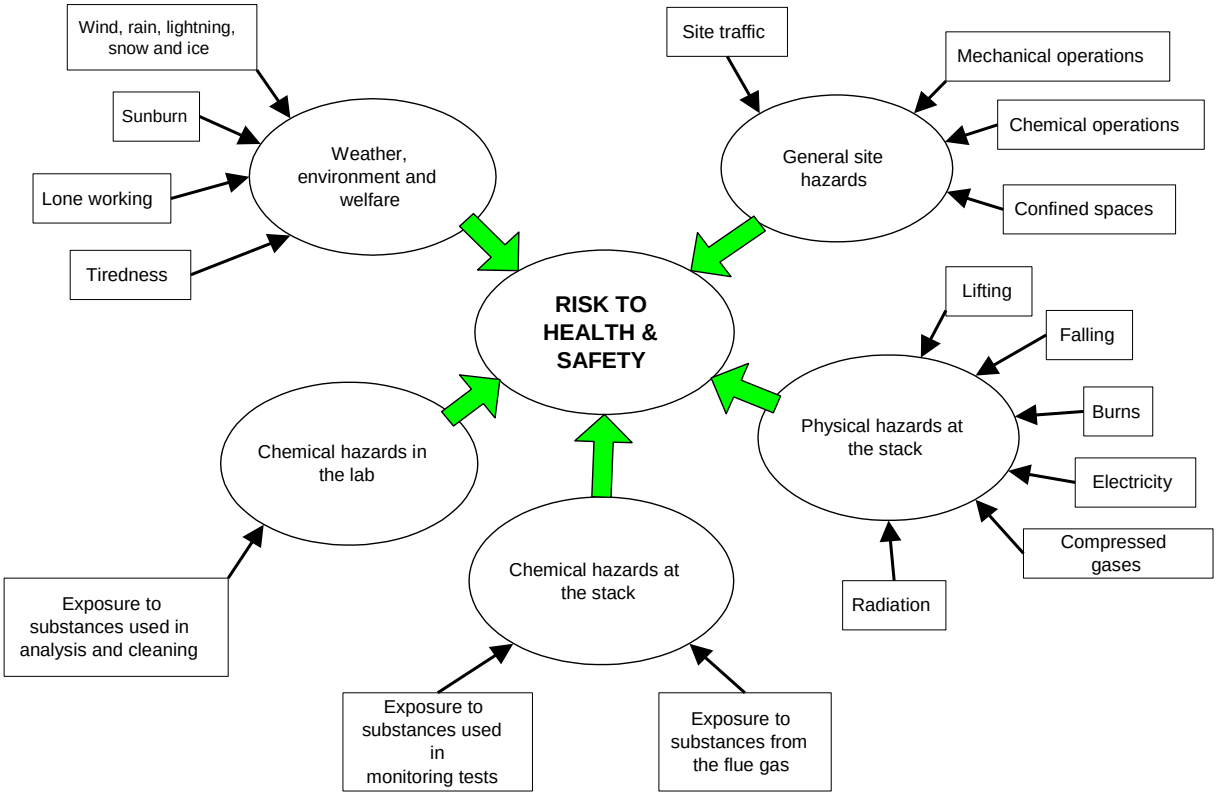
The STA provide a Health and Safety training programme for stack testers. The UK MCERTS scheme makes it mandatory for all personnel seeking certification to have taken this course and to pass the accompanying examination. Although it is not mandatory under the INAB accreditation scheme, it is recommendable to all personnel conducting air emissions monitoring.

A range of valuable guidance is available on the Health and Safety section of the association’s website www.s-t-a.org.

4 Risk Assessment

Stack testing is an inherently hazardous occupation, but it can be performed safely provided that rigorous Health & Safety rules are applied and adopted. Accidents, some causing fatalities, have happened due to inappropriate Safety, Health and Welfare and Risk Assessment procedures. Figure 1 shows some of the many hazards that need to be considered when carrying out stack testing. The risks associated with these hazards can be managed through the application of appropriate control measures along with proper staff training and adherence to risk assessment methodologies. The use of suitable PPE is the last line of defence and it should not be the primary control measure.

Figure 1: Hazards associated with stack monitoring



4.1 The risk assessment process

The risk assessment process must always precede stack testing. The risk assessment process can be summarized as

Risk assessment begins by identifying the hazards to be faced, and then making a judgement on what the risk will be (i.e. the likelihood of an accident) in light of all the relevant factors. It is desirable that the hazard is removed altogether. However, if this is not possible and if the risk associated with a particular hazard is not acceptable then control measures must be put in place to

reduce the risk to a level which is as low as reasonably practicable (ALARP). Control measures can be:

- Collective - such as engineering measures (e.g. a self-closing gate to reduce the risk of falls from a platform) and procedural measures (e.g. permit-to-work systems; safety induction training provided by the licensee); or
- Personal – using personal protective equipment (PPE) (e.g. safety goggles to reduce the risk of eye injury when opening access ports).

In order to reduce risks to an acceptable level, control measures should be applied in the following order of priority:

1. Engineering,
2. Procedural, and finally
3. PPE.

Both the licensee (the host site) and the stack testing organization have a responsibility to conduct a risk assessment. When a test house is first engaged by a licensee to conduct monitoring it is likely (and advisable) that a site review be conducted to assess the risks, the visit can also be used to formulate a site specific protocol. Regardless of any advance visits, it is the appropriately trained field technician that will be best placed to assess the risks to the team and to others. This assessment should be conducted daily and immediately prior to starting work.

It is important to remember that the assessment should be of the risk as it stands now. Not as you think it will be when any necessary control measures are in place. The work risk assessment should be repeated or revised once the control measures have been implemented.

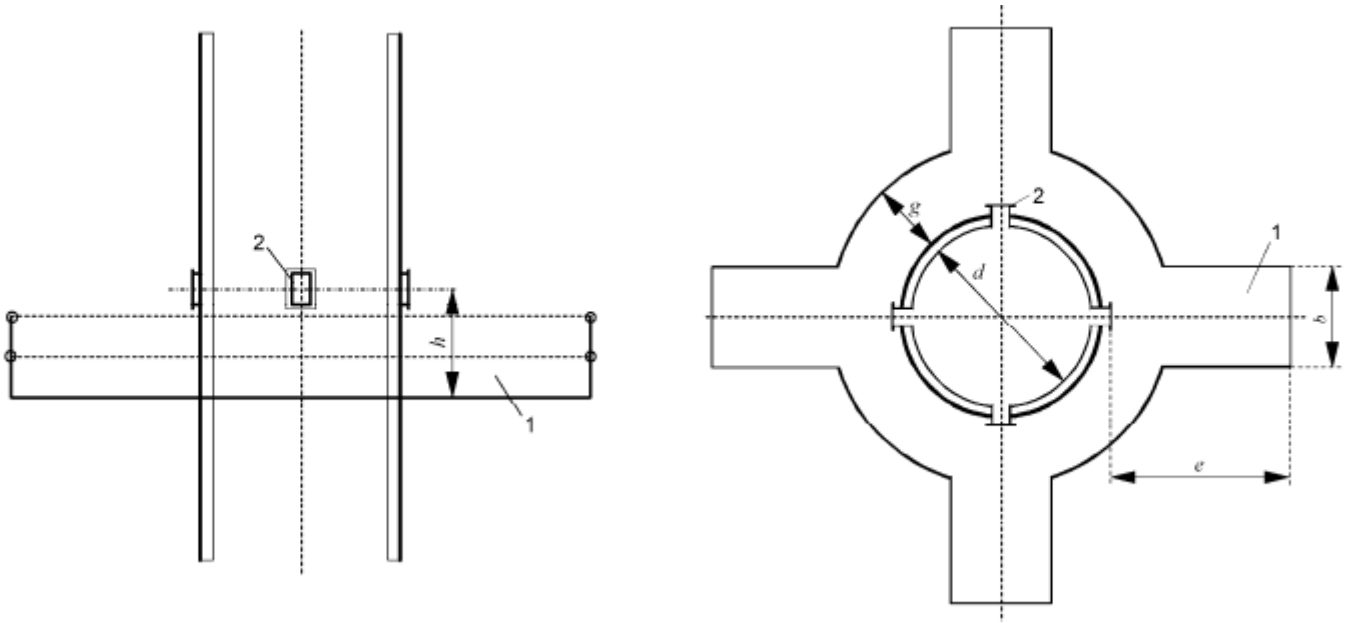
Monitoring work shall only commence when the work risk assessment has been completed and the control measures have been implemented to the satisfaction of the competent person carrying out the risk assessment (normally the monitoring Team Leader). The work risk assessment shall be communicated by the Team Leader to other members of the monitoring team before work commences.

5 Access Facilities and Services

The monitoring of licensed emissions may be a planned event or, in the case of Agency independent monitoring, it may be unannounced. The licensee is responsible for ensuring that the necessary facilities are in place at all reasonable times.

The following access requirements must be satisfied for all licensed stacks:

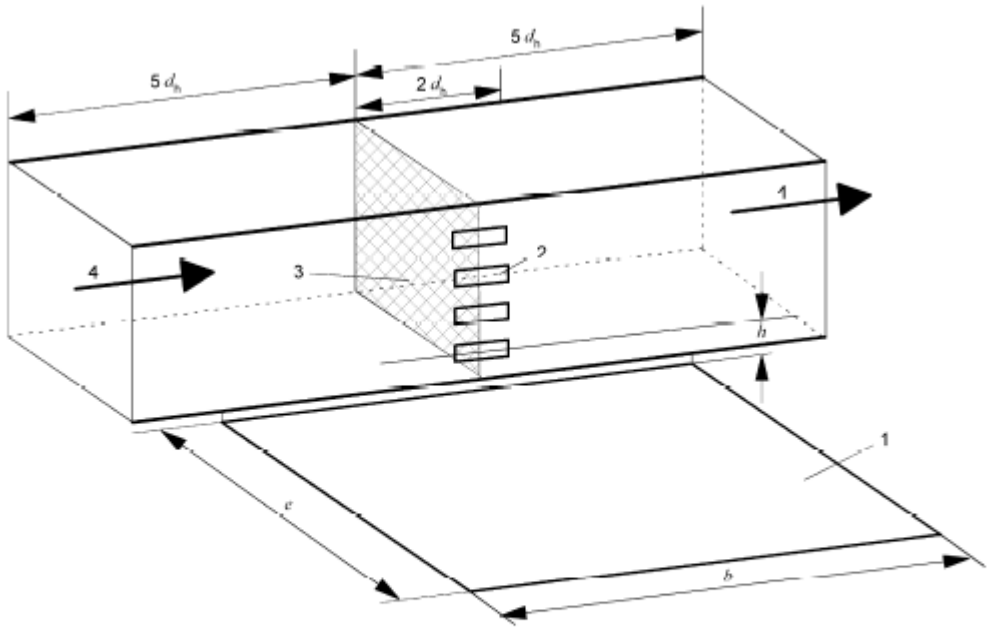
- Access must be via secure stairway, permanent ladder or gangway.
- A working platform which is adjacent to the sampling ports and provides adequate space for handling of equipment (see Figures 2 & 3). The platform surface area must not be less than 5m^2 with a minimum width at any point of 2m and a minimum length in front of access ports of 2m or the length of the appropriately sized probe (including nozzles, suction/support tubes and associated filter holders) plus 1m, whichever is the greater.
- Open sides of platforms must be fitted with safety handrails and kickboards.
- Self-closing gates must be installed on top of ladders when works are to be carried out in close proximity to it.
- The Safety, Health and Welfare aspects of working at height are dealt with in later chapters.



Key

1	working platform	*b*	width of the working area
2	measurement port	*d*	internal diameter of the waste gas duct
		e	depth of the working area
		g	passage width between the working areas
		h	working height

Figure 2: Example of a working platform and the position of measurement ports in a vertical round waste gas duct. (Extracted from EN15259).



Key

1	working platform	b	width of the working area
2	measurement port	d_h	hydraulic diameter of the waste gas duct
3	measurement plane	e	depth of the working area
4	flow direction	h	minimum working height

Figure 3: Example of a working platform and the position of the measurement ports in a horizontal rectangular waste gas duct. (Extracted from EN15259).

Shelter and protection from the elements may be required at exposed sites (cf: section 5.4). Lifting apparatus may be required to raise sampling equipment to elevated locations (cf: section 3.6). Some licenced facilities have continued to use cherry pickers and forklift trucks as a means of allowing air monitoring to be carried out on their site. While cherry pickers and forklift trucks may be used to transport/lift equipment into place, they are generally not acceptable for use as a sampling platform except for very limited scopes of monitoring when operating handheld equipment.

5.1 The site review

The site review or reconnaissance visit is a commonly used tool in advance of the monitoring visit. It has many practical benefits for the contractor and the host site and may be undertaken in advance of a final costing being agreed. The process is used to confirm the scope of the monitoring work and to conduct a preliminary examination of all the monitoring locations on site. The participants should include experienced members of the monitoring organisation and preferably members of the monitoring team, the site environmental officer who is commissioning the work and the site safety representative.

The purpose of a site review is to:

- Allow the host site, the contractor (and in some cases the regulator) to agree the scope of the monitoring, the number of emissions points, the time and date of measurement, the duration of the measurement. The monitoring programme must be designed to ensure that it will meet the monitoring objectives.

- Resolve any Health & Safety (H&S) issues with the licensee. Where circumstances exist that would present an unacceptable risk to the contractor's staff when carrying out monitoring, then the host site should effect the necessary improvements before work begins.
- Collect information on the sampling facilities i.e. sampling ports, sampling plane, essential services (e.g. electric supplies), working platform and access and assess compliance with the relevant Standards and legislation.
- Collect information on stack gas conditions and identify stacks that may require the use of non-standard measurement techniques.
- Collect information from the licensee regarding process and abatement details that could affect the emission levels and suitability of the measurement methods.
- Identify the licensee's process operating and self-monitoring information that is to be collected and reported at the time of carrying out the required measurements.

The site review process is covered extensively in I.S. EN 15259[i].

5.2 Sampling platform and access

Most IE/Waste/IPC licences require "*safe and permanent access to all on-site sampling and monitoring points*". This covers not only the working platform where monitoring is conducted, but also the route towards the emission points. Obstructed or unfixed pathways, ladders, stairs, etc. or structures with signs of corrosion on them do not qualify as safe. Temporary structures such as scaffolds do not qualify as permanent.

Platforms must be inspected at regular intervals, and also after any exceptional circumstances have occurred that are liable to jeopardise the safety of the platform. A competent person should determine the nature, frequency and extent of any inspection, taking account of such factors as the type of equipment, how and where it is used, and the likelihood of deterioration. Periods between inspections should be chosen on the basis of a risk assessment and should be reviewed in the periodically.

The manner of the inspection of sampling platforms should fulfil the necessary legal requirements. Those requirements relate to the competency of the person conducting the inspection[b], the format of the inspection report and its retention at the site. The HSA provide a form for the inspection of work equipment (scaffolds, guard-rails, toe-boards, etc) which may be used to assist with compliance with Regulation 119. The form may be downloaded at:
http://www.hsa.ie/eng/Publications_and_Forms/Forms/GA3_form.pdf

In addition to routine inspections the platform must be considered when preparing the risk assessment and safety statement pursuant to sections 19 and 20 of the Act. Thus a prior to use examination of the platform must be completed by a competent person[c].

5.3 Ex rated areas

Some premises have restricted EX rated areas where there is a risk of explosion. Such areas often require a special work permit and limit the activities than can be carried out in them. In general, the

[c] The Safety and Welfare at Work Act 2005 (as amended) defines a competent person: *For the purposes of the relevant statutory provisions, a person is deemed to be a competent person where, having regard to the task he or she is required to perform and taking account of the size or hazards (or both of them) of the undertaking or establishment in which he or she undertakes work, the person possesses sufficient training, experience and knowledge appropriate to the nature of the work to be undertaken*

use of electrical equipment is not permitted in EX rated areas unless the electric equipment is intrinsically safe and/or EX rated as well.

Although there are some manufacturers that provide EX rated air monitoring equipment, it is quite exceptional for the large equipment (isokinetic monitoring, heated filters, heated lines, etc) to be EX rated. The Agency's approach on EX rated areas is that if the widely common air monitoring equipment (non EX rated) is not safe to use due to the risk of explosion, then the monitoring location is not suitable for air monitoring, and an alternative suitable location must be provided by the licensee.

It is not acceptable to use unheated filters, lines or probes when the relevant air monitoring standards require those elements to be externally heated as part of the mandatory sampling train.

5.4 Shelter

Where the opportunity exists to site the sampling location indoors it should be taken. It protects the monitoring personnel and equipment from the elements, and avoids postponement of the monitoring programme due to bad weather. It is often possible to meet the criteria for gaseous pollutant monitoring (cf: section 6.2) at an internal location and then to use a separate external location for monitoring particulate and volumetric flow (cf: section 6.1).

It is not acceptable for sampling locations to be sited in areas of excessive heat or poor ventilation.

5.5 Power supply

A 110V power supply should be provided at the point of monitoring. The normal 110V safety socket is rated at 16 amps. This may not provide enough power for stack sampling which can demand up to 100 amps depending on the amount of equipment and types of tests being undertaken. Extension cables increase the risk of accident and can be easily snagged on moving parts. External power points should be weather proofed. If a transformer is used to step down a 220v supply it must be located at the power point. Extension cables carrying 220v should never be used.

When using steel probes with electrostatic dust precipitators, technicians have frequently received electrostatic shocks. This is due to poor earthing of abatement equipment.

5.6 Stack identification

Most IE/Waste/IPC licences require the licensee to "*clearly label … all on-site sampling and monitoring points*". All licensed stacks should be clearly labelled and uniquely identified at the sample port. Labels should be weatherproof and identify the emission point as per its designation in the licence.

For example:

EPA licensed emission point
Emission point description: _____
Emission point reference number (in-house): _____
Emission point reference number (licence): _____

Note: Where possible the in-house numbering system should be the same as that used in the licence.

5.7 Person in charge

It is a standard requirement of all IE/Waste/IPC licenses that a suitably qualified and experienced manager should be employed, who shall be designated as the person in charge of the facility. The person or a nominated, suitably qualified and experienced, deputy shall be present on the installation at all times during its operation or as otherwise required by the Agency.

In the context of the Agency's independent emissions monitoring programme the designated person must be available to receive and assist Agency staff or their authorised contractors during the course of the sampling/monitoring visit.

The designated staff member should be in a position to provide information related to the following:

- The conformance of the site with the requirements set out in this guidance note.
- Safety, Health and Welfare procedures for visiting contractors. The site Safety Officer shall implement a specific programme to ensure that the risk associated with emissions testing are as low as reasonably practical. The programme should include a suitable two way communications system between site personnel and monitoring personnel that will remain open throughout the duration of the visit and in the event of an incident or emergency, (e.g. mobile phone and/or walkie-talkies).
- Processes that are due to operate during the period of the site visit and likely changes that would affect the emission levels. Where a process is out of operation, the reasons for its non-operation and its next scheduled date of operation must be provided.
- Abatement plant and any associated control equipment.
- Continuous monitoring equipment and relevant historical emission data.

The licensee must ensure that all relevant personnel are familiar with the terms and conditions of the company's IE/Waste/IPC licence.

Please note that any proposed changes to the location of a sampling point (including any changes to be made as a consequence of an IE/Waste/IPC licence condition) must be notified to the Agency in writing.

6 Sampling Location and Sampling Ports

It is the responsibility of the licensee to examine their current IE/Waste/IPC licence and to identify the air emission parameters which require measurement at each emission point.

The choice of sampling location and sample ports will depend on the parameters to be measured. The parameters can be divided into two categories:

- Isokinetic parameters (particulates, metals, dioxins, etc.) and Volumetric flow (or stack gas velocity)
- General gaseous pollutants

6.1 Isokinetic parameters and Volumetric flow measurement

Isokinetic monitoring from stack emissions, together with the measurement of the volume flow rate demands the most rigorous selection of sampling location. Accurate sampling of solid phase pollutants (i.e. particulates) requires that the waste gas flow is laminar (free from turbulence) and that the sample is collected isokinetically. The principle of isokinetic sampling is that a sharp-edged nozzle is positioned in the stack facing into the moving gas stream and a sample of the gas is extracted through it, at the same velocity as the gas in the stack, for a measured period of time. To allow for non-uniformity of particulate distribution, samples are taken at a pre-selected number of points across the sample plane. The probes used for collecting particulate samples, using isokinetic collection, require a larger size of sampling port than that which is needed for the collection of gaseous samples[d] since the sampling train includes relatively bulky parts such as the filter holder and sampling nozzle. The below figure represents the parts of the sampling train that is introduced in the stack for monitoring purposes:

Figure 4: Sampling ports shall allow the insertion and regress of the necessary sampling equipment for isokinetic monitoring preventing any contact that may lead to cross contamination. The picture shows the front end of the sampling probe (sampling nozzle, pitot tube, filter holder).

[d] I.S. EN15259 section 6.2.2 now requires the same sample port consideration for both isokinetic and gaseous species

The following steps should be followed when installing sampling ports in stacks which are licensed for isokinetic parameters:

- Sampling ports must be downstream of any abatement equipment at a representative location.
- The best available sampling plane must be chosen. The sampling plane should be positioned in a length of straight duct of uniform cross section, where homogeneous flow conditions are found and as distant as possible from any feature that may disturb the flow such as:

    1. Bends
    2. Fans
    3. Dampers or obstructions
    4. Sections with an increase or decrease of the internal diameter of the stack
    5. Merge of ducts
    6. Final exhaust

- The position of fans with regards to the sampling ports will dictate if the sampling plane is under positive pressure (gas escaping out through the ports) or negative pressure (surrounding air ingressing into the stack through the ports), see Figure 5. Regardless of the position of the fan, ports shall be tightly capped during monitoring in order to prevent exposure to potentially hazardous gases (positive pressure) or to prevent dilution of the sample gas with the subsequent increase in O_2 concentration (negative pressure). Port flanges provide a good seal around the sampling probe and are recommended.
- Extreme negative pressure conditions may affect the suction performance of the monitoring equipment pumps, leading to underestimated results or monitoring failure.

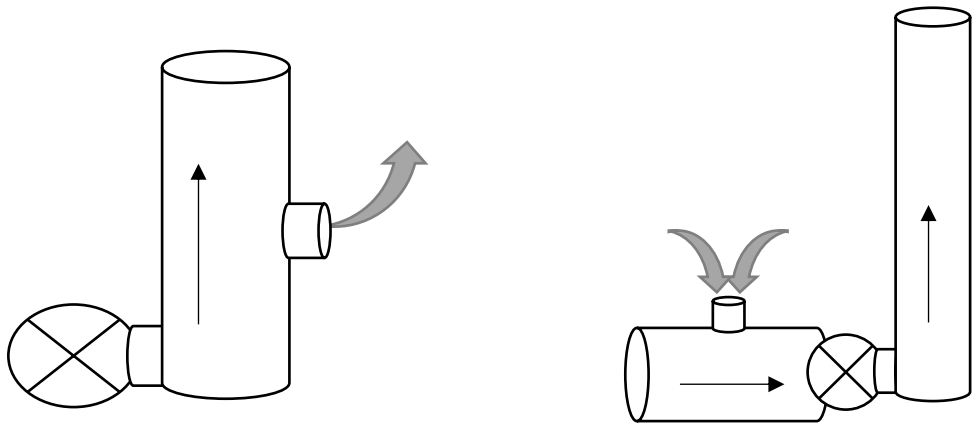


Figure 5: Sampling ports under positive (left) and negative (right) pressure conditions, due to the location of the fan (X).

- Where suitable sample planes exist in both vertical and horizontal sections of ductwork, the former should be chosen. From a practical point of view, monitoring at a vertical stack is generally less complex as the ports can support the sampling probes. In horizontal stacks, the probes would have to be fixed against gravity, having the back end at heights what requires longer dry lines.

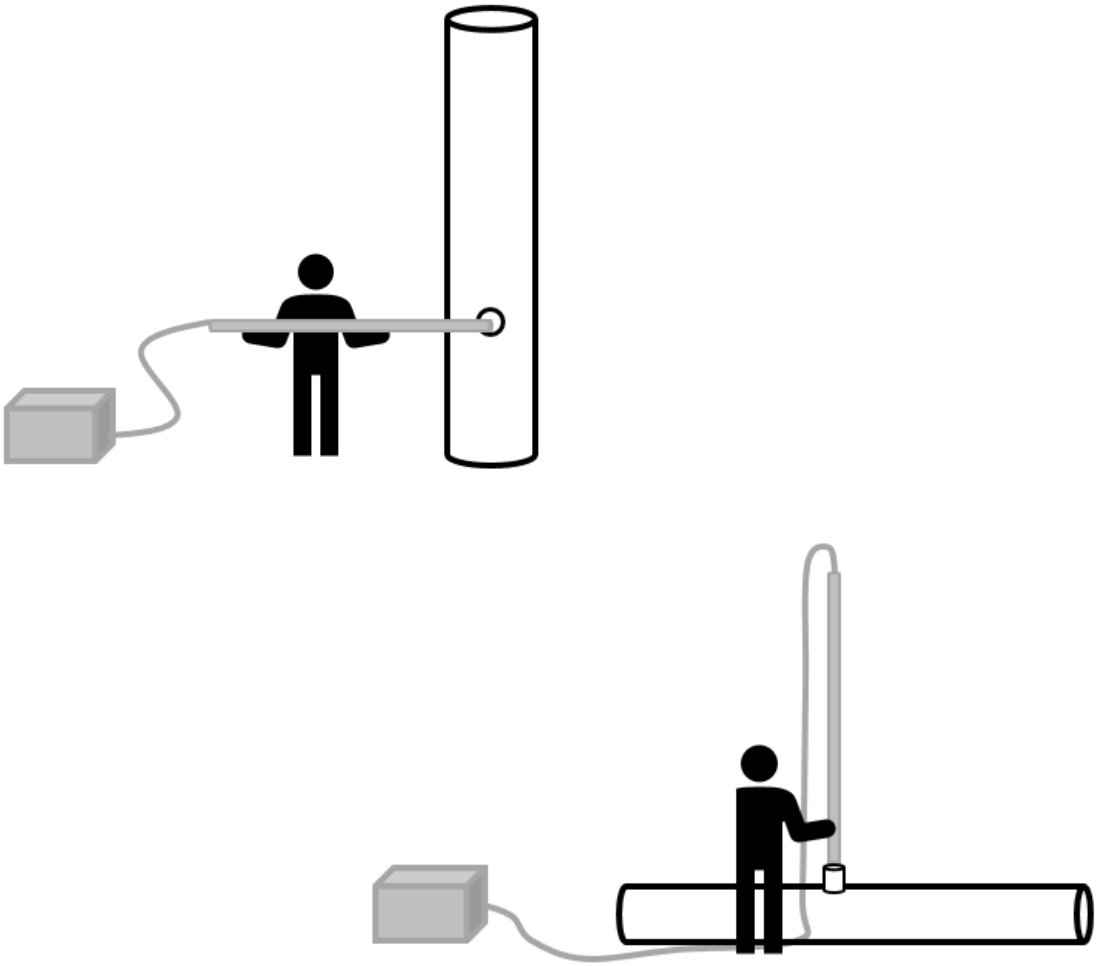


Figure 6: Monitoring at vertical sections of duct is the most practical option

- There are 4 mandatory criteria that the sampling plane must satisfy to provide a representative sampling location in compliance with the I.S. EN 15259:2007 standard.

    1. angle of gas flow less than 15° with regard to duct axis;
    2. no local negative flow;
    3. minimum velocity depending on the flow rate measuring method used (for Pitot tubes a differential pressure larger than 5 Pa[e]);
    4. ratio of the highest to lowest local gas velocities less than 3:1;

The above criteria are likely to be satisfied in sections of duct with at least five hydraulic diameters of straight duct upstream of the measurement plane and two hydraulic diameters downstream (five hydraulic diameters from the top of a stack). Therefore, it is strongly recommended to design sampling locations accordingly

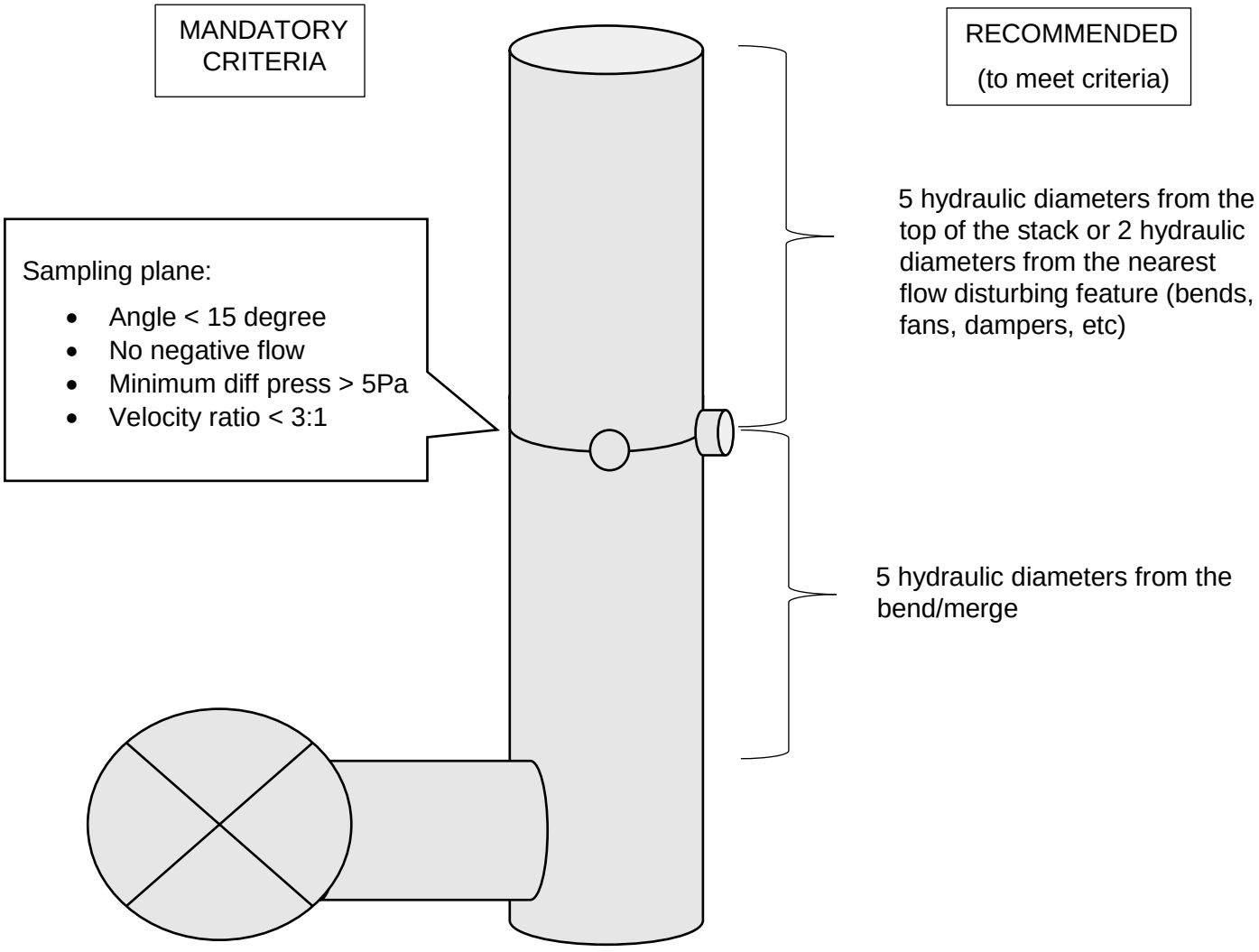


Figure 7: Minimum criteria for representative isokinetic and volumetric flow monitoring.

If the mandatory criteria are not met, the monitoring location is not in compliance with the requirements of the EN15259 standard. In such cases, the stack would need to be rectified or an alternative monitoring location provided.

[e] I.S. EN 15259 is a performance-based standard. Lower differential pressure readings would be accepted if evidence is provided about the ISO 17025 accreditation and certification of pitot tubes and measuring devices able to measure at lower differential pressure conditions.

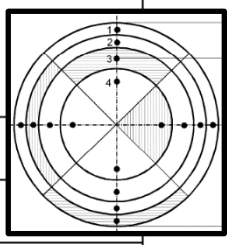
- Having established the best available sampling plane, the exact position of the sampling ports within that plane must be decided. For smaller ducts, a single sampling port may be all that is practicable. The minimum mandatory number of ports and sampling points is dictated by the size of the stack:

Minimum number of sampling lines and sampling points for circular stacks (extracted from EN15259 standard):

Range of sampling plane areas m^2	Range of ducts diameters m	Minimum number of sampling lines (diameters)	Minimum number of sampling points per plane
< 0,1	< 0,35	–	1 [a]
0,1 to 1,0	0,35 to 1,1	2	4
1,1 to 2,0	>1,1 to 1,6	2	8
> 2,0	> 1,6	2	at least 12 and 4 per m^2 [b]

[a] Using only one sampling point can give rise to errors greater than those specified in this European Standard.

[b] For large ducts, 20 sampling points are generally sufficient.



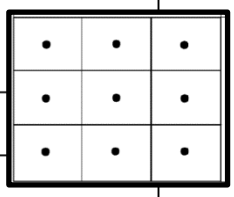
Minimum number of sampling lines and sampling points for rectangular stacks (extracted from EN15259 standard):

Range of sampling plane areas m^2	Minimum number of side divisions [a]	Minimum number of sampling points
< 0,1	–	1 [b]
0,1 to 1,0	2	4
1,1 to 2,0	3	9
> 2,0	≥ 3	at least 12 and 4 per m^2 [c]

[a] Other side divisions can be necessary, for example if the longest duct side length is more than twice the length of the shortest side (see C.3).

[b] Using only one sampling point can give rise to errors greater than those specified in this European Standard.

[c] For large ducts, 20 sampling points are generally sufficient.



It is highly recommended to perform an exploratory velocity traverse to verify the suitability of the location of the sampling plane before committing to a comprehensive installation. All new installations for licenced emission points shall be in compliance with the requirements of the I.S. EN 15259 standard.

For existing plants, the same requirements apply. However, there will be cases where due to physical, H&S, or economic restrictions, the required number of sampling lines/points cannot be provided. In such cases, the licensee shall contact the EPA where the issue will be assessed in a case-by-case basis.

For testing laboratories performing air emission monitoring at monitoring locations where the above requirements are not satisfied, the number of sampling points shall be increased beyond the above specified to compensate for the decrease in representativeness of the test. A monitoring deviation for this shall be included in the air monitoring report.

Having determined the required number of sampling lines, the working platform shall allow to safely manoeuvre the sampling equipment (probes). Large stacks require long probes to reach all sampling points within the sampling line, and therefore large monitoring platforms to carry out the monitoring. It is possible to reduce the minimum dimensions of the working platforms by installing additional ports:

- Circular ducts of diameter < 1.5m; two ports positioned on the same sample plane but separated by an angle of 90º.
- Circular ducts of diameter > 1.5m; four ports positioned on the same sample plane and separated by an angle of 90º.
- Rectangular ducts; the number of ports will depend on the size of the duct (2 to 4 for most ducts) and the ports should be equally spaced.

A regular 2m probe would reach all points in the sampling lines at small stacks

At larger stacks, 4 sampling ports would allow to use probes shorter than the diameter of the stack. Large probes (>3m) are difficult to transport and require larger working platforms to manoeuvre

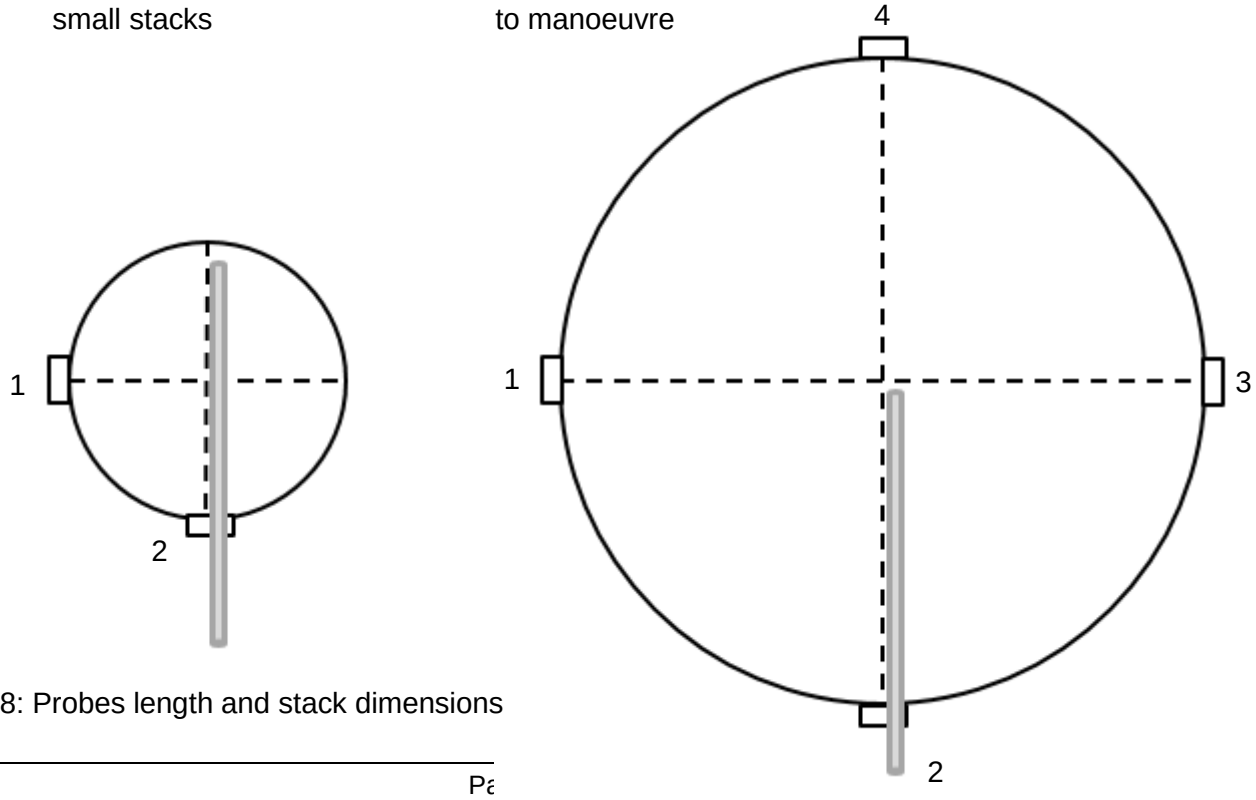


Figure 8: Probes length and stack dimensions

The size and design of sampling ports for the monitoring of particulates depend on the sampling probe to be used and these can vary with equipment manufacturer. Generally speaking, the recommended design for a sampling port is a 4-5-inch BSP parallel-threaded socket which should be welded to the duct wall, (cf: APPENDIX B)[f]. Sampling ports shall be properly capped when not in use.

It is recommended to chain the ports to a fixed structure (stack) to prevent falling object hazards. This is particularly relevant for hot stacks and platforms with gaps nearby the stack.

6.2 Gaseous pollutant measurement

Gases, unlike particulates, are not subject to momentum forces when moving in a gas stream. The following requirements should be met when installing sampling ports in stacks which are licensed for gaseous pollutants:

- Sampling ports must be downstream of any abatement equipment.
- The composition of the gas should be homogeneous across the area of the sampling plane (i.e. the waste gas should be thoroughly mixed[g]).
- The size of the sample port can be the same as that described for the velocity ports (cf: section 6.1).[h].
- The position of fans with regards the sampling ports will dictate if the stack is under positive pressure (gas escaping out through the ports) or negative pressure (surrounding air ingressing into the stack through the ports). Regardless of the position of the fan, ports shall be tightly capped during monitoring in order to prevent exposure to potentially hazardous gases (positive pressure) or to prevent dilution of the sample gas with the subsequent increase in O_2 concentration (negative pressure).
- Extreme negative pressure conditions may affect the suction performance of the monitoring equipment pumps, leading to underestimated results or monitoring failure.

Regardless if isokinetic or gaseous monitoring is carried out, monitoring in close proximity to the final exhaust would not provide representative monitoring, the following aspects are considered:

- The monitoring team may be exposed to the substances emitted through the stack;
- Turbulence at the exhaust, especially on windy days, would provide unsteady conditions for isokinetic monitoring;
- There is a risk of air ingress, especially on windy days, with the consequent dilution of the concentration of the tested parameters.

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[f] I.S. EN 15259 now recommended a 125 mm flange port (PM_{10} monitoring), the following link provides port design details: http://www.s-t-a.org/Files%20Public%20Area/MCERTS%20EA%20docs/Standard%20port.pdf.

Where PM10/2.5 monitoring is required, there may be a minimum requirement for a 6-inch BSP port in order to gain access with the dual cyclone sampling head [g] Section 8.3 of I.S. EN15259 has a procedure for determination of stratification within the duct.

[g] Section 8.3 of I.S. EN15259 has a procedure for determination of stratification within the duct.

[h] I.S. EN 15259 does not distinguish between the ports for gaseous and particulate measurement. All ports should be 125mm flanged opening and a number of ports are required to permit the segmented sampling across the sample plane, (i.e. as per isokinetic methods).

6.2.1 Homogeneity Test

A single port is usually sufficient for the collection of gas samples, however for certain processes and stack sizes, the determination of homogeneity is mandatory to confirm a valid sampling point or grid monitoring approach.

The homogeneity test shall be carried out for combustion processes where the stack has an area greater than $1m^2$ (1.13m diameter for circular stacks). The homogeneity test shall be carried out for each of the gaseous compounds with Emission Limit Values (ELV) in the licence, and Oxygen, using instrumental techniques as per the requirements in Section 8.3 of the I.S. EN 15259 standard. The homogeneity test is generally carried out only once per emission point at representative operational conditions, unless the stack is fully refurbished, abatement systems are installed/removed/changed, or the process fuel is changed (between gaseous, liquid or solid fuel, or a change from a single type of fuel to a mixture of more than one type of fuel).

The homogeneity test may be not practical for pollutants found in a very low concentrations (i.e. TVOC on waste incinerators) or when no instrumental techniques are available within the scope of accreditation of the testing laboratory. In those cases, surrogate parameters (i.e. O_2 instead of HN_3) can be used if agreed with the Agency. In general, heavier molecules (i.e.SO_2) provide more representative results for homogeneity tests than those with lighter molecular mass. Surrogates species should be generally heavier than the pollutant being surrogated.

The homogeneity test can be omitted if historical results data show an averaged concentration below 30% of the ELV, in those cases permission from the Agency shall be sought.

6.3 Monitoring from Biofilters

Air emissions monitoring from open biofilters may lead to incorrect results, if the monitoring facilities are not suitable for testing, as per the relevant air monitoring standards. In many occasions, there is no fixed stack to conduct monitoring, but a portable hood is used to carry out the tests. Such hoods do not provide representative locations for compliance monitoring.

Ideally, biofilters should be contained in enclosures where the abated gases are extracted from a single duct or stack at the top, to allow tests to be carried as per the relevant air monitoring standards (i.e. flow or ammonia monitoring). Sampling ports and sampling points requirements in Sections 6.1 and 6.2 shall apply to biofilters monitoring.

Where due to physical, H&S or economic reasons, the biofilters cannot be enclosed, a permanent fixed stack at a representative location shall be provided to conduct monitoring, as per the relevant air monitoring standards.

7 EPA independent monitoring

Contractors employed by the EPA to carry out its programme of independent monitoring are required, as part of the Agency's contractor quality assurance arrangements, to be accredited to ISO17025 for manual stack emission testing[i]. Any stack testers who are interested in attaining the relevant accreditation should contact INAB for more detailed information as to how this can be achieved.

The EPA requires its contractors to complete a reconnaissance visit, at all sites where the contractor is to carry out monitoring for the first time. Reconnaissance visits are announced and carried out on a date agreed with the licensee.

After the reconnaissance visit a report is issued to the EPA. Following proper revision, the report is submitted to the licensee and it may include control measures and recommendation to be implemented, aiming compliance with the relevant monitoring standards requirements and therefore with this guidance and the licence.

Where circumstances exist that would present an unacceptable risk to the contractor's staff when carrying out monitoring then the EPA will employ its powers under the licence condition to effect the necessary improvements before work begins.

Licensees who follow this guidance note should reduce the number of adverse findings reported to the EPA following reconnaissance visits.

7.1 Authorised persons

The licensee should ensure that all relevant personnel are aware of the powers of Authorised Persons under Section 13 of the EPA Act 1992, as amended by the Protection of the Environment Act, 2003. These powers would also apply to those contractors who have been appointed as an authorised person by the Board of the Agency, and thus provide for prompt access to the EPA's contractor personnel when they call to the site. Site security and reception staff should be informed of arrangements for allowing the EPA's contractor personnel access to sampling locations, in order to avoid site access delays. Where necessary, the EPA's contractor personnel should be accompanied by a designated staff member, and both site security and reception staff should be aware of who the appropriate designated staff member is. If the designated staff member is absent, alternative arrangements must be in place and communicated to both site security and reception.

[i] CEN/TS 15675:2007-10: Air quality – Measurement of stationary source emissions –Application of EN ISO/IEC 17025:2017 to periodic measurements.

APPENDIX A

Checklist to establish suitability of an emission point for sampling

This sheet should be copied and completed for each licensed air emission point on site.

Name of emission point _____ Licensed emission reference number _____

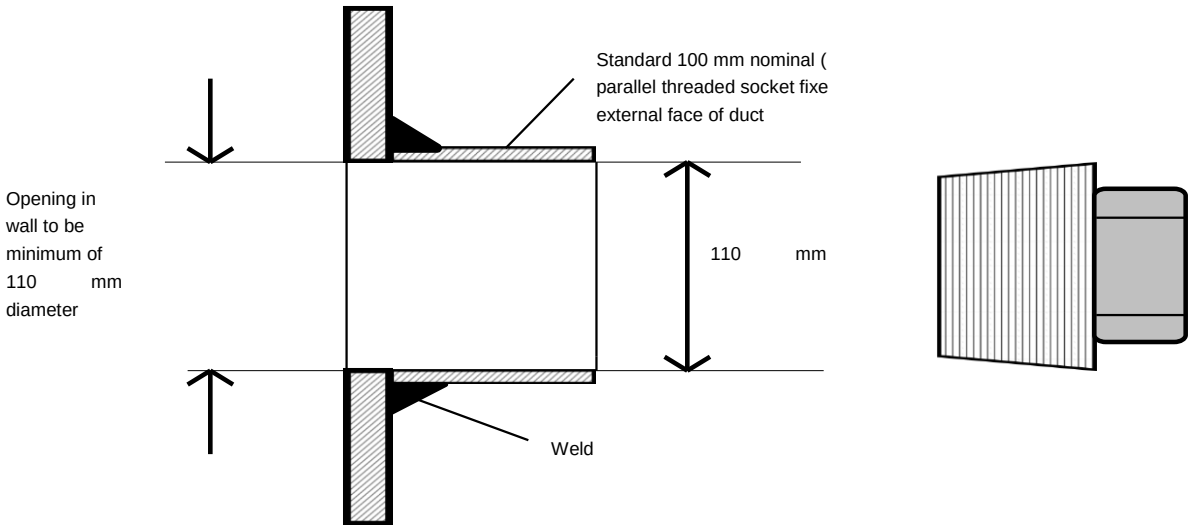
CONDITION REQUIRING VERIFICATION	**Report (including action to be taken if appropriate)**
Does the emission point have an associated ELV for isokinetic parameters or volumetric flow. If so, are the requirements of section 6.1 of guidance note satisfied. (1). Port downstream of abatement (2). Sampling plane 5 diameters downstream and 2 diameters upstream of obstruction (3). 2 ports @ 90^{o} in circular duct; multiple ports in rectangular duct (4). 4-5 inch BSP parallel-threaded socket, capped when not in use	
Does the emission point have an associated ELV for one or more gaseous substances. If so, are the requirements of section 6.2 satisfied.	
Is there suitable and safe access to the sampling point, (cf: section 5.2)	
Are utilities provided, (cf: section 5.2 and 5.5)	
Is the emission point properly labelled, (cf: section 5.6)	
Are arrangements in place for a company safety representative to be available before monitoring begins, (cf: section 5.7)	
Are arrangements in place for a designated person to be available during the course of monitoring, (cf: section 5.7)	

Signed: _____ Date: _____

APPENDIX B

Typical sampling ports and fittings

Note: The drawings below describe the type of ports that should be in place at both existing and new plants



(a) A particulate sampling port fixed to a metal duct wall, plug fitting also shown.

Additional notes on installation of sockets

1. Steel BSP sockets and plugs are widely available from suppliers of industrial pipeline fittings.
2. The diagrams above show sockets which are welded to the outside surface of a narrow gauge metal duct. Other arrangements may be used in ducts where the wall thickness is greater, (e.g. a hole can be cut in the duct wall to suit the external diameter of the socket fitting, and the socket can be secured within the hole).
3. The opening in the duct wall must be free from weld flashes or other obstructions which would reduce the effective diameter of the opening. The fitted socket should not protrude into the duct

References

[i] *I.S. EN 15259:2007 Air Quality – Measurement of stationary source emissions – Requirements for measurement sections and sites and for the measurement objective, plan and report.*

[ii] *ISO 10780 1994 (E), Stationary source emissions- Measurement of velocity and volume flow of gas streams in ducts*

[iii] Health and Safety Authority, Guide to the Safety, Health and Welfare at Work (General Application) Regulations 2007. Part 4: Work at Height

[iv] The Institution of Electrical Engineers Code of Practice for In-service Inspection and Testing of Electrical Equipment.