# UKETS04 MRR – Data flow activities and control system

July 2025

**Note**

**This document is intended to provide guidance for operators of installations. If there is any inconsistency between the guidance and legislation, the legislation prevails.**



Any enquiries regarding this publication should be sent to us at:
emissions.trading@energysecurity.gov.uk

# Contents


1. Overview 5
2. Context of the monitoring plan 6
   2.1. Monitoring plan and written procedures 6
   2.2 Data flow activities 6
   2.3 Control system 6
   2.4 Implications for design of a monitoring plan 7
   2.5 Installations with low emissions 7
   2.6 Small emitters (aircraft operators) 8
3 Data flow activities 9
   3.1 The example 9
   3.2 Data flow diagram 10
   3.3 Task list 12
   3.4 Written procedures 12
   3.5 Check lists and incidents triggering activities 15
4 Risk Assessment 17
   4.1 Introduction – definitions 17
   4.2 What is to be assessed 18
   4.3 Steps to perform in a risk assessment 19
      4.3.1 Probability 20
      4.3.2 Impact 20
      4.3.3 Risk 21
      4.3.4 Assessment of inherent risk 21
   4.4 Control activities 22
   4.5 Result of the risk assessment – final data flow 23
   4.6 Risk assessment tool 25
5 The control system 26
   5.1 Measurement equipment 26
   5.2 Information technology systems 27

5.3 Segregation of duties 27
5.4 Internal reviews and validation of data 27
5.5 Corrections and corrective action 27
5.6 Out-sourced processes 28
5.7 Record keeping and documentation 28
6 A detailed example 29
6.1 Information about the example installation 29
6.2. Data flow and control activities 29
6.2.1. General considerations 29
6.2.2. Examples for control measures lowering the probability of an incident 29
6.2.3. Examples for control measures lowering the impact of an incident 30
6.2.4. Examples for control measures lowering both the probability and the impact of an incident 30
6.3. Full exemplar risk assessment 32
Annex I: Further examples of control activities 37

# 1. Overview

This guidance is for operators of installations and aircraft operators and covers the options for describing data flow activities for monitoring in the UK ETS, the risk assessment as part of the control system, and examples of control activities. The relevant legislation in this area is:

- **the Greenhouse Gas Emissions Trading Scheme Order 2020** (**The Order**) (https://www.legislation.gov.uk/uksi/2020/1265/contents) as amended from time to time
- **the Monitoring and Reporting Regulation (MRR)** (Commission Implementing Regulation (EU) 2018/2066 of 19 December 2018 on the monitoring and reporting of greenhouse gas emissions pursuant to Directive 2003/87/EC of the European Parliament and of the Council (disregarding any amendments adopted after 11 November 2020) as given effect for the purpose of the UK ETS by article 24 of the Order, subject to the modifications made for that purpose from time to time
- **the Free Allocation Regulation (FAR)** (Commission Delegated Regulation (EU) 2019/331 of 19 December 2018) as it has forms part of domestic law as amended from time to time
- **the Verification Regulation (VR)** (Commission Implementing Regulation (EU) 2018/2067 of 19 December 2018 on the verification of data and on the accreditation of verifiers pursuant to Directive 2003/87/EC of the European Parliament and of the Council (disregarding any amendments adopted after 11 November 2020), as given effect for the purpose of the UK ETS by article 25 of the Order, subject to the modifications made for that purpose from time to time

# 2. Context of the monitoring plan

## 2.1. Monitoring plan and written procedures

The monitoring plan (MP) of an installation or aircraft operator is at the core of the monitoring, reporting and verification (MRV) system of the UK ETS. The MP is supplemented by “written procedures”, which the operator or aircraft operator establishes, documents, implements, and maintains for activities under the MP, as appropriate. They must be described in the MP in sufficient level of detail that the regulator and the verifier can understand the content of the procedure and can reasonably assume that a full documentation of the procedure is maintained and implemented by the operator or aircraft operator. The operator must supply a copy of the procedure to the regulator/verifier upon request (see section 4.5 of guidance document ‘UKETS01 MRR – General guidance for installations’).

## 2.2 Data flow activities

Monitoring of emissions data is more than just reading instruments or carrying out chemical analyses. It is of utmost importance to ensure that data are produced, collected, processed and stored in a controlled way. Therefore, the operator or aircraft operator must define instructions for “who takes data from where and does what with the data”. These “data flow activities” (Article 58 of the MRR) form part of the monitoring plan (or are laid down in written procedures, see section 3.4), where appropriate. A data flow diagram (see section 3.2) is often a useful tool for assessing and/or setting up data flow procedures. Examples for data flow activities include reading from instruments, sending samples to the laboratory and receiving the results, aggregating data, calculating the emissions from various parameters, and storing all relevant information for later use.

## 2.3 Control system

As human beings (and often different information technology systems) are involved, mistakes in these activities can be expected. The MRR therefore requires operators and aircraft operators to establish an effective control system (Article 59 of the MRR). This consists of two elements:

- A risk assessment (see chapter 4), and
- Control activities (see section 4.4) for mitigating the risks identified.

## 2.4 Implications for design of a monitoring plan

The design of a monitoring plan is an iterative process (see also section 4.1 of 'UKETS01 MRR – General guidance for installations'). First, the operator or aircraft operator identifies the data sources and calculation and/or measurement activities. They then create the data flow providing a logical sequence of data collection and processing steps. Next, they will assess the risks associated with this data flow and set up appropriate control activities for mitigating the identified risks. In this context, "risk" is always related to errors, misrepresentations and omissions in the monitoring data (for details see chapter 4). Finally, they must assess the risks (now mitigated) once more to determine if the control measures will be effective and properly applied. If the result is not satisfactory, they will have to return to the step of developing the control activities. However, it might even be necessary to go back to the early steps of selecting more appropriate data sources, or to rearranging the data flow in a sequence which is less prone to errors.

The result of this exercise should be a monitoring plan (and the associated procedures) that contains:

- a well-defined data flow (documented in data flow procedures and a data flow diagram, if relevant),
- a set of control activities (which may be described together with the data flow activities) and
- a final risk assessment which demonstrates that the remaining risk for errors, misrepresentations or omissions is reduced to an acceptable low level.

The control activities are laid down in written procedures and referenced in the monitoring plan. The results of the final risk assessment are submitted as supporting documentation to the competent authority when approval of the monitoring plan is requested by the operator or aircraft operator.

## 2.5 Installations with low emissions

Article 47(3) exempts operators of installations with low emissions (see section 3.4.2 of 'UKETS01 MRR – General guidance for installations') from submitting a risk assessment when submitting the monitoring plan for approval by the regulator. However, operators will still find it useful to carry out a risk assessment for their own purposes. It has the advantage of reducing the risk of under-reporting, under-surrender of allowances and consequential penalties, and over-reporting and over-surrender.

## 2.6 Small emitters (aircraft operators)

The same as said for installation with low emissions applies to aircraft operators who are classified as "small emitters" and who intend to use Eurocontrol's small emitter tool[1]. Article 55(3) of the MRR exempts them from submitting a risk assessment when submitting the monitoring plan for approval by the regulator. However, aircraft operators will still find it useful to carry out a risk assessment for their own purposes, for the same reasons given for installations.

[1] https://www.eurocontrol.int/tool/small-emitters-tool

# 3 Data flow activities

The data needed for an annual emissions report may be generated in different departments of a company (laboratory, HSEQ managers, shift managers in production, financial department for invoices, etc.) and may occur at different timescales (e.g. some fuels may only be delivered every few months, other data may be collected daily, other data may be continuously measured). To prevent data gaps or double counting, the data flow must be well designed. The MRR takes this into account when it requires written procedures for the data flow activities. As stated in the previous chapter, they serve as instructions for "who takes data from where and does what with it".

Data flows can be described in writing in different forms. The MRR does not require any specific template to be used. For simple data flows a few words may be sufficient, while in complex cases a data flow diagram will be indispensable. Furthermore, detailed checklists for each department involved, and training materials for staff may need to be developed. This guidance paper only gives examples for how data flows can be described.

## 3.1 The example

This guidance will describe the data flow, risk assessment and control system of a very simple category A installation:

- natural gas is the only source stream
- the standard calculation approach is used (see section 3.3.1 of guidance document 'UKETS01 MRR – General guidance for installations')
- activity data (AD), i.e. volume of gas purchased, is taken from monthly invoices
- emission factor (EF) and net calorific value (NCV) are taken from national inventories, the oxidation factor (OF) is 1.

The formula for calculation is Em = AD × EF × NCV × OF

Note: For such simple installations it will usually *not* be necessary to develop a data flow diagram or a detailed risk assessment such as presented below. However, a simple example has been chosen for easier discussion of the concepts. A more complex example can be found in Annex I.

## 3.2 Data flow diagram

There are several ways of describing a data flow. The common element is that the logical flow or temporal sequence of data collection or processing steps is shown along the main axis. The diagram may be organised with each department or role as separate column, or as in the example here, with the responsibilities given for each step.

The example format used for Figure 1 places the activity into the centre, with the input for each process on the left hand and the output of each step on the right side.

Each activity is described by:

- what is to be done? (Name of the process step)
- who is responsible? (Department or post)
- when is it to be done? (By a certain deadline, or regularly every x interval)

Inputs are described by:

- which data?
- where is it found? (Reading from an instrument or document, copied from an IT system, etc.)

Outputs are described by:

- which data?
- where is it stored? (Electronically and/or hardcopy? How can it be found again?)

Figure 1 shows the data flow diagram for the example installation described in section 3.1, using the described level of detail.

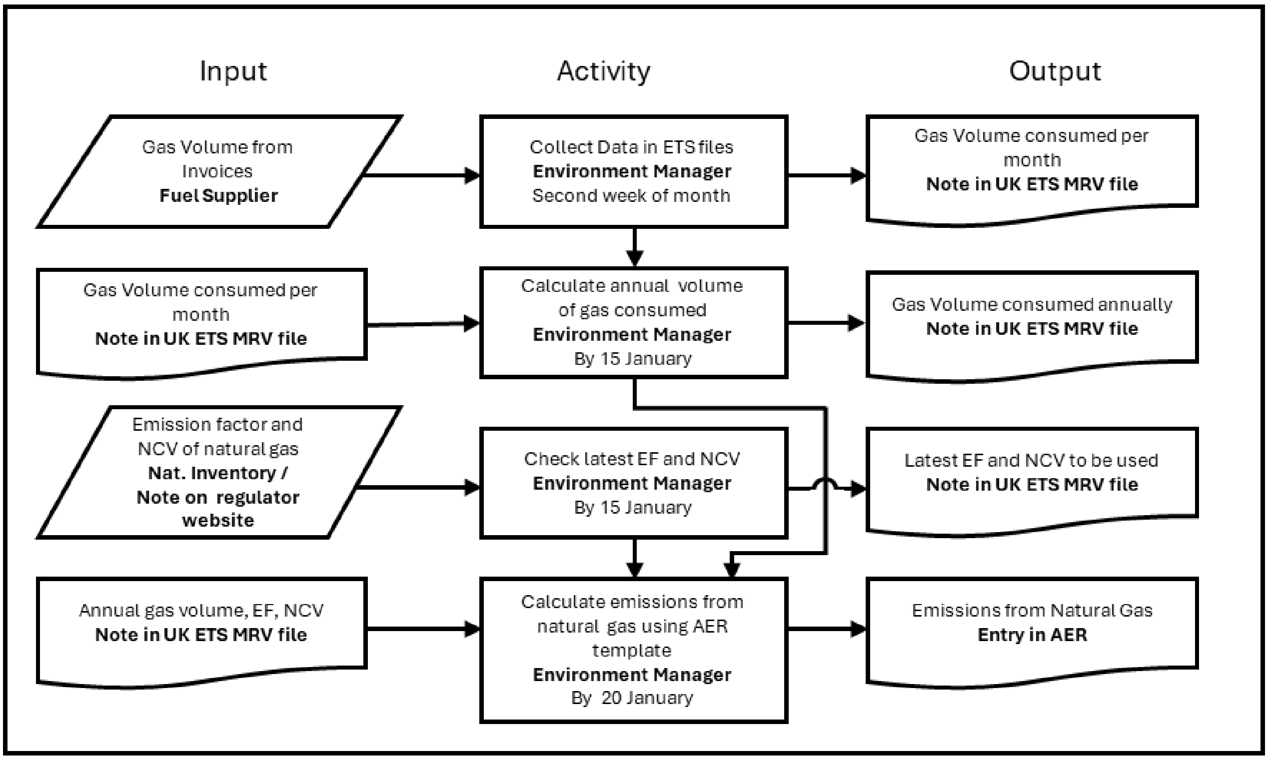



**Figure 1: Data flow diagram for the example installation described in section 3.1.**

Note: For some activities it might not be obvious what the output is and how to store it. In everyday life an activity may be for example “check if all invoices are in the dedicated file”. The output of a successful check might be “no findings”, and if an invoice is found to be missing, the output might be “look for the invoice”. However, these two reactions would be undocumented results. The verifier would not be able to judge whether the activity has been carried out at all. In a written data flow, it is better to have as a note as an output note saying, “Person A has checked on date X. and the result was OK/not OK and followed up”.

If there doubt as to whether a piece of information is important, it is always better to put it in written form and do so “immediately”. This may range from a paper notebook which may serve as a “logbook”, separate papers and notes collected in a file, or a central spreadsheet for collecting notes to a dedicated IT system. Where an operator or aircraft operator adheres to this principle of “write down everything”, outputs of activities are clearly defined. This helps to create the transparency which makes verification easier, which in turn helps to reduce costs.

## 3.3 Task list

Another tool for establishing a data flow is to write down a task lists for the different departments/posts, indicating again “who has to do what when and how”, and where to store data thereafter.

In complex installations or aircraft operators, usually a data flow diagram will be developed first, and the task list will then be used to translate the diagram into instructions for staff training, which may also serve as check list throughout the monitoring period. In simpler cases (such as in the example of section 3.1), it may be enough to have a task list without a data flow diagram as seen in Table 1 below.

**Table 1: Task list for the example installation in section 3.1**

| Who? | Task | When? | Action required |
|---|---|---|---|
| Accounts department | | | |
| | 1 | Each time a payment for a fuel invoice is booked | Send (electronically) a copy of the invoice to environment manager |
| Environment manager | | | |
| | 2 | When a fuel invoice is received | Store copy in the ETS folder (hardcopy and electronically) |
| | 3 | By every 15 January (or nearest working day) | Check CA website for latest EF and NCV default values |
| | 4 | Same date as task 3 | Calculate gas volume consumed in previous calendar year (i.e. year to be reported) |
| | 5 | When tasks 3 and 4 are complete | Calculate the annual emissions using the formula laid down in the data flow procedure attached to the MP |

## 3.4 Written procedures

Activities which are too complex to be described in a simple task list should be described in the form of written procedures (see Article 12(2) of MRR and section 4.4 of UKETS01). Table 2 shows an example for a typical data flow procedure. It should be noted once more that this is a simple example used for illustration purposes only. A simple data flow as described here may not need a fully elaborated procedure.

Table 3 shows an example of the description of a written procedure as required in the monitoring plan for a more complex data flow. This description should be supplemented by a more elaborated written procedure separately from the monitoring plan.

**Table 2: Example related to data flow: Description of a written procedure as required in the monitoring plan.**

| Item according to Article 12(2) of MRR | Possible content (examples) |
|---|---|
| Title of the procedure | Calculate annual emissions |
| Traceable and verifiable reference for identification of the procedure | EmCalc |
| Post or department responsible for implementing the procedure and the post or department responsible for the management of the related data (if different) | Environment Manager |
| Brief description of the procedure[2] | • Check that the necessary data is available and complete<br>• Perform calculation (see "processing steps" below)<br>• Store result for finalising annual report and verification |
| Location of relevant records and information | Hardcopy: HSEQ Office, shelf 27/9, folder identified as "ETS 01-Rep".<br>Electronically: "P:\ETS_MRV\manag\ETS_01-Rep.xls" |
| Name of the computerised system used, where applicable | N/A (Normal network drives) |
| List of EN standards or other standards applied, where relevant | N/A |
| List of primary data sources | Output from previous procedure:<br>• Annual volume of gas consumed (based on invoices)<br>• Calculation factors (from regulator website) |

[2] This description is required to be sufficiently clear to allow the operator, the regulator and the verifier to understand the essential parameters and operations performed.

| | |
|---|---|
| Description of the relevant processing steps for each specific data flow activity | • Check if the necessary data is available and complete (see "primary data sources")<br>• Check if new version of reporting template is available<br>• Enter data in latest version of the reporting template<br>• If template is new, compare result to own calculation based on formula:<br>$Em = NCV \times EF \times \sum FQ_{invoices}$<br>• Note down the result calculated by the template in the ETS folder |

**Table 3: More complex example for a description of a procedure.**

Here the amount of cement clinker produced is determined based on the cement sales figures, because there is no direct weighing possibility for clinker or raw meal in the installation.

| Item according to Article 12(2) of MRR | Possible content (examples) |
|---|---|
| Title of the procedure | Calculation of clinker |
| Traceable and verifiable reference for identification of the procedure | ClinkerCalc. V.1 |
| Post or department responsible for implementing the procedure and the post or department responsible for the management of the related data (if different) | Management of the procedure: Environment Manager<br>• Data contributions (monthly collections):<br>• Sales department: Weighing slips of trucks loaded with cement<br>• Packaging unit manager: production protocols which indicate mass and type of cement packed<br>• Grinding plant manager: clinker factors for each cement type |
| Brief description of the procedure | • Environment manager collects data from the persons listed under "data contribution"<br>• Using the formulae laid down in the main text of this procedure, the clinker mass is |

| | |
|---|---|
| | calculated from clinker factor and cement mass<br>• A data flow diagram is also contained in the main body of the procedure |
| Location of relevant records and information | Hardcopy: ……….<br>Electronically: ………… |
| Name of the computerised system used, where applicable | ………… |
| List of EN standards or other standards applied, where relevant | N/A |
| List of primary data sources | Weighing slips of trucks: Truck scale TS003<br>Weight of big bags: Scale BB342<br>Consumer size packages: Pallets are counted[3] by packaging unit manager |
| Description of the relevant processing steps for each specific data flow activity | *[Here the detailed calculation should be described, indicating where the input and output data is stored, how data gaps are treated, etc.]* |

## 3.5 Check lists and incidents triggering activities

In many cases it will be beneficial to establish data flow activities for carrying out regular or spot checks for diverse issues. These checks will usually trigger another activity. For example, the procedure could be "have all samples of material XY for the current month been sent to the laboratory?" The result "No" would trigger the activity "collect the remaining samples, take further samples (if necessary), mark them clearly and send them to the laboratory".

Examples:

- monthly check for completeness of source streams
- completeness of samples and analyses results for each batch of fuel
- for each measurement instrument:

[3] In this example the weight of each bag is determined by a balance under national legal metrological control, but no individual weighing slips are available.

- when has it to be calibrated?
- has the scheduled calibration been performed?
- have all relevant maintenance activities been carried out?
- are necessary replacement parts in stock?

Note: these checks with their deadlines should be included in the relevant task lists.

Furthermore, there will be many activities which are not dependent on a check by the operator or aircraft operator, but which must be initiated if a certain event occurs. An example of such a useful procedure could be “when a truckload of biomass material [ABC] is delivered, the responsible person should ensure that they request proof that the material meets the required sustainability criteria (where sustainability criteria are relevant).”[4]

Those “incident triggered procedures” cannot be included in task lists with a certain date. Therefore, it is important that all staff involved receive regular training and are made aware that they are responsible for initiating these procedures. The first activity in such a procedure (started as consequence of the triggering event) should always be “make a note to the file: What happened, who was in charge, what was the next step (who was informed, which data has been noted down, e.g. weight of the truck, etc.)”.

Note: Data flow activities of this type may often need a close link to control procedures, or some may be considered control activities themselves (see section 4.4).

[4] For details on sustainability criteria for biomass see guidance document ‘UKETS03 MRR - Reporting biomass in installations’.

# 4 Risk Assessment

## 4.1 Introduction – definitions

"*Risk*" (*R*) is a parameter which accounts for both the *probability* (*P*) of an incident and its *impact* (*I*). In terms of emissions monitoring, the risk refers to the probability of a misstatement (omission, misrepresentation or error) being made, and its impact in terms of the annual emissions figure. Simply put, it can be said that $R = P \times I$. Therefore, if either the probability or the impact is high, the risk will be high as well, unless the other parameter is very low. Where both probability and impact are high, the risk will be very high.

The higher the risk identified by the operator or aircraft operator, the greater importance on implementing an effective control measure for mitigating the risk.

In the context of the monitoring, reporting and verification (MRV) of greenhouse gas emissions, the definitions as given in Article 3(1) and (16) to (18) of the VR[5] are the most appropriate ones:

- **inherent risk** (IR) means the susceptibility of a parameter in the operator's or aircraft operator's report to misstatements that could be material, individually or when aggregated with other misstatements, before taking into consideration the effect of any related control activities.
- **control risk** (*CR*) means the susceptibility of a parameter in the operator's or aircraft operator's report to misstatements that could be material, individually or when aggregated with other misstatements, and that will not be prevented or detected and corrected on a timely basis by the control system.
- **detection risk** (*DR*) means the risk that the verifier does not detect a material misstatement.
- **verification risk** (*VR*) means the risk, being a function of inherent risk, control risk and detection risk, that the verifier expresses an inappropriate verification opinion when the operator's or aircraft operator's report is not free of material misstatements.

In simpler language this means: The inherent risk mirrors the fact that MRV is carried out by human beings, and that therefore errors can simply happen. The control risk reflects

[5] The MRR (Article 3(9) and (10) uses the same definitions. However, the definitions of detection risk and verification risk are only found in the VR.

the quality of the control system. The more effective the operator's or aircraft operator's control system is, the lower is the control risk, i.e. the likeliness for a failure to prevent errors. Similarly, the detection risk gives an indication for the possibility that a verifier may fail to detect the one or other misstatement which has slipped through the control system. Finally, the overall verification risk is the overall result of the first three. It can be described as $VR = IR \times CR \times DR$.

The verifier must strive to reduce VR as much as possible. However, from the operator's or aircraft operator's view, it is only the two factors *IR* and *CR* which give his overall risk:

The inherent risk is to be reduced as much as possible by choosing robust data sources and short and simple communication paths. The control risk is minimised by setting up effective control activities.

## 4.2 What is to be assessed

In principle the operator or aircraft operator should carry out the risk assessment for the whole data flow from obtaining primary data from measurement instruments to the final annual emissions report or tonne-kilometre report, including document management and storage of data. However, common sense suggests that reasonably a threshold for the overall risk should be used. Data flow activities for which the associated risk can reasonably be expected to be below this threshold, may be left out from the assessment.

An example for setting the threshold may be to set the impact to half the materiality level[6] of the installation or aircraft operator, or more conservatively to e.g. 20% of the materiality level. The probability threshold should be "less than once per year", or even lower for being on the safe side.

Each data source, data handling or processing step should be assessed against "what can go wrong". For example, if natural gas is metered, the gas meter itself as well as the temperature/pressure compensation can break down; they can fail only for a short period (if they need electricity for operation); they can be inaccurate (due to a lack of or inaccurate calibration); the data transmission (if electronic) can fail; the meter can be read inaccurately; readings can be noted down with typos; notes scribbled on paper can be lost (if the meter is read manually); the flow rate to be measured or any ambient conditions can be outside the specifications of the meter; the software for data collection can contain bugs; hard disks for storage can crash, etc. Even this simple example

[6] Article 23 of the VR: The materiality level is 5% of the total annual emissions for category A and B installations, and aircraft operators emitting up to 500,000 tonnes $CO_2$ per year, and 2% for other installations and aircraft operators. For tonne-kilometre data, the level is 5%. Note that materiality level is a value used for planning and performing a verification. It is by no means a threshold for an "acceptable" error (see Article 22(2) of the VR: "The operator or aircraft operator shall correct any communicated misstatements or non-conformities").

illustrates the high number of possible risks and provides a rationale for the need for a threshold. Table 4 gives another example for a list of possible risks to be assessed.

**Table 4: Example for risks associated to a flow meter with electronic data logger.**

| Data Flow Step | Inherent risk | Data inaccuracy | Data Loss |
|---|---|---|---|
| 1. Meter measures flow rate | Flow is outside calibrated range | ✓ | |
| | Ambient temperature is outside operational range | ✓ | |
| | Meter failure | ✓ | ✓ |
| | Time since last calibration greater than specification | ✓ | |
| 2. Data logger records flow rate and time data received | Break in data transmission | | ✓ |
| | Interference in data transmission | ✓ | ✓ |
| | Data logger fault | ✓ | ✓ |
| 3. At the start of the shift the operator reads the digital display | Display fault | | ✓ |
| | Operator fails to read display | | ✓ |
| | Operator misreads display | ✓ | |
| 4. The operator records the digital display reading in the logbook | Operator mis-records reading | ✓ | |
| | Damage to logbook | | ✓ |

## 4.3 Steps to perform in a risk assessment

When the operator or aircraft operator carries out a risk assessment, they analyse (e.g. by using an appropriate table format) each point in the data flow for each possible incident (see section 4.2) the following points:

1. Type of incident: What can go wrong?
2. Probability: How likely is it to happen? (section 4.3.1)

3. Impact: How big would the error be (in terms of emissions / t-km)? (See section 4.3.2)

4. Risk resulting from probability and impact (section 4.3.3)

5. Appropriate control activity: How can the risk be mitigated? (See section 4.4)

6. Final (overall) risk remaining when the control activity is factored in.

The MRR requires operators and aircraft operators to lay down the steps to be performed when carrying out the risk assessment in a written procedure.

### 4.3.1 Probability

It is usually not necessary to determine exact quantitative values for the probability of an incident. It is common practice to use semi-quantitative such as “happens very often” to “happens almost never”. Depending on the complexity of the installation or the aircraft operator’s activities it is useful to define e.g. three or five probability levels. An example is given in Table 5.

**Table 5: Example for definitions of five probability levels to be used in an UK ETS risk assessment.**

| | |
|---|---|
| Very low | Unlikely to occur more than once per year |
| Low | May occur up to 4 times per year |
| Moderate | May occur up to 12 times per year |
| High | May occur up to 24 times per year |
| Very high | May occur more than 24 times per year |

### 4.3.2 Impact

Similar to probability, a semi-quantitative value should be defined for the impact of an incident as appropriate for the circumstances of the individual installation or aircraft operator. Useful threshold definitions refer either to absolute emission figures, or to percentages of the whole installation’s or aircraft operator’s emissions. Percentages of the materiality threshold might also be considered. Table 6 shows an example referring to absolute emissions (referring to the example of section 3.1, which is a category A installation).

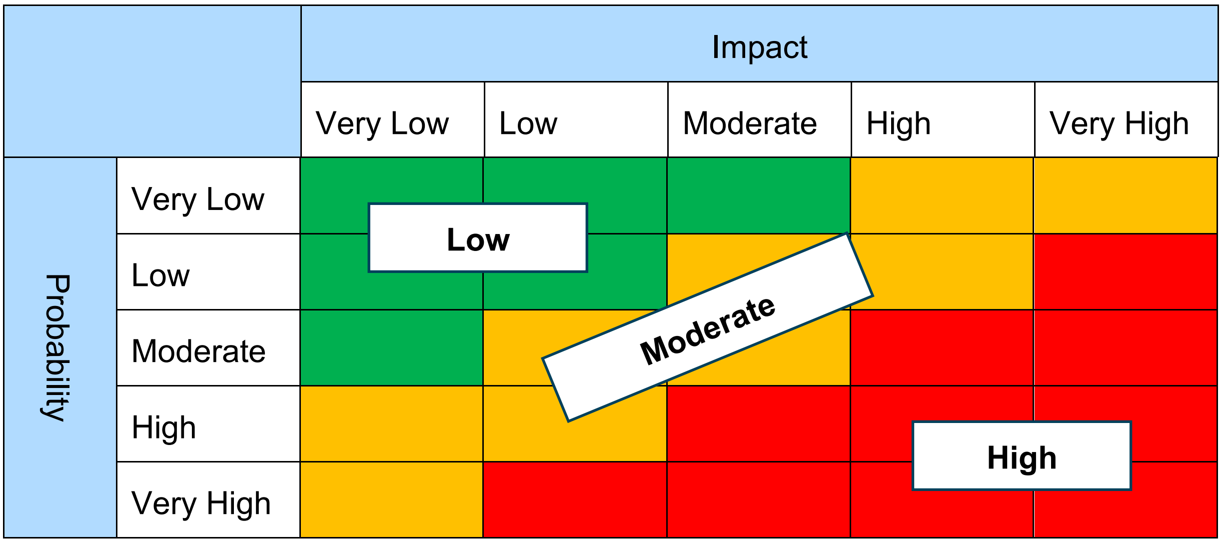
**Table 6: Example for definitions of five impact levels to be used in an UK ETS risk assessment of the sample installation in section 3.1.**

| | |
|---|---|
| Very low | No noticeable effect on measured parameter |
| Low | Effect leads to misstatement of max. ±50 tonnes CO2(e) |
| Moderate | Effect leads to misstatement of max. ±250 tonnes CO2(e) |
| High | Effect leads to misstatement of max. ±500 tonnes CO2(e) |
| Very high | Effect leads to misstatement of more than ±500 tonnes CO2(e) |

### 4.3.3 Risk

Before the operator or aircraft operator can assess the risk for each potential incident, a combination of the two scales from the previous steps is to be defined. Table 7 shows an example.

**Table 7: Example for definitions of five impact levels to be used in an UK ETS risk assessment.**




### 4.3.4 Assessment of inherent risk

Using the scales developed under the three previous steps, the operator or aircraft operator can now assign the values for probability, impact and risk for each possible incident. As these risks are not yet mitigated, they represent the “inherent risk”. Table 8 gives some examples for such assessment referring to the example installation described in section 3.1. In this table also examples for proposed risk mitigation measures (control activities) and the expected overall risk (i.e. with application of the control activity) are shown.

A simple overview such as in this table is expected to satisfy the requirements of Article 12(1)(b) of the MRR (supporting document to be submitted to the regulator with the monitoring plan).

**Table 8: Example for the risk assessment for a few possible incidents for the example installation in section 3.1.**

| Incident | Probability | Impact | Inherent risk | Control activity | Overall risk |
|---|---|---|---|---|---|
| Gas invoice is wrong | moderate | high | high | Compare with own reading | Low |
| Meter breakdown | Very low | high | moderate | Fuel supplier contract contains fast repair clause | Low |
| Missed inclusion of new source stream | Very low | Very high | moderate | None, because unlikely | moderate |

## 4.4 Control activities

After the operator or aircraft operator has assessed the risks associated with their data flow, the second part of the control system must be established, i.e. the control activities. As mentioned in chapter 2 this may be an iterative process i.e. data flow procedures, the associated risks, the control activities and the resulting overall risk are mutually influencing each other. Various types of controls may be assessed for effectiveness before choosing the best one.

The control activities are laid down in written procedures. As mentioned earlier, they may sometimes be tightly linked with the data flow procedures.

**Examples**

Some examples for control activities are included in Table 8 above. For the example installation described in section 3.1 the following controls might be helpful:

- the operator should carry out their own readings of the gas meter regularly, particularly on 1 January every year.

- their own readings are used to corroborate the values found on the invoices of the gas supplier.
- the 4-eyes principle should be applied at least on the overall annual emissions report (analogous to the independent review of the verifier).

Further example control activities that will enable operators to comply with Articles 60 to 67 of the MRR can be found in Annex I.

## 4.5 Result of the risk assessment – final data flow

As a next and final step, the control activities are included in the data flow diagram and the associated procedures, check lists etc. The risk assessment is finalised using the overall risks remaining after implementing the control activities. For illustration, the data flow diagram given in section 3.2 for the installation described in section 3.1 can then be updated as shown in Figure 2 below. The control activities outlined for the example in the previous section are included and shown in red.

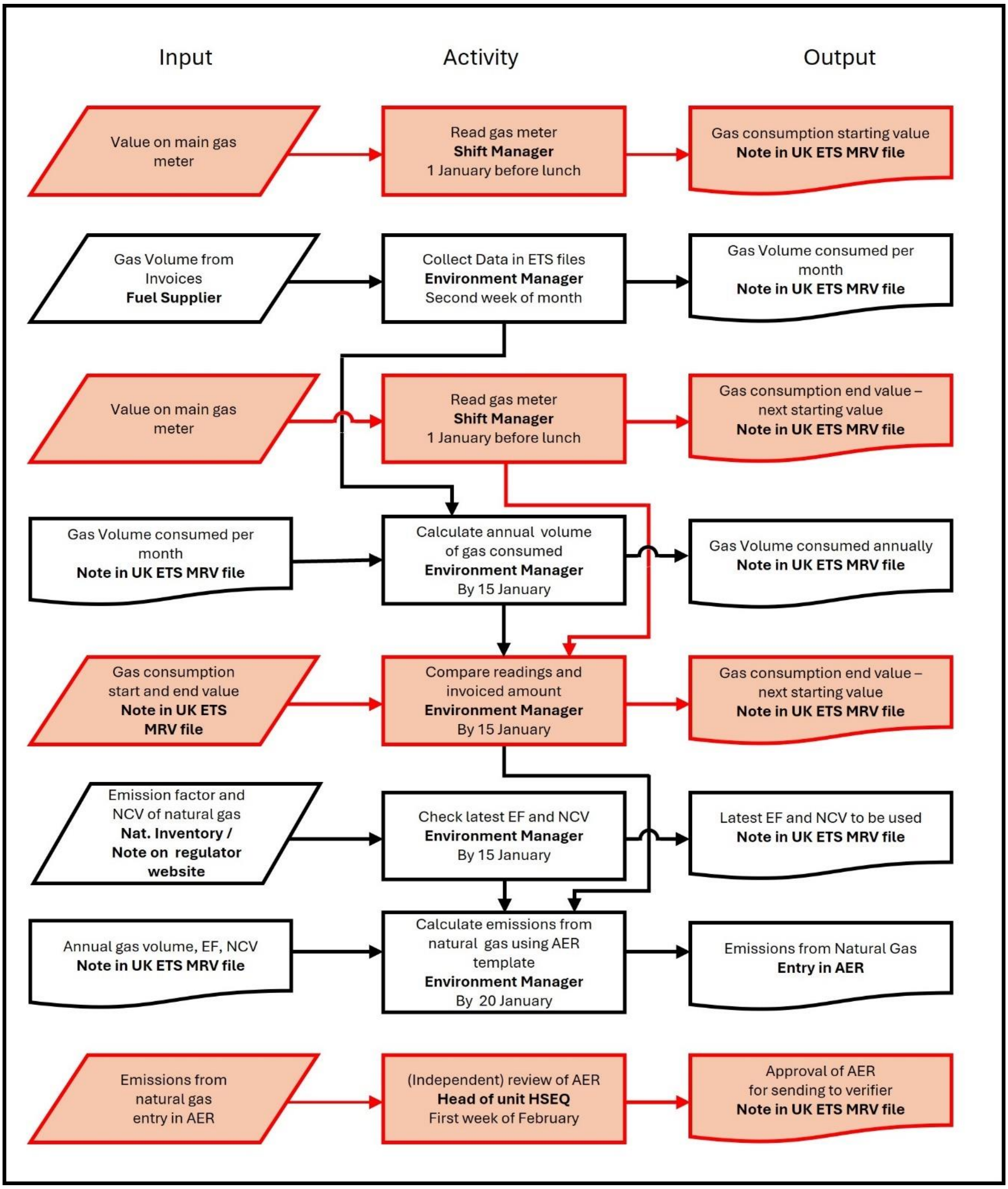



**Figure 2: Final data flow diagram for the installation described in section 3.1.**

The red elements are control activities as outlined in the section 4.4.

## 4.6 Risk assessment tool

To facilitate the development of the risk assessment, the European Commission website contains a risk assessment tool[7] for operators or aircraft operators. However, using the tool is optional. Alternative approaches may be used, where considered more useful.

Note that operators do not need to use the risk assessment tool provided by the EU Commission but can use an existing risk assessment mechanism, so long as it fulfils the requirements of a risk assessment for UK ETS purposes, as set out in this chapter.

---

[7] https://climate.ec.europa.eu/document/download/58ad2c9c-a916-4e00-8fa3-df651a4e859d_en?filename=tool_risk_assessment_en.xls

# 5 The control system

Article 59 of the MRR requires the operator or aircraft operator to establish an effective control system. This consists of two elements:

- a risk assessment (see chapter 4), and
- control activities (see section 4.4) for mitigating the risks identified.

In addition to what has been discussed in chapter 4, operators and aircraft operators should ensure that they cover at least the points listed in Article 59(3) of the MRR with their control system:

- quality assurance of the measurement equipment (see Article 60 of the MRR)
- quality assurance of the information technology system used for data flow activities, including process control computer technology (see Article 61)
- segregation of duties in the data flow activities and control activities, and management of necessary competencies (see Article 62)
- internal reviews and validation of data (see Article 63)
- corrections and corrective action (see Article 64)
- control of out-sourced processes (see Article 65)
- keeping records and documentation including the management of document versions (see Article 67).

In the following we give a very short overview to these requirements.

## 5.1 Measurement equipment

Article 60 “reminds” the operators and aircraft operators of what should be clear based on what the MRR requires under the tier approach. All relevant measuring instruments must be regularly calibrated, adjusted and checked as appropriate for their specifications or as required by national legal metrological control, if applicable (for further details see guidance document ‘UKETS02 MRR/FAR - Uncertainty assessments for installations’). Where continuous emission measurement systems (CEMS) are used, Article 59(2) of the MRR sets out the necessary requirements, particularly the application of EN 14181 for quality assurance.

## 5.2 Information technology systems

Article 61 of the MRR requires that information systems used for monitoring and reporting are appropriately designed, documented, tested, implemented, controlled and maintained. Control is to be particularly exerted regarding access to the systems, backups, recovery, continuity planning and security. IT systems include plant information, distributed control systems, measurement flow computers, etc.

## 5.3 Segregation of duties

In short, Article 62 of the MRR requires the four-eyes principle to be used as much as possible ensuring the competence of involved staff.

## 5.4 Internal reviews and validation of data

Operators and aircraft operators are required to regularly review the data collected throughout the year. This is intended to prevent situations where the verifier detects errors or data gaps very late in the process and corrective action is coming too late. Appropriate written procedures must be in place which lay down the types of checks to be carried out (comparison of data over time, comparing data from different sources where possible, plausibility checks of emissions data with production data, etc.). Article 63 of the MRR lists the minimum checks that need to be included. It also highlights that those control procedures shall, to the extent feasible, contain criteria or thresholds for rejecting data. The operator or aircraft operator must decide in advance about criteria which would lead to corrective action.

## 5.5 Corrections and corrective action

Article 64 of the MRR lays down requirements for operators and aircraft operators on how to react in case their internal reviews find data that must be rejected. In essence, the Article requires that any corrections of data must avoid an underestimation of emissions. Furthermore, the root cause for the malfunctioning or error must be determined. If relevant, the correction is to be accompanied by appropriate corrective action regarding the root cause of the error (e.g. replacement of a bad measurement instrument, use of another laboratory, improvement of control activities, etc.).

Note: Such corrective action may have an impact on the monitoring plan and/or its procedures. For the requirements regarding update of the monitoring plan please see section 4.6 of guidance document ‘UKETS01 MRR – general guidance for installations’ or ‘UK Emissions Trading Scheme for aviation: how to comply’.[8]

## 5.6 Out-sourced processes

Summarising Article 65 of the MRR, the operator or aircraft operator has the full responsibility for the efficient functioning of any data collection or processing steps which have been outsourced (such as external laboratory analyses, maintenance of measurement equipment, etc.). Thus, they must be included in the control system, particularly regarding the reviewing of results, setting criteria for the efficient functioning and for initiating appropriate corrective action if needed. Criteria for the efficient functioning may be particularly useful if already included in the contract between operator or aircraft operator and provider of the outsourced activity.

## 5.7 Record keeping and documentation

The operator or aircraft operator is required by Article 67 of the MRR to keep records of “all relevant data and information” (including the information listed in Annex IX of the MRR). This is required for robust verification, as verifiers can’t work based on assumptions or conjecture, but only by using clear objective evidence for their judgment. This is the reason why the results of all data flow procedures and control procedures should somehow be stored, either in an IT system or in a paper file, or logbook. The data and information stored must enable the verifier to follow the complete audit trail.

Furthermore, this data retention is required for at least 10 years from the date of submission of the relevant emissions report. This means that

- paper must be sufficiently stable, well-indexed for clear identification (including version management of documents)
- IT systems must be designed or upgraded such that the data can be retrieved after that time (i.e. exotic data formats are to be avoided, sufficient backups are to be kept, storage media can still be read, etc.)

[8] https://www.gov.uk/guidance/uk-emissions-trading-scheme-for-aviation-how-to-comply

# 6 A detailed example

## 6.1 Information about the example installation

The installation discussed in this chapter is producing lime and is emitting on average 100,000tCO2 per year. The following source streams need monitoring:

| Fuel/Material | Estimated emissions (tCO2 per annum) | Further information |
|---|---|---|
| Natural gas | 25,000 | Activity data determined by invoices |
| | | Calculation factors determined by using national default values |
| Lime | 75,000 | Activity data determined by weighing of trucks upon delivery |
| | | Calculation factors determined by sampling and laboratory analyses |

## 6.2 Data flow and control activities

### 6.2.1 General considerations

This section discusses the general approach to determine the probability and impact levels of the inherent and control risk associated with each incident. The resulting exemplar risk assessment for the example installation can be found after this section.

As indicated in sections 4.3.1 and 4.3.2 this assessment should rather be “semi-quantitative” than a mathematically demanding exercise. However, in the following examples still some calculations related to the example lime installation are carried to give an insight on the way of thinking behind the attributed probability and impact levels for the exemplar risk assessment.

### 6.2.2 Examples for control measures lowering the probability of an incident

**Example 1**: The natural gas fuel stream in the example lime installation is measured by a gas flow meter. As a control measure a secondary (redundant) gas flow meter could be installed.[9] This measure would im-pact the probability of the incident, because now both metering devices must fail to lead to a loss of activity data due to gross failure of

[9] Note that pursuant to point (e) of Article 18(3) of the MRR the cost-efficiency of this improvement might be evaluated by assessing whether the annual costs for the secondary system can be considered unreasonable. For that purpose, the benefit must be calculated taking into account the default improvement factor of 1%, because the tier is not affected.

metering. However, the impact of such failure still is that in the worst-case scenario activity data for the whole reporting period is lost. If the probability that one instrument fails is 10%, then the probability that both instruments fail within one reporting period is $10\%^2 = 1\%$ (corresponding to the statement: “gross failure of both metering devices within one reporting period happens every 100 years”).

**Example 2**: After the analysis of one batch of limestone in the example installation the laboratory recognises that the sample has been contaminated. As a result, the emission factor of this batch is lost. However, as a control measure the laboratory is keeping retained samples according to common good laboratory practice. Since samples from this batch can now be re-analysed, the probability that the emission of one batch is completely lost is greatly reduced.

### 6.2.3 Examples for control measures lowering the impact of an incident

**Example 3**: In addition to receiving monthly invoices for the natural gas in the example lime installation, the shift manager reads the gas meter e.g. weekly or even daily. The probability of the gross failure of a metering device would still be 10%, but the impact would only be 1/4 or even 1/30, respectively, of the original inherent risk.

**Example 4**: Another and probably the most important influence on lowering the impact of an incident is the availability of plausibility (cross) checks. Such checks include comparison with data for e.g. heat, electricity or product production as well as data derived from correlating parameters or from historic trends.

### 6.2.4 Examples for control measures lowering both the probability and the impact of an incident

**Example 5**: In the example the operator is using invoices as the primary data source for determining the monthly activity data of the source stream “natural gas”. Those invoices are based on the trading partner’s readings of the main gas flow meter. Consequently, the gross failure of the main gas meter in a worst-case scenario may have an impact of 2,000tCO2, i.e. 1/12 of the annual emissions from natural gas, for one reporting period. As this value is between impact levels 3 (1,000tCO2) and 4 (5,000tCO2) the more conservative level 4 is taken for further calculations. The operator assesses the probability of such failure to be about 10% (= probability level 3) which corresponds to the statement: “Gross failure of the main gas meter is expected to occur on average every ten years”. The resulting inherent risk ($R = P \times I$) is 500tCO2. This means that the expected risk for a misstatement before taking into account any control activities for each reporting period is 500tCO2.

Since the flow meter is under national legal metrological control and maintenance or replacement is done in regular intervals the probability of gross failure is being reduced (assessed to occur with a probability of 1%, probability level 2). In addition to that, cross-checks with e.g. production data will even be available in case gross failure should still occur. Conservatively assuming that the correlation between production data and activity data exhibits an associated uncertainty of 25%, the resulting impact would be 500tCO2 (impact level 2). This means that the expected risk for a misstatement after taking into account control activities for each reporting period is 5tCO2.

**Example 6**: In the example the operator is determining the emission factor of the limestone (Monitoring Method A: Carbonate Input) in his own non-accredited laboratory. In case the logbook containing data for calculating the emission factor is lost, also the emission factor is lost. The inherent risk associated with such an incident is calculated taking into account that in the worst case (i.e. assuming the worst expected limestone quality) the limestone gathered from a quarry exhibits an emission factor of about 0.4tCO2/t. This is deviating by approximately 10% from pure $CaCO_3$ (EF = 0.44tCO2/t). With these assumptions the impact may be 10% of the annual emissions stemming from the decomposition of limestone, i.e. 7,500tCO2. Therefore, the impact level in the example is 5 (> 5,000tCO2). As a control measure, data from the logbook is transferred to the electronic system at least weekly, hence reducing the impact of such loss to 1/52 of the annual value.

**Example 7**: The same approach is applicable for assessing the risk that the installation's own laboratory does not provide correct results. Considering a potential inherent impact on the emission factor of 5% in the worst case the impact on the emissions is determined to be 5% × 75,000 = 3,750tCO2/t, i.e. impact level 4. The participation of the installation's non-accredited laboratory in annual inter-laboratory testing as part of the procedure demonstrating equivalence to EN ISO/IEC 17205 serves as a control measure lowering the probability of this incident. Additional plausibility/cross-checks with historic data will lower the impact even further.

## 6.3 Full exemplar risk assessment

**Table 9 Risk matrix showing the levels of impact (in t $CO_2e$) and probability (%chance the incident occurs within one year) and resulting risk**

| PROBABILITY \ IMPACT | | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| | | 50 | 500 | 1,000 | 5,000 | 20,000 |
| 1 | 0.5% | 0.25 | 2.5 | 5 | 25 | 100 |
| 2 | 1% | 0.5 | 5 | 10 | 50 | 200 |
| 3 | 10% | 5 | 50 | 100 | 500 | 2,000 |
| 4 | 20% | 10 | 100 | 200 | 1,000 | 4,000 |
| 5 | 50% | 25 | 250 | 500 | 2,500 | 10,000 |

### Table 2. Exemplar risk assessment for an installation producing lime (P = probability, I = impact)

| Process/ Activity | Incident | Type of risk | Inherent Risk | | | Inherent Risk x Control Risk | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | P | I | Risk | Control measure(s) | P | I | Risk |
| Main gas flow meter | Gross failure | Activity data lost or in-accurate | 3 | 4 | 500 HIGH | Fuel supplier contract → high availability; cross check with invoices/production data (see procedure on how to close data gaps) | 2 | 2 | 5 LOW |
| | Meter malfunction | Activity data lost or inaccurate | 3 | 3 | 100 MED | Fuel supplier contract → high availability; procedure for corrective action part of EN ISO 9001 | 1 | 3 | 5 LOW |
| | Missing calibrations | Activity data incorrect (drift or other inaccuracies) | 4 | 3 | 200 HIGH | Fuel supplier contract → high availability; quality assurance procedure for maintenance part of EN ISO 9001 | 1 | 3 | 5 LOW |
| | Display error or misreading | Activity data incorrect | 3 | 3 | 100 MED | Cross check with production data; values reviewed by a 2nd person | 1 | 2 | 2.5 LOW |
| | Invoices wrong | | 3 | 4 | 500 HIGH | Shift manager reads gas meter on 1 Jan each year (at 11:30), compares with invoices; compare invoices with other months and previous years | 1 | 3 | 5 LOW |
| | Not appropriate for the operating conditions or not appropriately installed | | 3 | 2 | 50 MED | Checklist comparing conditions applied and manufacturer's specification; personnel regularly educated (see procedure for managing O&M and ETS personnel) | 1 | 2 | 2.5 LOW |
| | Electronic volume converter malfunction | | 3 | 2 | 50 MED | Fuel supplier contract → high availability; proxy data available (see procedure on how to close data gaps) | 2 | 2 | 5 LOW |

| Process/ Activity | Incident | Type of risk | Inherent Risk | | | Inherent Risk x Control Risk | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | P | I | Risk | Control measure(s) | P | I | Risk |
| Truck weighing bridge (limestone activity data) | Gross failure | Activity data lost or inaccurate | 3 | 2 | 50 MED | Cross check with invoices (supplier's metering data) and with production data | 3 | 1 | 5 LOW |
| | Meter malfunction | Activity data lost or inaccurate | 3 | 3 | 100 MED | Temporary use of invoices as data sources; procedure for corrective action part of EN ISO 9001 | 1 | 1 | 0.25 LOW |
| | Missing calibrations | Activity data incorrect (drift or other inaccuracies) | 4 | 3 | 200 HIGH | Cross checks with production data; quality assurance procedure for maintenance part of EN ISO 9001 | 1 | 2 | 2.5 LOW |
| | Display error or misreading | Activity data incorrect | 3 | 3 | 100 MED | Cross check with invoices, supplier's metering data and with production data; values reviewed by a 2nd person | 1 | 1 | 0.25 LOW |
| | Not appropriate for the operating conditions or not appropriately installed | | 3 | 3 | 100 MED | Checklist comparing conditions applied and manufacturer's specification; personnel regularly educated (see procedure for managing O&M and ETS personnel), cross checks | 1 | 1 | 0.25 LOW |
| | | | | | | | | | |
| Stock changes (limestone) | Forgetting to determine stocks at start or end of year | Activity data incorrect | 4 | 2 | 100 MED | Nomination of a 2nd person responsible for keeping track of stocks; automatic alert messages in MS Outlook calendar | 1 | 2 | 2.5 LOW |

| Process/ Activity | Incident | Type of risk | Inherent Risk | | | Inherent Risk x Control Risk | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | P | I | Risk | Control measure(s) | P | I | Risk |
| Emission Factor (Limestone) | Logbook lost | Emission factor lost | 2 | 5 | 200 **HIGH** | Analytical data is at least weekly transferred into electronic files; clear responsibilities for data management and back-up | 3 | 1 | 2.5 **LOW** |
| | Batch not analysed or data lost | Emission factor wrong | 3 | 3 | 100 **MED** | Nomination of a 2nd person responsible for keeping track of sampling and analyses; retained samples are being kept (see procedure for managing ETS personnel) | 1 | 1 | 5 **LOW** |
| | Samples not representative | | 3 | 3 | 100 **MED** | Homogenous raw material; see procedure for reviewing appropriateness of the sampling plan | 1 | 2 | 5 **LOW** |
| | Frequency of analyses not sufficient | | 3 | 2 | 50 **MED** | Regularly checked for improvement reports (Art. 69(1) of the MRR) if "1/3"-rule still applicable | 1 | 1 | 2.5 **LOW** |
| | Installation's own laboratory does not provide correct results | | 3 | 4 | 500 **HIGH** | Annual participation in inter-laboratory testing; see procedures for demonstrating equivalence to accredited laboratory in accordance with Article 34; plausibility checks | 1 | 1 | 2.5 **LOW** |
| | Weighted average not correctly calculated | | 4 | 2 | 100 **MED** | Review by a 2nd person; new personnel regularly instructed keep track in the logbook of each size of batches analysed | 1 | 2 | 2.5 **LOW** |
| | Analytical method inappropriate | | 2 | 2 | 5 **LOW** | Long experience with analysing limestone; annual participation in inter-laboratory testing; See procedures for demonstrating equivalence to accredited laboratory in accordance with Article 34 | 1 | 2 | 2.5 **LOW** |

| Process/ Activity | Incident | Type of risk | Inherent Risk | | | Inherent Risk x Control Risk | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | P | I | Risk | Control measure(s) | P | I | Risk |
| Data transfer to electronic files | Wrong data transfer to Excel MRV file | Activity data and emission factor incorrect | 5 | 5 | 10,000 **HIGH** | Review by a 2nd person; cross checks with previous years and production data | 2 | 2 | 5 **LOW** |
| | File or computer damage | Emissions calculations lost | 4 | 5 | 4,000 **HIGH** | IT data storage system in place; proxy data for data gaps available (production, previous years) | 1 | 2 | 2.5 **LOW** |
| | Calculation errors | Emissions wrong | 3 | 4 | 500 **HIGH** | Cross checks with result in AER template; review by 2nd person; cross checks with previous years | 1 | 1 | 0.25 **LOW** |
| | | | | | | | | | |
| New source streams | Mistaken inclusion of new fuels or materials | Emissions wrong | 1 | 1 | 0.25 **LOW** | Highly unlikely; kiln only designed for firing natural gas and limestone with specific properties | 1 | 1 | 0.25 **LOW** |

# Annex I: Further examples of control activities

The following Annex is taken from a working paper of the Task Force on Monitoring under the EU ETS Compliance Forum, which is relevant for the UK ETS. It is intended to supplement chapter 5, and to demonstrate which kind of activities may be useful to meet the requirements set out by Articles 60 to 67 of the MRR.

## Measurement equipment (Article 60)

1. Describe the measures undertaken to ensure that equipment is correctly in-stalled and operated, in accordance with the manufacturer's recommendations so that it can achieve the uncertainty specified for the relevant tier over the full range of expected operation and ambient conditions

2. Describe how individual equipment items (measurement components such as pressure, temperature etc.) are identified and recorded so that they are traceable

3. Describe the arrangements for calibration and maintenance, including the calibration standards applied, how calibration and maintenance are scheduled and recorded and how it is ensured that scheduled calibrations and maintenance activities are carried out

4. Describe back-up measurement procedures that can be used if the equipment malfunctions.

## Information technology systems (Article 61)

1. Describe the measures undertaken to ensure that equipment is correctly installed and operated, in accordance with the manufacturer's recommendations so that it can achieve the necessary recording frequency, data storage quantity and data processing requirements

2. Describe how individual equipment items (components) are identified and recorded so that they are traceable

3. Describe measures such as backup power supplies installed to ensure security of operation

4. Describe measures such as data back up and off-site storage to ensure data security

5. Describe the arrangements for maintenance, including how maintenance is scheduled and recorded and how it is ensured that scheduled maintenance activities are carried out

6. Describe backup data recording and processing arrangements that can be used if the information technology system malfunctions

## Segregation of duties (Article 62)

1. Describe the responsibilities and required competencies of all personnel involved in data flow activities

2. Describe how it is ensured that only personnel with the necessary competencies carry out the relevant responsibilities for data flow activities

3. Describe how process responsibilities are segregated from control responsibilities (duties devolved to different persons)

4. Describe how personnel changes are managed

## Internal reviews and validation of data (Article 63)

1. Describe checks that are carried out to validate the data produced by measurement equipment.

2. Describe checks that are carried out to confirm that the information technology system is working correctly.

3. Describe how maintenance and calibration records are reviewed.

4. Describe how training records are reviewed.

5. Describe how the measurement and reporting procedures are reviewed.

6. Describe how records of corrective actions are reviewed.

## Corrections and corrective action (Article 64)

1. Describe how errors and gaps in data are identified and corrected

2. Describe how data corrections are recorded

3. Describe how equipment malfunctions are corrected and recorded

## Out-sourced processes (Article 65)

1. Identify all out-sourced processes related to measurement and reporting of greenhouse gas emissions. These might include laboratory analyses, consumption and composition data provided by suppliers, calibration and maintenance of measurement and information technology equipment, etc.

2. Describe who within your organisation is responsible for monitoring the performance of each out-sourced service

3. Describe the levels of service specified in the contracts for out-sourced services

4. Describe the procedures for monitoring the performance of out-sourced ser-vice providers

## Records keeping and documentation (Article 67)

1. Identify all documents and records related to measurement and reporting of greenhouse gas emissions. This might include management procedures, operating procedures, equipment specifications, equipment manuals, calibration and maintenance certificates and records, responsibilities and training records of personnel, contracts for out-sourced services, data reports and logs, fault reports.

2. Describe how different versions of the documents are identified.

3. Describe how current versions of documents are identified and access to outdated documents is restricted.

4. Describe how documents are reviewed and updated and how new versions are authorised before use.

If you need a version of this document in a more accessible format, please email alt.formats@energysecurity.gov.uk. Please tell us what format you need. It will help us if you say what assistive technology you use.