Greenhouse Gas (GHG) Emissions Verification and Accreditation Guidelines

PART I: VERIFICATION REQUIREMENTS FOR THE EMISSIONS REPORT

VERSION 11 JAN 2019

National Environment Agency

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1. Introduction to the Guidelines

1.1 Purpose

This document provides details and elaboration which supplement the Carbon Pricing (Measurement, Reporting and Verification) Regulations 2018 under the Carbon Pricing Act (CPA).

These Greenhouse Gas (GHG) Emissions Verification and Accreditation (V&A) guidelines and templates provided by the National Environment Agency (NEA) should be read in conjunction with the Greenhouse Gas (GHG) Emissions Measurement and Reporting (M&R) guidelines.

These guidelines provide guidance on:

i) requirements relating to planning and conducting independent third-Party verification of GHG emissions reporting (Part I);

ii) the preparation of the verification report (Part I); and

iii) requirements and process for accreditation of verification companies for verification of GHG emissions reports (Part II)

2. Introduction to the Verification and Accreditation Requirements

2.1 Overview

Under the CPA and Measurement, Reporting and Verification Regulations, if a business activity of a registered corporation (herein referred to as 'facility')'s total direct GHG emissions (Scope 1[1]) is equivalent to or exceeds the prescribed GHG emissions threshold of 25,000 tonnes of carbon dioxide equivalent (CO_2e) in any calendar year, the registered corporation (herein referred to as 'corporation') will be required to submit a Monitoring Plan (MP) and an annual Emissions Report (ER) for each facility to NEA.

Under the Regulations, the facility's ER shall be subjected to verification by an accredited third-party verification company[2] before submission to NEA.

The Regulations aim to ensure that the GHG emissions computed and submitted by the facility represents a true and fair account of the emissions emitted from the facility.

2.1.1 Roles and responsibilities between NEA, verification company and the facility

Verification involves an independent and objective assessment of the accuracy of the ER based on the MP, including the implementation of the quality management framework (QMF) and the data sources that have been used to collect and collate the data in the ER.

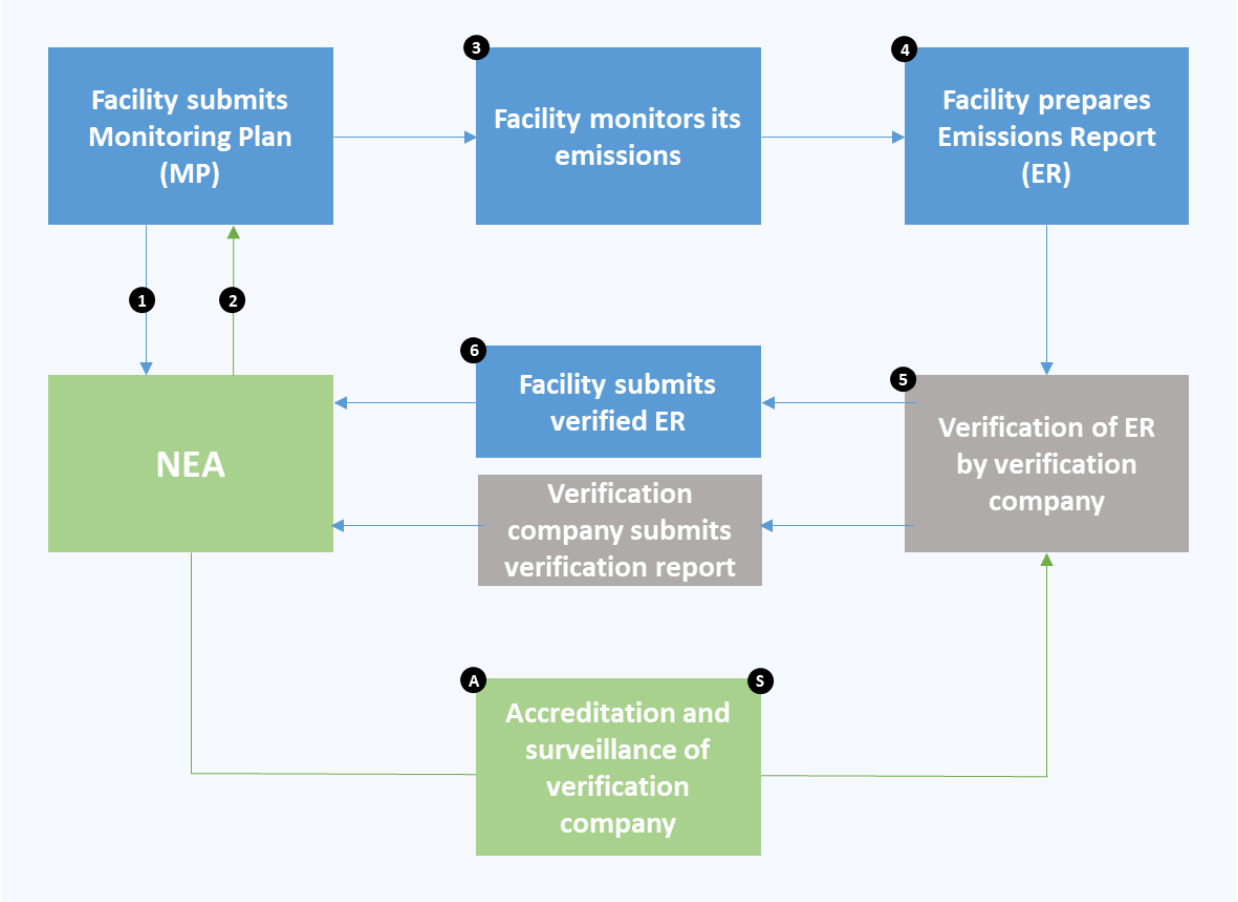
Accreditation involves an independent assessment by NEA on whether a verification company has the competence to carry out the verification of GHG emissions reporting in line with the Regulations.

The relationship between the M&R and V&A requirements, and the different stakeholders (NEA, verification company and the facility) involved are shown in Figure 1

[1] Three scopes of reporting are defined by the GHG Protocol (http://www.ghgprotocol.org/corporate-standard), direct emissions as Scope 1, indirect emissions related to production of energy commodities used (e.g. electricity) as Scope 2 and other indirect emissions as Scope 3.

[2] Referred to as 'accredited external auditor' in the Carbon Pricing Act and Measurement, Reporting and Verification Regulations.

Figure 1. Relationship between the M&R and V&A requirements and its stakeholders



Stage	Details
1	The facility submits its MP to NEA for approval.[3]
2	NEA validates and approves the facility's MP.
3	The facility monitors its emissions based on the approved MP. The approved MP serves as the blueprint for the facility's measurement and reporting.
4	The facility compiles the ER based on the approved MP.
5	The facility's ER shall be verified by an accredited third-party verification company prior to submitting to NEA.
6	The facility shall submit its verified ER together with the verification report to NEA by 30th June after the reporting period via the Emissions Data Monitoring and Analysis (EDMA) system. The verification company shall concurrently submit the verification report and finalised verification plan summary to NEA.

[3] Refer to the Greenhouse Gas (GHG) Emissions Measurement and Reporting Guidelines Part I: Introduction to the GHG Measurement and Reporting Requirements Section 2.3: Submission of Monitoring Plan and Emissions Report for the submission timeline.

A	The verification company shall attain accreditation by NEA prior to commencement of any verification.
S	All accredited verification companies will be subjected to annual surveillance by NEA.

3. Verification Process and Requirements

3.1 Principles of verification

The verification company **shall** strictly adhere to the following principles of verification throughout any verification engagement:

i) *Independence and objectivity* –The verification company and its verification team shall remain independent of the facility and activity being verified, and free from bias and conflict of interest. The verification teams shall maintain objectivity throughout the verification to ensure that the findings and conclusions will be based on objective evidence generated during the verification.

ii) *Ethical conduct* - Demonstrate ethical conduct through trust, integrity, confidentiality and discretion throughout the verification process.

iii) *Fair presentation* - Reflect truthfully and accurately verification activities, findings, conclusions and reports. Report significant obstacles encountered during the verification process, as well as unresolved, diverging opinions among verification team members , the responsible party and the client.

iv) *Due professional care* - Exercise due professional care and judgment in accordance with the importance of the task performed and the confidence placed by the corporation and verifier(s). Have the necessary skills and competences to undertake the verification.

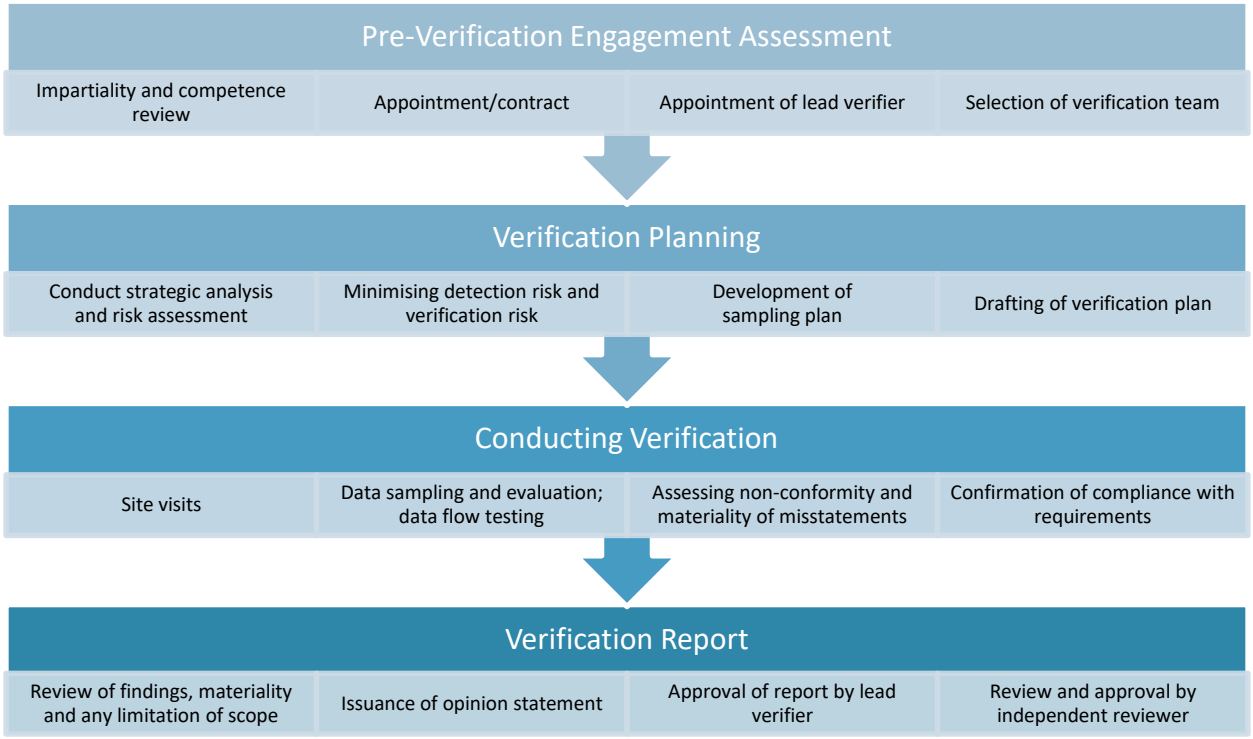
Further details of the requirements on the verification company's management systems to maintain independence and objectivity, and implementation of such systems to ensure these principles are adhered to during each verification engagement are outlined in Section 2.3.1 and 2.3.3 of the V&A Guidelines Part II: Accreditation Requirements for Verifiers respectively.

3.2 Key stages and deliverables

3.2.1 Verification process overview

A verification engagement comprises four main stages: (i) pre-verification assessment, (ii) verification planning, (iii) conducting verification activities, (iv) drafting and issuing the verification report.
Figure 2 highlights the key activities within each of the verification stages:

Figure 2. Key activities for each verification stage



3.2.2 Deliverables and documentation

For each verification engagement, the verification team shall prepare and submit the following documents to NEA as outlined in Table 1 below:

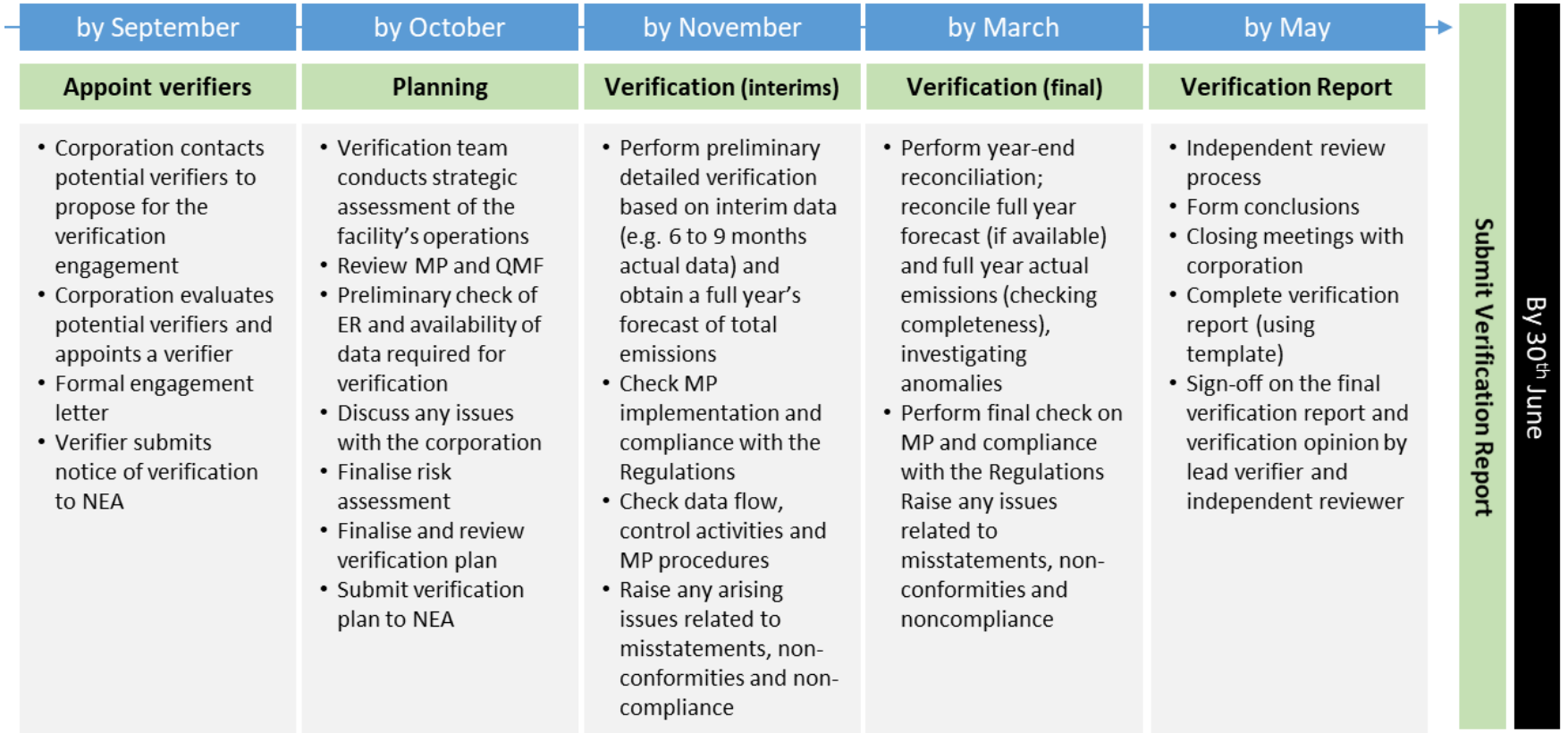
Table 1. Verification deliverables and documentation during verification

Key stage of verification	Deliverable to NEA	Deadline for submission to NEA
Pre-verification engagement assessment (section 4)	Notice of verification	Within ten (10) working days of the start of a verification engagement
Verification planning (section 5)	Verification plan summary	Within three (3) months of the start of a verification engagement
Conducting verification (section 6)	Notice of site visit	At least seven (7) working days prior to the scheduled site visit
Verification report (section 7)	Verification report with the verification opinion statement and final verification plan summary	June 30th of each year following the end of reporting period (e.g. June 2020 for 2019 reporting period)

3.2.3 **Recommended verification timeline**

As a good practice, the facility is encouraged to engage the verification company before the end of the reporting period. This will help in the early detection and rectification of errors, thereby reducing the risks of having a negative verification opinion statement. The recommended timeline is shown in Figure 3 below.

Figure 3. Recommended verification timeline



3.3 Verification requirements

3.3.1 Scope of verification

Each facility **shall** submit an ER verified by an accredited independent third party annually by 30 June after the reporting period. Only information relating to reckonable[4] GHG emissions is subjected to third party verification.

The verification team **shall** plan and perform the verification to state with a reasonable level of assurance[5] that the aggregated error in the total reckonable GHG emissions for the reporting period does not exceed the materiality limit. The verification team **shall** accumulate sufficient evidence to substantiate the positive verification opinion statement that:

i) The data reported in the ER was collected in compliance with the approved MP (including the QMF);

ii) The data reported in the ER is complete, reliable, accurate; and

iii) The ER complies with the Regulations.

These guidelines outline in some detail the type of verification procedures which **shall** be conducted (i.e. substantive testing, controls testing, site visit) to achieve reasonable level of assurance and are aligned with international standards[6]. However, the guidelines are not intended to be prescriptive about the exact verification activities to be performed during verification. The exact verification activities shall be conducted based on the lead verifier's professional judgment.

3.3.2 Materiality

Materiality is the professional judgement by the verification team on whether the uncorrected misstatements could influence the verification conclusions of the ER. Only ERs that the verification team are able to state with a reasonable level of assurance that the aggregated error in the total reckonable GHG emissions for the reporting period does not exceed the materiality limit may be issued a positive verification opinion statement.

Evaluating materiality of any misstatements found is essential in concluding whether the ER can be verified as positive. It is important to note that every identified misstatement and non-conformity **shall** be corrected or explained by the facility (see section 6.4.2).

The prescribed materiality limit shown in Table 2 differs depending on the facility's total reckonable emissions. The prescribed materiality limit **shall** be considered on an aggregated basis for the facility's total reckonable emissions stated in the ER (i.e. the deviation of the verification team's value from the

[4] Please refer to the Carbon Pricing Act Part 4 Section 13(1) and Second Schedule Part 2: Non-Reckonable Emissions for detailed definitions and coverage of reckonable and non-reckonable emissions.

[5] To note that reasonable level of assurance is not absolute assurance. Reducing verification risk to zero is not attainable or cost beneficial as we are seeking for the evidence available to the verifier to be persuasive rather than conclusive. Professional judgement should be used in gathering and evaluating evidence, and forming conclusions based on that evidence.

[6] Internal Standard on Assurance Engagements ISAE 3410, Assurance Engagements on Greenhouse Gas Statements, June 2012

facility's ER shall not exceed the prescribed materiality limit in order for the verification team to issue a positive verification opinion statement).

Table 2. Materiality limit

Total reckonable emissions (tCO_2 eq)	Prescribed materiality limit
25,000 to 1,500,000	5%
≥1,500,000	2%

Although materiality is assessed quantitatively at an aggregated emissions level, the verification team shall also assess and consider the following before issuing the verification opinion statement:

i) Deviation of the verification team's value from the value in the facility's ER at the individual emission stream level; and

ii) Other qualitative aspects or issues that may influence the decisions and actions of NEA, e.g. size and nature of the misstatements, and their particular circumstances of occurrence

Even if the materiality limit is not exceeded at the aggregated emissions level, it is important to note that the verification team may not issue a positive verification opinion statement if the verification team assessed that there are qualitative aspects or issues that may influence the decisions and actions of NEA.

3.3.3 Verification team roles and responsibilities

The verification team **shall** minimally comprise n an accredited lead verifier. The team may also include additional verification team members as well as technical expert(s), if required. There **shall** be an independent reviewer to perform the internal quality control checks. The roles and responsibilities of the respective team members and the independent reviewer are summarized in Table 3. For details on the accreditation requirements of these roles, refer to Section 2.2 of the V&A Guidelines Part II: Accreditation Requirements for Verifiers.

Table 3. Roles and responsibilities of the verification team and independent reviewer

Role	Responsibility
Lead verifier	The lead verifier leads and manages the entire verification engagement, from planning and execution to issuing the verification report, including: i) determining the team requirements and resource allocation on the verification, including assembling the verification team and assessing competence and independence of the verification team; ii) allocation and briefing on specific tasks to verification team members; iii) responsibility for ensuring the verification plan is complete and appropriate, as well as its proper implementation and any necessary amendments during the verification process; iv) responsibility for submission of the notice of verification, verification plan summary, notice of site visit and verification report to NEA; v) maintaining communication with the reporting facility or corporation;

	vi) conducting the site visit, including assembling the team for site visit and managing the process and communication of planning and concerns to the facility; vii) ensuring that all internal verification documentation, including supporting evidence, is complete and compiled in compliance with document retention requirements; viii) guiding the drafting of the verification report; ix) providing assistance, clarification and response to requests from the independent reviewer in order to complete the verification report quality checks; x) endorsing the verification report and issuing the verification opinion statement
Verifier team members	Assist the lead verifier to carry out verification activities, including: i) confirming the scope of verification with the facility; ii) assisting the lead verifier in assessing whether the verification objectives are addressed in the detailed verification planning; iii) undertaking the data sampling; iv) resolving issues relating to verification, in particular those associated with the materiality of reported data and conformance with the MP; v) compiling the internal verification documentation; vi) drafting the verification report
Complex sector expert	To conduct verification activities for facilities in complex sectors, a verification company shall have obtained complex sector accreditation, in addition to the general accreditation, which requires the appointment of a complex sector expert. The role of the complex sector expert is to ensure that the verification team has sufficient knowledge of the complex sector to understand and adequately conduct the verification for the facility in the complex sector. The complex sector knowledge can reside in the lead verifier or any other verification team members in the team.
Technical expert (TE)	The role of a TE is to supplement the verification team with detailed information on certain specific processes of the facility where the team lacks technical expertise, knowledge or experience in, for example on a specific piece of measurement equipment or understanding a complex emission stream. As such, the TE need not possess GHG verification experience and **shall** not be part of the decision making process of the verification. The TE can be subcontracted outside of the corporate group and shall not be used in place of the complex sector expert.
Independent Reviewer	An independent reviewer must maintain independence by not participating in verification activities for the facility. The independent reviewer's role is to provide independent internal quality control at two stages: i) upon completion of the initial verification plan, and before submission of the verification plan summary to NEA

	ii) upon completion of all verification activities, and before submission of the verification report to the facility and NEA. The independent reviewer will review documents applicable to the verification services provided, and identify any failure to comply with the verification plan, Regulations, or with the verification company's internal policies and procedures for providing verification services. The independent reviewer must concur with the verification findings and sign off on the verification report before it can be issued to the facility and NEA. The independent reviewer's assessment and sign-off shall serve as a final check on the verification team's work to identify any errors made by the verification team in the conduct of the verification engagement, including errors in planning, errors in data sampling, and errors in judgement by the verification team related to the verification opinion statement.

4. Pre-verification engagement assessment

Prior to commencing any verification engagement (i.e. either initial or consecutive) of a facility, the verification company **shall** undertake a pre-verification engagement assessment. The purpose of the pre-verification engagement assessment is to evaluate:

i) Whether the verification company is able to competently and objectively complete the third-party verification of the facility's ER in line with the Regulations and V&A guidelines (e.g. ensuring that its scope of accreditation is appropriate for the verification, and to affirm the independence and objectivity of the verification team);

ii) Whether there are any risks to the verification company as a result of undertaking a verification engagement with the facility or corporation;

iii) The resources required and cost of performing verification engagement of the ER.

The verification company **shall** carry out the following checks before undertaking any verification engagement:

i) Evaluate the risks involved in undertaking the verification engagement, considering:

   a) The nature of the facility's operations and the corporation's interests to assess what risks are involved in undertaking the verification engagement;

   b) Potential risks to independence and objectivity of the verification company or verifiers; and

   c) Risks involved in terms of time and resource allocation to the verification engagement.

ii) Undertake a review of the GHG measurement and reporting information supplied by the facility to assess the scope and complexity of the verification engagement. Relevant information could include the approved MP, and the previous year's ER and verification report, if applicable.

iii) Assess whether the verification company is able to issue a verification report given the sector and activities of the facility and the verification company's scope of accreditation.

iv) Assess whether the verification company has the competence, personnel and resources required to select a verification team for this specific verification engagement and to complete the verification activities within the timeframe required.

v) Determine the time needed to properly carry out the verification engagement. The verification company should ensure that the scope of the verification work and the time allocated in the contract is consistent with the risks identified.

vi) Review the appointment of the lead verifier, taking into account any complex sector requirements

vii) Assess and be able to demonstrate that:

a) the verification company has legal and financial independence from the corporation;
b) no personnel involved in the verification has provided consultancy or technical assistance related to the preparation of MP and ER with any facility owned by the corporation within the previous two (2) years;
c) no personnel involved in the verification was employed as staff of the corporation involved in any GHG emissions related work within the previous two (2) years; and
d) no personnel involved in the verification has any conflict of interest with the facility and/or the corporation.

viii) Has not provided verification services to the facility for more than six (6) consecutive reporting periods.

The facility **shall** make the necessary documentation available to the verification company for it to perform this assessment. The verification company **shall** ensure independence and objectivity at all times during the verification, and **shall** declare any conflict of interests to NEA at any stage of the verification.

4.1 Notice of verification

Once a verification company has been engaged by a facility to conduct verification of its ER, the verification company **shall** inform the facility of the date of the start of the verification engagement, and submit a notice of verification to NEA, using the template provided. (The Notice of Verification Template can be downloaded from NEA website.)

The completed notice of verification template along with any supporting documents **shall** be submitted to NEA within ten (10) working days of the start of the verification engagement.

4.1.1 Change of Verification Company

If the corporation decides to engage a different verification company before the conclusion of the verification engagement, the corporation **shall** notify NEA of the change of the verification company, stating the reasons for the change.

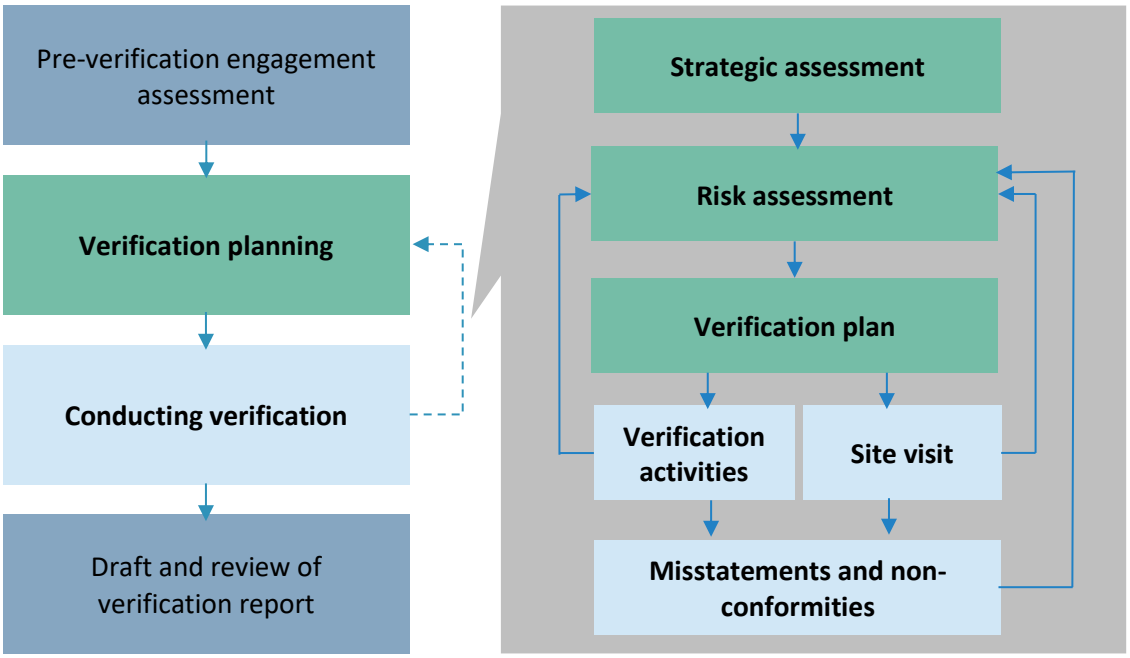
5. Verification planning

Verification planning is a strategic, risk-based exercise carried out in order to develop the verification plan of data sampling and activities to be performed during the verification.

This section provides the overview of key activities to undertake during verification planning, which are: (i) strategic assessment, (ii) risk assessment and (iii) development of the verification plan.

Figure 4. below shows the relationship between verification planning activities and the results of verification within the context of the four verification process stages. It is important to note that the findings during the verification itself and any misstatements identified may require a revised risk assessment and revised plan of verification activities. Therefore, verification planning can be an iterative process in order to minimise the verification risk.

Figure 4. Relationship between verification planning activities



5.1 Strategic assessment

At the start of verification, the verification team **shall** carry out a strategic assessment of all relevant activities of the facility. This analysis assists the verification team to understand the facility's activities to determine the likely nature, scale and complexity of the verification activities to be performed in order to ensure sufficient allocation of resources, and also provides input for structuring the subsequent risk assessment. It may draw upon the work performed during the pre-verification engagement assessment.

Strategic assessment involves a review of the facility's existing GHG-related information, including the facility's approved MP submission for the reporting period and any relevant previous emissions reporting.

In order to assess the inherent risks due to the environment within which the ER was produced, several areas **shall** be considered across:

i) The facility's operations, including:
   a) Type and scale of the facility and its operations, and its normal operating conditions and planned and unplanned events (including typical schedule for shutdown and maintenance, plant upsets, emergency shutdown)
   b) Number, nature and links between emission sources and streams included in the MP, from the emission source diagram and emission stream diagram

ii) Data management (collection, processing and storage), including:
   a) Variety of methods of quantifying GHG used for each emission stream
   b) Availability of records and data required during verification
   c) Whether there have been any modifications of the MP during the reporting period

iii) Facility management and corporation business environment, including:
   a) Findings and non-conformities corrected during previous verifications and MP approval

iv) Preliminary findings of data analysis, including:
   a) Outliers, unexpected trends or apparent misalignment of emissions data with operational events
   b) Significant differences from the previous reporting year or projected values

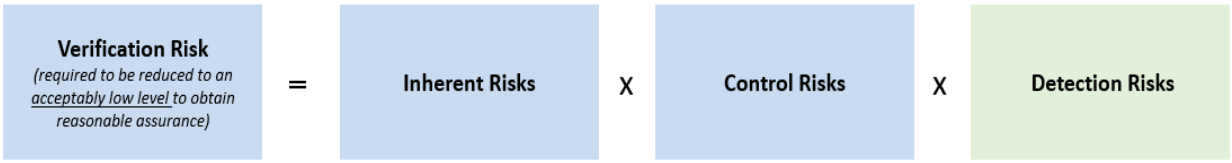
v) Compliance with the Regulations:
   a) Completeness, robustness and proper implementation of the procedures mentioned in the approved MP
   b) Controls and quality assurance implemented in QMF

The verification team **shall** also check (i) whether the MP presented is the most recent version approved by NEA; and (ii) whether there have been any changes onsite during the reporting period that are not reflected in the MP. The verification company **shall** inform NEA of any such issues within seven (7) days after the discovery.

5.2 Risk assessment

Building on the knowledge and understanding gained from the strategic assessment, the verification team **shall** perform a risk assessment to inform the planning and design of required verification activities in order to achieve a reasonable level of assurance and to minimise verification risk.

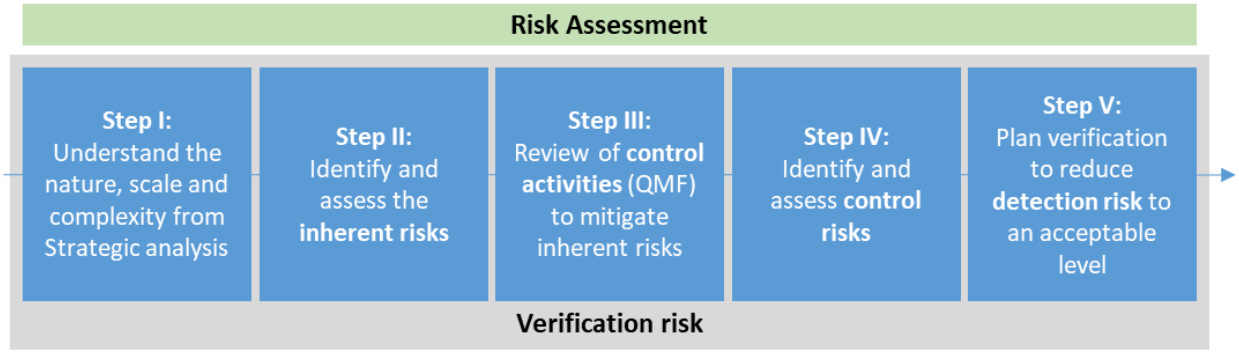
Verification risk is the overall risk that the verification team issues an inappropriate verification opinion statement and is assessed based on inherent risk, control risk and detection risk. The relationship between verification risk and its constituent risk components is expressed by the formula:



The risk assessment directs the verification effort to weaker areas of the facility's data generation, control environment, control system, management and reporting process, i.e. areas that give rise to an increased risk of misstatement or non-conformities. If during the verification process, the verification team identifies additional risks that need to be reduced or concludes that there is lower risk than originally expected, the risk assessment and verification plan has to be updated. The risk assessment is an iterative process and should be updated if data flows or the on-site verification shows that the risks are higher or lower than initially assessed when necessary. Other findings during the verification might also result in the need to revise the risk assessment and subsequently modify and/or repeat verification activities.

Figure 5 depicts the risk assessment process which is used to systematically evaluate the inherent and control risks in order to design the verification activities to minimise the detection risk, and therefore the verification risk.

Figure 5. Elements of risk assessment process



Step I: Understand the nature, scale and complexity from the strategic analysis

The verification team has to consider the following information to obtain a more complete understanding of the facility as input into the risk assessment:

i) The findings of the strategic assessment and the understanding gained in that phase of the verification;

ii) More in-depth analysis of the information found in the strategic assessment to enable the verification team to assess the likelihood of the risk of misstatements and non-conformities and their likely material impact on the reported data; and

iii) The applicable materiality limit enabling the verification team to assess the likely material effect of the risks involved in the ER.

Step II: Identify and assess the inherent risks

Inherent risk refers to the susceptibility of a parameter in the facility's ER to misstatements, individually or when aggregated with other misstatements, before taking into consideration the effect of any related control activities. Inherent risks are risks linked to the data flow activities[7], assuming that there are no related control activities to mitigate these risks and without considering the facility's control environment. Inherent risks are related to the size and characteristics of the facility's data flow.

Factors the verification team will need to consider in determining the inherent risk of non-conformity or misstatement **shall** include, but are not limited to, the following possible sources of inherent risks:

i) Complexity and number of emission sources (including types of fuel, types of industrial processes);

ii) Malfunctions, shut-downs or changes in the production process during the reporting period;

iii) Addition and/or removal of emission stream(s) from the MP;

iv) Information security environment within which the data is managed (e.g. who has access/permission);

v) Extent of manual transfers and input of data (e.g. fuel supplies, lab results, calibration);

vi) Complexity of data management systems for collecting data and quantifying emissions (e.g. multiple spread sheets related/linked to each other) or changes in data management since the last verification engagement;

vii) Inconsistent or complex M&R policies (including where the facility has multiple reporting methods for different reporting purposes or differing reporting frequency for elements of an emission stream);

viii) Unit conversions when consolidating information from different components or streams (e.g. converting mass to volumetric flowrates, energy consumption to fuel use etc.);

ix) Management override of controls.

In addition to the sources of inherent risk associated with the systems and policies in place, the verification team **shall** perform an assessment of inherent risk of misstatement or non-conformity due to the operations during the reporting period. This **shall** include, but is not limited to, the following checks:

i) An analysis of the fluctuations and trends in the emissions data in order to detect inconsistencies and deviations; and to identify the nature and size of the inherent risks associated with these fluctuations. The verification team **shall** compare detailed calculation data with data from

[7] Data flow activities are all operational activities and systems necessary to produce the data for the Emissions Report. This may include measuring, monitoring, collecting, recording, processing, analysing and calculating parameters and handling any subsequent data.

previous reporting period(s) and request a justification from the facility for any obvious unexplained differences.

ii) An assessment of whether the data management system is functioning properly, and is in line with the approved MP (including the QMF).

Once the inherent risks have been identified, the verification team **shall** assess the magnitude of these inherent risks, ranking them as high, medium and low risks in relation to their likelihood to give rise to misstatements and their impact on the reported data.

The verification team **shall** also consider the relative size of the different emission sources and their importance to the total emissions, identifying major, minor and negligible contributing streams. The size of contribution of a stream along with the assessment of inherent risks and their ranking gives an indication as to where misstatements could arise in the reported data and where a non-conformity with the MP or a non-compliance with the Regulations could exist in the data management system.

Step III: Review of control activities to mitigate inherent risks

If the inherent risks of a misstatement in a data flow activity are high, this particular data flow activity and its population shall be subject to extensive data testing, unless appropriate control activities have been put in place to mitigate these inherent risks.

For Step III, the verification team will therefore assess the adequacy of the control activities (in the QMF) in terms of their ability to prevent misstatements arising in the ER, including misstatements as the result of a non-conformity or a non-compliance. The review of the QMF is required to understand the number, type and nature of control activities in place.

Control activities are any acts carried out or measures implemented by the facility to mitigate inherent risks. Control risk refers to the susceptibility of the facility's ER to misstatements, which will not be prevented or detected and corrected on a timely basis by the control system described in the QMF. Therefore, control risks are risks that the control system may not be adequate to prevent, detect or correct misstatements arising from inherent risks in a timely manner.

The verification team **shall** assess the robustness of the control activities outlined in the QMF in terms of their ability to prevent misstatements arising due to errors in reported data or non-compliance. If the review by the verification team identifies areas where controls outlined in the QMF are insufficient to prevent misstatements, the facility **shall** implement the resulting recommendations for improvement or provide explanations. The verification team **shall** assess at least the following factors associated with control risk:

i) The organisation of tasks, safeguards, and competence within the M&R processes. This includes:
   a) The extent to which duties are segregated; the control risks are considerably higher if measurements, calculations, analyses, checks and reporting of data are performed by separate persons
   b) Quality assurance review on the work delivered by subcontractors
   c) Responsibility and competence of personnel involved in the M&R process (e.g. if the staff have sufficient knowledge and experience to carry out the control activity effectively, consistency of personnel performing checks and calibrations, cross and double checks)

d) Controls over how misstatements are being prevented, identified or rectified by the facility
e) Changes in the M&R process compared with previous years
f) Existence and effective functioning of management systems and computer information systems covering the activities under verification and how these relate to, and properly integrate, the emissions reporting process
g) Sections of the installation that are being audited by third parties
h) The manual or automatic nature of the controls
i) Frequency of control activities
j) Segregation of duties (i.e. checks and balances) with appropriate delegation of authority

ii) The calibration and maintenance of measurement and laboratory equipment or other measures that have been implemented by the facility to prevent misstatements from occurring (e.g. cross checks, corroborative calculations to substantiate measured data). This also includes factors such as the nature and frequency of calibration and the proper design specification and installation of metering etc.

iii) Whether the information systems being used are part of the normal administrative/operational information systems in the installation. Where the information systems are separate from the normal information systems, the control risks are likely to be greater (e.g. when activity data are kept in separate spread sheets and not automatically generated from existing finance or process control systems)

iv) In the case where separate information systems are used for emissions data collection and management, the adequacy of the interface between the main information system(s) and the emission M&R database/spread sheets

v) The manner in which data, data flow activities, control activities and procedures for control activities are implemented and documented. Where these activities are not properly documented, the control risks are higher, especially when there are changes in staff responsible for elements of the process

vi) Changes in the facility's risk assessment and control activities compared to previous years and the reason for those changes (e.g. improvements to the risk assessment and control activities to reduce control risks following suggestions from previous GHG verification engagements or internal audit).

Step IV: Identify and assess control risks

Step IV is used to evaluate which data streams are at the greatest risk of misstatement or non-conformity based on the review in Step III.

The verification team **shall** evaluate the magnitude of each control risk based on its ability to prevent data loss or errors and therefore misstatement of total emissions in the ER.Table 1Table 4 below outlines the significance of a high, medium or low control risk.

Table 4. Significance of the control risk levels

Risk level	Reasoning
High	The control system is likely not to prevent, detect and correct misstatements and there is a considerable to high risk of misstatements occurring.
Medium	The verification team is not sufficiently confident that the control system will prevent, detect and correct a misstatement which could lead to misstatements.
Low	The control system is well-structured, well-documented, well implemented and well-maintained, leading to confidence on the part of the verifier that misstatements will be avoided or corrected as a result.

Step V: Plan verification to reduce detection risk to an acceptable level

The verification risk consisting of inherent risks, control risks and detection risks, shall be reduced to a low level to obtain a reasonable level of assurance to issue the verification report that positively states that the aggregated error in the total reckonable GHG emissions for the reporting period does not exceed the materiality limit. The verification team reduces the verification risk through the design and implementation of the verification plan.

Whilst inherent and control risks are related to the systems and activities of the facility, detection risk relates to the nature, extent and timing of verification activities. Detection risk is the risk that the verification team does not detect a misstatement.

The verification team **shall** design the verification plan so as to arrive at a sufficiently low detection risk that will compensate for the inherent risks and control risks of the facility.

The verification team shall rank the facility's overall inherent risk and control risk in semi-quantitative terms of high, medium or low risk. Table 5 shows how the acceptable level of detection risk may vary based on the verification team's assessment of the inherent and control risks. It highlights that if both the inherent risk and the control risk are high, the verification team has to apply more detailed and strengthened verification activities and increase the sample size to lower the detection risk to a very low level. However, if both the inherent and the control risks are low, the verification activities can be less extensive and elaborate, implying that the verification team can accept a higher detection risk. In a similar way, at the intermediate levels of the inherent and control risks, the verification team can set the verification activities at an intermediate level, thereby accepting a medium detection risk.

Table 5. Assessment of detection risk given level of inherent and control risks

Acceptable detection risk given level of inherent and control risks		**Assessment of the control risk is**		
		High	Medium	Low
Assessment of the inherent risk	High	Very low	Low	Medium
	Medium	Low	Medium	High
	Low	Medium	High	Highest

In no situation **shall** low assessed levels of inherent and control risks be used as justification to eliminate the need to perform any data testing or testing of control activities.

5.3 Data sampling

Data sampling allows the verification team to perform substantive data testing to verify the accuracy of a subset of data used to calculate the emissions within a given stream, in order to assess the likelihood of misstatement of the total emissions for that stream. Data sampling can also be used when checking the implementation of control activities and MP procedures by sampling documents related to the procedures involved, such as calibration records or laboratory tests.

The verification team **shall** establish an appropriate data sampling plan in order to achieve the desired level of detection risk identified in the risk assessment. It is essential that for each risk identified during the risk assessment, appropriate verification activities are designed to gather sufficient evidence to ensure that the verification risk is acceptable.

The following key sampling principles **shall be** considered:

a) Sampling is based on the verification team's risk assessment and detailed in the verification plan,

b) The sampling approach and the sampling size must be fully documented in the verification plan,

c) The sampling approach must be specific to the facility,

d) Sampling the data universe of several facilities or combining data of several sites is prohibited as the data set is not homogenous,

e) Sampling must be representative of the total population of the control activities, procedures or the data selected,

f) In determining the sampling approach for the current verification engagement, verification team takes into account the sampling approach and results from prior year verification engagements.

<u>Risk assessment sample volume and determined materiality limits</u>

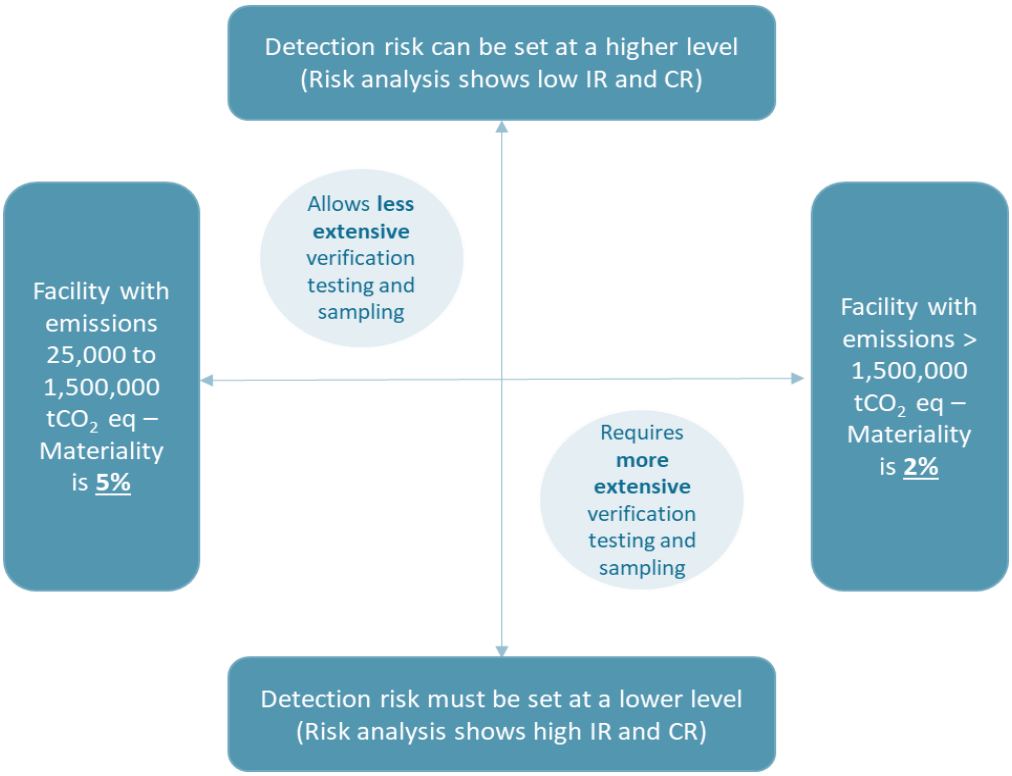
Sampling is one of the verification activities that is impacted by the risk assessment. Based on the verification team's analysis of the level of inherent and control risks, the verification team will then determine whether the sampling is justified, which samples[8] it needs to take, what the sampling size and selection approach should be, and which types of tests or other checks it should undertake on each sample. A greater sample size gives a higher confidence that there are no undetected misstatements in the population being sampled.

If the combination of inherent and control risks is high (i.e. high risk of misstatements), the verification team should aim for a low detection risk in order to be sure that it will detect misstatements as much as

[8] Any subset of the total population of data or control activities and procedures, that is selected for assessment.

possible to facilitate an acceptably low level of verification risk to obtain reasonable level of assurance. In practice, a lower detection risk and verification risk can be achieved through more extensive testing and sampling. The detection risk should also be set at a level taking the materiality limit (2% or 5%) into consideration. The relationship between the detection risk and the materiality is illustrated in Figure 6:

Figure 6. Relationship between detection risk and materiality limit



Sampling techniques

The verification team **shall** use their professional judgement to decide on the sampling approach (statistical or non-statistical), technique and sample size. The most appropriate sampling techniques (e.g. random[9], systematic[10] or risk-based[11]) as well as sample size required to verify each emission stream in order to achieve reasonable level of assurance will depend on the relevant activity data tier, GHG quantification method, uncertainty and controls specified in the MP (including the QMF), and therefore the level of associated risk established in the risk assessment.

Determination of the appropriate sample size for testing control activities depends on the (i) frequency of the internal control tests/activities (e.g. a control activity carried out monthly would have a frequency of 12 over the reporting period), and the (ii) number of data flows that need to be controlled by each

[9] Random selection of samples requires a selection tool that will ensure that the selection of samples I indeed "random", i.e. independent from the judgement or preference from the sampler. This is important to ensure that all items in the population to be sampled have an equal chance to be taken.

[10] Systematic sampling picks "randomly" a starting point and then applies a systematic rule to select further items (e.g. each 10th item after the first (at a randomly selected) starting item).

[11] Risk-based sampling is a non-statistical selection of items based on various international (thus, biased) elements.

control activity (e.g. how many measurement instruments are being used, how many calibration reports there are, how many documents are there in the documentation management system for that given control etc.). Combining the two gives the total population size of data available relating to a control activity and this will form the basis for the number of samples required to verify that control activity.

Table 6 below gives an illustrative example of determining appropriate sample size, based on the measurement frequency and resulting data population size in relation to the inherent and control risks.

Table 6. Example of difference in sample size to achieve low verification risk given the inherent and control risk

Measurement frequency and resulting annual data population size	Combined inherent risk and control risk	
	High	Low
Annually, or less than once a year (1)	1	1
Quarterly (4)	2	2
Monthly (12)	4	2
Weekly (52)	10	5
Daily (365)	50	30

5.4 Verification plan

The verification plan is an outline of the planned schedule of verification activities to be performed to reach the desired level of verification risk, including data sampling and site visit plans.

The verification plan resulting from the analyses outlined in this section **shall** include:

i) Proposed document and data reviews;

ii) A verification programme describing the nature, timing and extent of the verification activities;

iii) A plan setting out the scope and methods of testing the control activities and procedures for control activities;

iv) A data sampling plan setting out the scope and methods of data sampling related to data points underlying the aggregated emissions;

v) An assessment of how the planned verification activities cover the inherent, control and verification risks;

vi) Overall timetable of verification services;

vii) Dates of proposed meetings and/or site visit(s);

The verification plan **shall** be modified to include more extensive testing when:

i) A review of sample data identifies issues with controls that affect the integrity of the data (e.g. lack of training for key personnel, incorrect data collection or review processes etc.)

ii) Aggregated uncorrected misstatements approach materiality limit. The verification team may modify the verification plan to collect additional evidence to confirm whether the aggregated errors are material.

5.4.1 Review and submission of verification plan summary to NEA

Once the verification team has completed the strategic assessment, risk assessment and sampling plan to produce a verification plan, this verification plan **shall** be assessed by an independent reviewer within the verification company. The independent reviewer must assess whether the verification team has appropriately assessed the risks, and that the proposed plan of verification activities is appropriate and commensurate with the findings of the strategic and risk assessments.

After this internal quality control review, the verification team **shall** complete the latest verification plan summary template. The verification plan summary **shall** be submitted to NEA for reference no later than three (3) months from the start of the verification engagement. The submission of the verification plan summary is for NEA's information and to aid NEA in surveillance planning. The verification plan summary is not subject to NEA's approval before verification activities can commence.

After the initial submission of the verification plan summary, the verification team may subsequently update the verification plan based on the findings made in the course of the verification engagement. As such, the verification team shall update the verification plan summary based on the finalised verification plan and submit the finalised verification plan summary to NEA, together with the verification report, by 30th June following the reporting period.

An overview of the tabs in the verification plan summary template is as follows:

i) **Tab A: Verification details:** Records the corporation and facility details, emissions profile of the facility and sign off by the lead verifier, independent reviewer and complex sector expert (if applicable)

ii) **Tab B. General risk assessment:** Summarise the consideration of qualitative factors influencing inherent risk.

iii) **Tab C. Source and streams assessment:** Summarise the quantitative assessment of inherent risk, including the assessment of the number, magnitude and uncertainty of each GHG emission sources and streams, overall uncertainty of the facility and to classify each emission stream as either major, minor or negligible in the context of the verification engagement.

iv) **Tab D. Control procedures assessment:** The summary and evaluation of quality control from the QMF and internal risk management and control documentation, as well as the control risks associated with these procedures.

v) **Tab E. Detection Risk:** Summarising the resulting permissible detection risk as a result of the inherent and control risks assessment

vi) **Tab F. Verification Activities Plan:** Outlines the sampling and testing to be conducted for each emission stream. It will also be used to identify which verification activities are to be performed during the site visit and access to the documentation or systems would be required.

The detailed verification plan, including the data sampling plan, **shall not be released to the facility** as this could compromise the objectivity of the verification engagement. NEA may however request for these documents to be submitted if necessary.

6. Conducting Verification

The objective of the verification engagement is to perform checks and testing to obtain sufficient supporting evidence in order for the verification team to issue the verification opinion statement with a reasonable level of assurance. The verification team **shall** follow the sampling and testing activities outlined in the verification plan and conduct appropriate analysis to assess the correct implementation of the MP and integrity of data flows. The verification team **shall** also assess whether the underlying cause of any misstatements or non-conformities identified in previous verification engagements have been corrected.

To verify the accuracy of the reported data in the ER, the verification team **shall** check that the ER has been prepared in accordance with the approved MP (including the implementation of control activities outlined in the QMF).

Where the verification team uncovers anomalies, emissions trend variances, data gaps or data that are inconsistent with other relevant information or that differ materially from expectations, the verification team **shall** obtain explanations from the facility. These issues **shall** be included in the issues log of the verification report.

In verifying the ER, the verification team shall check whether there have been any changes onsite during the reporting period that are not reflected in the MP. The verification company **shall** inform NEA of any such issues within seven (7) days after the discovery.

6.1 Checking Monitoring Plan implementation

Checking the correct implementation of the MP **shall** include, but is not limited to, the following:

i) Checking all emission sources and streams in the MP are present and quantified in the ER;

ii) Checking that the MP has been implemented correctly, with all emission sources quantified using the approved activity data tier, and where appropriate, the specified conversion factor tier. Where this is not the case, check if the GHG emissions are calculated using the alternative approach[12];

iii) Checking that all GHG emission sources within the facility (if additional emission sources are found during the course of verification engagement) have been accounted for in the MP;

iv) Where the alternative approach is used, checking that it is not used for more than 90 days during the reporting period, or if it is used for more than 90 days, that the revised MP has been submitted and approved by NEA;

[12] Alternative approach is approved as part of the Monitoring Plan submission to ensure that there will be no data gaps and incomplete datasets for GHG emissions computations. The alternative approach documented in the Monitoring Plan would be used should the primary measurement approach (metering and analysis) to derive the activity data and/or conversion factor) become no longer suitable or available due to a certain scenario or event, e.g. process upset, shutdown, maintenance, failure and/or replacement of meters etc.

v) Checking the facility's data flows by tracing the reported data back to its primary source (refer to Section 6.2);

vi) Checking that the supporting documents from the ER and MP submissions are present and correct.

6.1.1 Checking implementation of Quality Management Framework control activities

Under the Regulations, NEA requires the facility to develop, document, implement and maintain an appropriate QMF for the collection, computation and reporting of GHG emissions data. The QMF covers three main areas of inventory development:

i) inventory preparation and management;

ii) data gathering, input and handling; and

iii) data documentation, reporting and review.

The verification team **shall** also check that following QMF elements (Refer to the M&R Guidelines Part II Section 4) have been implemented as per in the approved MP:

i) Procedure to ensure that all emission sources and streams are reported in the MP Template;

ii) Procedure to determine that the selected GHG quantification methods are appropriate, including the approach to determine any site-specific conversion factors;

iii) Quality assurance procedures to ensure that SOPs for maintaining and/or calibrating measurement instrument and IT tools are followed appropriately;

iv) Procedures to ensure no conflict of interest between compilation/computation and counter-checking roles;

v) Procedures to ensure accurate collection and checking of activity data;

vi) Change management procedures to ensure proper documentation of updates to data collection and computation approaches;

vii) Procedures to check that data submitted in the ER is accurate, robust and complete;

viii) Procedure to review appropriateness of data compilation and computation.

Verification of the above quality control procedures **shall** include data checks, document review and site visit, to ensure that control activities and processes:

i) Have been adequately implemented and are up to date;

ii) Are operating effectively throughout the year in preventing and identifying misstatements;

iii) Contain the information required in the approved MP;

iv) Are sufficiently documented and retained.

The verification team **shall** consider the factors outlined in Figure 7 below in performing control activity checks.

Based on the findings of the above, the verification team **shall** assess the effectiveness of such monitoring controls and whether the results have any bearing on the verification risk and tailored verification procedures. If the review by the verification team identifies areas where the QMF are insufficient to prevent misstatements, the facility must implement the resulting recommendations for improvement. If applicable, the verification team shall also assess if recommendations for improvement arising from findings of prior reporting period(s) have been implemented.

The verification team **shall** also document in the verification report areas where the procedures can be improved and recommendations for improvements. In addition, should misstatements arise from weaknesses in the procedures, or if the procedure/s are not in line with the M&R Guidelines, this **shall** be documented in the verification report.

Figure 7. Quality assurance of control activities

Quality Assurance of Control Activities

Technical checks	IT systems	Internal reviews and corrective actions	Personnel and outsourcing
Check records and visual inspection of **equipment** to ensure • Regular calibration and adjustment • Regular maintenance and cleaning • Correct installation (placement, orientation, connections, seals) • Correct range and prevision (maximum and minimum values, uncertainty) • Maximum cycles, samples, usage or age are not exceeded Check document management systems are effective in retaining this and any other information	Check for risks related to data collection or processing from hardware, software, infrastructure or applications and processes Manually check system functionality and review records for the effectiveness of procedures and any risk of non-conformities from • Completeness, integrity and continuity of data • Data flow transparency and traceability • Malfunctioning • Human error • Access controls, security and vulnerabilities • Back-ups and data recovery	Check both data review systems are in place • Monitoring controls to identify data flow failures (double checks) • Detection controls to identify errors (plausibility) Check data review has taken place, including horizontal, vertical and plausibility checks Check any resulting corrective actions have been carried out and that these have been correctly documented and parties notified where necessary	Check the extent of **outsourcing** to external service providers, and for outsourced control activities, check facility's processes for • Procurement and contracts • Internal auditing of contracted services • Ensuring compliance of outsourced activities with M&R Check personnel assigned to roles for • Segregation of duties • Competence • Conflicting duties (eg same person recording, processing and reporting)

6.2 Data sampling, data flow testing and data analysis

To perform the checks outlined in Sections 6.1 and 6.1.1 to determine whether the MP (including the QMF) have been implemented correctly, and therefore the accuracy and validity of the reported data, data testing **shall** be performed. Three different approaches **shall** be combined in order to assess the validity of the reported data:

i) controls testing and testing of data flows and systems to evaluate the integrity of the data population;

ii) substantive data sampling to identify errors or gaps in data; and

iii) data analysis applied to identify trends and outliers not visible through sampling or control testing.

Substantive data sampling is the selective analysis of a representative subset of data in order to establish the likelihood of errors in the population as a whole. Analysis of sampled emissions data may include:

i) Tracing site-specific emission factors and activity data to the primary sources such as lab analysis results, fuel invoices etc;

ii) Checking the reconciliation from the aggregated reported data to the data flow activities, through to the primary data sources;

iii) Performing cross-checking e.g. emission data with production data and external sources (e.g. fuel data from external providers);

iv) Checking readings from the measurement instrument;

v) Re-calculating data and checking the appropriateness of formulae applied;

vi) Checking how emissions established through the alternative approach relate to other data;

vii) Checking that extraction of emissions data from internal systems has been performed correctly;

viii) Checking the appropriateness and validity of manual adjustments to the reported data;

ix) Checking the extraction of the emissions data from internal system or checking the collection/manipulation of data for the report.

Substantive data flow testing is the detailed data testing to ensure the integrity of the systems from which sample data is taken. Data testing **shall** include:

i) Data verification through methods of testing such as tracing the data back to the primary data source, cross-checking with internal and external data sources, carrying out recalculation of parts of the overall emissions calculation to check certain subsets and elements (e.g. that factors are correctly calculated from source data);

ii) Checking the correct application of the monitoring methodology by using approaches such as spread sheet assurance techniques, recalculating the reported data, or inserting different input data in the monitoring methodology to check its correct application (i.e. re-performance of data aggregation);

iii) An analysis of fluctuation and trends in the data including an analysis of relationships that are inconsistent with other relevant information or that deviate from predicted amounts. This should involve approaches such as comparisons of emissions from the same sources over a period of several years, analysis of anticipated production and emission data, investigation of whether the reported figures can be confirmed by other analytical means such as cross-checking emission data with production and other operational data.

In addition to data flow testing and detailed review of sampled data, data analysis applied to the entire population of data should be used to identify data gaps or potential risk of misstatements. Where analysis of the reported data shows that it is unexpectedly high or low, the verification team **shall** tailor the nature, timing and extent of the other verification activities (including sampling or site visit checks) to reduce the verification risk to an acceptably low level, in order to gain comfort over the reported data.

Table 7. Examples of checks

Issues for Data analysis	Examples of related checks
Plausibility of fluctuations and trends over time or between comparable items	• Comparing GHG emissions of the reporting period with previous reporting period's emissions • Comparing GHG emissions from various units with production figures for those units • Comparing the consistency of emission data and its underlying data • Analysing trends in emissions and production data during a defined period to identify anomalies for further investigation • Comparing operational conditions with associated emissions (e.g. emissions during shutdown) • Identifying immediate outliers Identifying unexpected data and data gaps
Accuracy of the facility's boundaries and the completeness of the emission sources and sources streams	• Whether the facility's boundaries, emission sources and source streams as described in the approved MP, reflect the actual situation on the ground; • Whether the emission sources/streams are correctly categorized; • Whether data gaps or double counts have occurred, and identifying root causes (e.g. emission sources were excluded or incorrectly defined in the MP)

6.3 Site visit

In order to ensure that a reasonable level of assurance is attained, the lead verifier **shall** conduct a minimum of one (1) site visit to each facility as part of every verification engagement regardless of the complexity of the facility's processes or previous verification result. The site visit is essential in evaluating the correct and appropriate implementation of the MP, including the QMF. The purpose of a site visit is

to gather sufficient evidence to enable the verification team to issue the verification opinion statement to a reasonable level of assurance.

The verification team **shall** notify NEA of its scheduled site visit no later than seven (7) working days prior to conducting the site visit regardless of whether or not the site visit is specified in the verification plan summary. NEA may accompany the verification team for the purpose of conducting accreditation surveillance.

If the site visit objectives are not met, subsequent visits **shall** be scheduled in order to carry out additional verification procedures such as walk-through tests, interviews, sampling.

Activities during site visits **shall** include, but are not limited to, the following:

i) Interviews with key personnel (i.e. the GHG Manager), as well as other relevant staff involved in compiling data and preparing the emissions data report (e.g. data owners, process engineers);

ii) Checking the facility's boundaries, the data flow and assessing the completeness of source streams and emission sources;

iii) Observation or testing of the control activities and assessing the implementation of procedures mentioned in the approved MP (including the QMF);

iv) Obtaining physical evidence through assessment of measurement equipment, monitoring systems, data flows, processes; and date sampling to support documentation provided;

v) Making direct observations of equipment for data sources and equipment supplying data for sources determined in the sampling plan to be high risk;

vi) Confirming the correct installation of measurement equipment;

vii) Assessing conformance with measurement accuracy and missing data substitution requirements, as well as approved alternate methods, temporary methods, and approved meter calibration postponements.

All checks performed **shall** be documented in the internal verification documentation, including any observations and conclusions.

6.4 Assessing misstatements and non-conformities

When performing checks on a sample, the verification team **shall** analyse any misstatements and nonconformities and their occurrence in the sample, and use the results to estimate the total likely error in the entire dataset.

The magnitude of the misstatement together with the estimated emissions, **shall** be based on the physical evidence obtained or observations during the verification engagement and the verification team's professional judgement, and **shall** be recorded in the internal verification documentation.

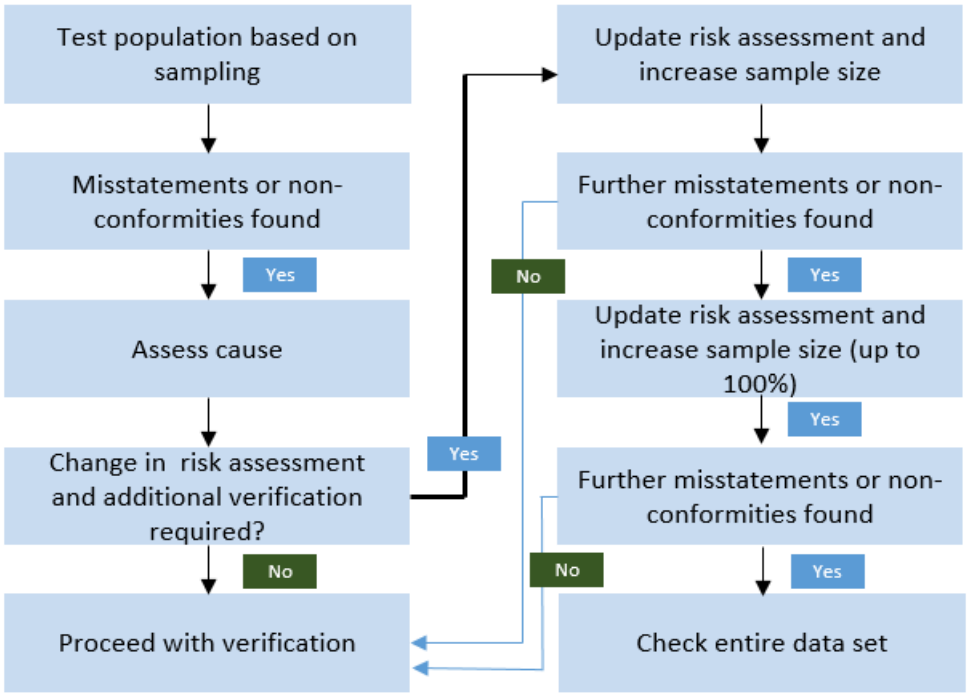
When analysing misstatements or nonconformities, the verification team **shall** consider their magnitude, nature, likely cause and possible impacts on other areas of verification and the verification opinion statement as a whole to determine their material impact on the total reported data.

6.4.1 Impact of a misstatement or non-conformity on the sampling size

When misstatements or data gaps are identified through carrying out of data analysis or as a result of the data verification process, the verification team **shall** perform a revision of the verification plan in order to resolve any issues and evaluate the materiality of remaining misstatements.

The verification team **shall** consider the pathways as highlighted in Figure 8. below. Should data gaps occur on a more frequent basis over a period of time, this could indicate that the control activities are not operating effectively.

Figure 8. Sampling workflow and addressing misstatements or non-conformities



If deviations result from testing the control activities, the verification team **shall** determine the following:

i) whether the testing provide an appropriate basis for relying on the control activities;

ii) whether the identification of the increased risks require additional testing of control activities; and

iii) whether the risks of misstatements need more detailed data testing. The revised risk assessment should then lead to an increased sample size, tailoring of the sampling activities or further testing requiring the verification plan to be updated.

If deviations result from checking the sampled data, the verification team **shall** assess the following:

i) the risk of misstatements and non-conformities in other parts of the population from which the sample was taken and commensurately increase the sample size, and

ii) whether further sampling activities and testing is required.

The verification team **shall** affirm in the verification plan whether the sample selected provides a reasonable basis for conclusion about the tested population to achieve a reasonable level of assurance.

6.4.2 Addressing misstatements and non-conformity

The facility **shall** correct each misstatement and non-conformity and their underlying causes (if any), identified by the verification team in the course of the verification engagement.

If the facility is unable to correct any misstatement, non-conformity or the underlying cause before the ER is submitted to NEA, the facility **shall** explain to the verification team why they are unable to do so, and **shall** correct such underlying cause before the facility submits the ER for the next reporting period.

6.4.3 Evaluating materiality

The verification team **shall** evaluate the magnitude and resulting materiality of any uncorrected misstatements or non-conformities identified. The verification team shall assess the deviation of the misstatements at the individual emission stream level, as well as the materiality of the misstatements at an aggregated emissions level.

In Example 1 below, while item 1 is individually material and item 2 is not individually material, in aggregate the variance is material:

Example 1

	Reported (A)	Verifier's value (B)	Difference (B)-(A)	Material [(B)-(A)]/(A)%
Item 1	28,000	30,000	2,000	7% (Yes)
Item 2	35,000	36,400	1,400	4% (NO)
Total	**63,000**	**66,400**	**3,400**	**5.4% (YES)**

In Example 2, while item 1 and 2 are material individually, it can be seen that due to the overstatement and understatement elements, it is not material on an aggregate basis:

Example 2

	Reported (A)	Verifier's value (B)	Difference (B)-(A)	Material [(B)-(A)]/(A)%
Item 1	30,000	25,000	(5,000)	17% (Yes)
Item 2	35,000	39,000	4,000	11% (Yes)
Total	**65,000**	**64,000**	**1,000**	**1.5% (NO)**

Factors that can be relevant in determining whether or not a misstatement or nonconformity has material impact could include, but are not limited to, the following:

i) whether it is a one-off or pervasive misstatement/non-conformity;

ii) refusal of facility to correct the misstatement or non-conformity identified;

iii) likelihood of the misstatement or non-conformity reoccurring;

iv) whether the misstatements and non-conformities are the result of an act with or without intent;

v) extent of non-compliance with the Regulations.

6.5 Concluding on findings from the verification engagement

Once all of the verification activities from the final verification plan have been performed and the materiality of any resulting misstatements and non-conformities have been evaluated, the verification team **shall** ensure that it has gathered sufficient evidence to conclude on the findings and to issue a verification opinion statement. The verification team **shall** justify the conclusion and findings based on the quality and reliability of the evidence supplied.

The reliability of evidence is influenced by its source and by its nature, and is dependent on the individual circumstances under which it is obtained. For example:

i) If evidence is obtained from external, independent and knowledgeable sources (e.g. external lab analysis), it could be more reliable than internal sources in the facility;

ii) Evidence that is generated internally is more reliable when the related control activities are effective or if the verification team has directly obtained the evidence (e.g. observing how the facility has carried out a manual cross check on the data instead of inquiring whether the facility has carried out such a control);

iii) There is typically greater confidence and therefore the verification team generally obtains more assurance from consistent evidence obtained from different sources or from evidence of a different nature than from items of evidence considered individually. When evidence obtained from one source is inconsistent with that obtained from another, the verification team will determine what additional verification activities mentioned under the process analysis are necessary to resolve the inconsistency.

At the conclusion of the verification activities, a verifications report **shall** summarize the findings and a verification opinion statement **shall** be issued, based on the quality and reliability of the evidence supplied, as outlined in section 7.

7. Verification report

After the verification activities have been concluded to the satisfaction of the lead verifier, a verification report **shall** be produced detailing any significant findings and the conclusion.

7.1 Verification report requirements

The verification team **shall** use the verification report template provided by NEA (downloadable from the NEA website). A completed verification report template along with the supporting documents will form the verification report submission.

The verification report submission **shall** include the following:

i) Details of the facility and reporting period covered in the verification engagement;

ii) Verified total reckonable GHG emissions (tonne CO_2e);

iii) Verification opinion statement (see section 7.2);

iv) Details of the verification company and list of personnel involved in conducting verification activities (with any changes from notice of verification);

v) Date of site visit(s) and summary of activities conducted during site visit;

vi) Issues log detailing any corrected misstatement and non-conformities with approved MP and/or the Regulations identified during the verification engagement, and all uncorrected misstatements and non-conformities at the time of issuing the verification report with the estimated magnitude of any misstatement and their materiality;

vii) Any misstatements or non-conformities identified in previous verification engagements that have not been rectified in the reporting year, where applicable;

viii) A summary of the approach and types of verification activities conducted to reach the verification opinion statement, highlighting significant matters arising where professional judgment was required;

ix) Sign off by the lead verifier and independent reviewer.

7.2 Verification opinion statements

The verification engagement **shall** conclude with a verification opinion statement based on the verification activities conducted by the verification team. The verification opinion statements are summarized in

Table 8 below.

Table 8. Verification opinion statements, justification and required actions

Verification opinion statement	Justification	Required actions
Positive opinion	The verification team is able to state with a reasonable level of assurance that the aggregated error in the total reckonable GHG emissions in the Emissions Report does not exceed the materiality limit.	For all uncorrected misstatements and non-conformities, the verification team **shall** recommend to the facility the corrections to be made. The facility **shall** correct the underlying cause of any uncorrected misstatements or non-conformities before the submission of the ER for the subsequent reporting period.
Negative opinion	The verification team is unable to give a positive verification opinion statement at a reasonable level of assurance. The reasons for giving a negative verification opinion statement may include, but not limited to the following: i) The aggregated error in the total reckonable GHG emissions in the Emissions Report exceeded the materiality limit ii) Non-conformities individually or collectively provide insufficient clarity to provide a positive opinion statement. This may arise from the following situations: a) Missing data which prevents the verification team from obtaining the evidence required to reduce the verification risk to the level needed to obtain reasonable level of assurance b) The MP was changed by the facility without seeking NEA approval c) The facility has failed to make sufficient information available to enable the verification activities to be carried out	The verification team **shall** make a reasonable estimation of the total reckonable emissions from the facility on the basis that the uncorrected misstatements had been corrected For all uncorrected misstatements and non-conformities, the verification team **shall** recommend to the facility the corrections to be made. The facility **shall** correct the underlying cause of any uncorrected misstatements or non-conformities before the submission of the ER for the subsequent reporting period.

7.2.1 Recommended improvements

The verification report may include recommendations for improvements in the facility's GHG-related data management systems or QMF based on the findings during the verification engagement, even where the current systems did not result in misstatements or non-conformities.

7.3 Independent review

Prior to the issuance of the verification report to the facility, the verification work performed and related documentation **shall** be reviewed by an independent reviewer. The independent reviewer must not have carried out verification activities that are subject to his/her review.

The main objectives of the review **shall** include, but are not limited to, the following:

i) Quality check to identify errors and/or omissions;

ii) A final assessment that due professional care and judgement has been applied in accordance with the verification company's quality control procedures;

iii) Assess that the verification work carried out by the verification team is in line with the Regulations and V&A guidelines;

iv) Assess that the evidence gathered during the course of the verification engagement is sufficient to support the verification opinion statement.

Checks undertaken by the independent reviewer **shall** include, but are not limited to, the following:

i) Whether the strategic assessment, risk assessment and verification plan, including revisions of the risk assessment and the verification plan have been carried out appropriately;

ii) Whether the verification engagement has been sufficiently documented in order to support the verification opinion statement, and the consistency between the working files and the verification report;

iii) Whether misstatements and non-conformities have been communicated to the facility, if they have been addressed by the facility, and how these have been identified in the verification report;

iv) Whether uncorrected misstatements and non-conformities and their impact on the reported data have been appropriately assessed;

v) Whether an appropriate verification opinion statement has been issued.

If the independent reviewer has identified errors or concludes that insufficient evidence has been gathered to achieve a reasonable level of assurance, the lead verifier **shall** ensure that the verification team corrects these and obtains the missing evidence or confirmation to substantiate the verification opinion statement. Changes that the verification team makes in the verification report as a result of the independent review **shall** be reviewed by the independent reviewer, along with the new evidence gathered before issuing the report to the corporation and NEA.

7.4 Verification report submission

The corporation **shall** be responsible for the submission of both the ER and verification report via the Emissions Data Monitoring and Analysis (EDMA) system by 30th June following the end of the reporting period.

The verification company **shall** issue the verification report to the facility once it has been signed-off by both the lead verifier and independent reviewer and the complex sector expert (applicable to verifications of complex facilities), with sufficient time for the facility to submit to NEA before the abovementioned deadline.

The verification company **shall** separately submit a copy of the verification report to NEA, together with the finalised verification plan summary, once the verification is completed and by 30th June following the reporting period.

7.4.1 Penalties for non-compliance

It is important for the corporation and verification company to be aware of the penalties for corporations stipulated under the Carbon Pricing Act relating to misstatements in the ER and non-conformities with the MP or non-compliances with the Regulations. The verification company may be subject to penalties, elaborated in Section 4.2 of the V&A Guidelines Part II if non-conformances with the Regulations are found in the verification process and verification report.

7.4.2 Separate independent verification

Should NEA find or discover inaccuracies in any ER or verification report, or a serious risk to the independence of the verification engagement, NEA may require the ER to be re-verified or the verification report to be rectified.

The facility may appoint a separate verification company to conduct a separate independent verification engagement of the facility's ER. The results of such an independent verification engagement will be used to compare with the results of the original verification to assess the efficacy of verification services provided by the verification company and compliance with the Regulations and V&A guidelines.

If any unidentified misstatements or non-conformities were found during the separate independent verification engagement, the original verification company **shall** justify why the misstatements or non-conformities were not identified during the original verification engagement, and may be subject to penalties.

7.5 Internal verification documentation

The verification team must compile and maintain internal verification documentation to provide a complete trail of evaluations and decisions that allowed the verification team to reach its verification opinion statement with reasonable level of assurance[13]. The internal verification documentation **shall** include both the corrected and uncorrected misstatements and non-conformities identified during the verification engagement.

The internal verification documentation needs to be transparent and must be drafted in such a manner that the independent reviewer, NEA, or an external verifier is able to assess whether the verification engagement has been performed in line with the Regulations and the V&A guidelines (i.e. could replicate the verification activities if necessary).

The internal verification documentation **shall** be compiled (i.e. there should be enough documentation to support the verification opinion statement) before the verification report is issued. No substantial changes can be made after the verification report is issued. Then, all internal verification documentation **shall** be finalised, endorsed (if necessary) and stored properly within sixty (60) days from the issuance of the verification report.

The verification company **shall** provide access to its internal verification documentation when requested by NEA, within the time frame stipulated by NEA.

7.6 Increase efficiency in consecutive verification engagement(s)

Should the same verification company be engaged by the same facility for consecutive verification engagements, assuming no significant changes have occurred in the facility's operations, the verification team may take advantage of opportunities for greater efficiency for the subsequent verification engagement(s). Increased efficiency in verification engagements may be achieved by reducing the extent of activities required at certain stages as a result of leveraging the experience, comfort and cumulative knowledge gained from previous verification engagements of the same facility in preceding verification (s). However, every verification engagement **shall** include sufficient risk assessment and testing to be performed to achieve a reasonable level of assurance.

The full conditions which allow for leveraging of the planning stages of previous verification engagements are as follows:

i) A positive verification opinion statement for the last verification;

ii) No change in verification company and lead verifier;

iii) No change in operational control of the facility or corporation since the last verification; and

[13] To refer to the International Standard on Auditing (ISA) 230, "Auditing Documentation" for more information on how to document and store internal verification documentation

iv) No significant change(s) made to the MP.

All of the four stages of verification must be completed, including all of the deliverables to NEA as highlighted in Section 3.2.2. However, elements such as the pre-verification checks, strategic assessment and risk assessment can draw upon activities performed in previous years' verification engagement(s) as the scope and complexity of the facility and verification should not have changed significantly. The verification team shall update the strategic and risk assessment to identify changes in the business environment or to the facility's internal Quality Control /Quality Assurance processes during the reporting period that may result in a higher risk of misstatement or non-compliance, despite no changes in the MP.

Examples of the areas within the scope of verification procedures that can be reduced for consecutive verifications, in relation to activities in a typical reasonable level of assurance verification engagement, are highlighted in Annex A: Consecutive Verification Efficiency. The verification team's professional judgement should be used to determine the areas where efficiencies could be gained on any individual verification engagement while still achieving a reasonable level of assurance.

8. Glossary

Accreditation	Accreditation involves an independent assessment by NEA on whether a verification company has the competence to carry out the verification of GHG emissions reporting in line with the Regulations.
Activity data	Activity data means data that (i) is about the amount of materials (including fuels and feedstock) consumed or produced by a process or activity, and (ii) is used or to be used to compute direct GHG emissions.
Activity data tiers	The measurement approach used by a facility to obtain an activity data value can be classified into four activity data tiers which reflect increasing accuracy of measurement. The facility shall use an activity data tier that is appropriate and ensures the direct GHG emissions are accurately computed. • Tier 1: Engineering estimate • Tier 2: Measured using typical industry approach • Tier 3: Invoiced quantity • Tier 4: Measured using an instrument meeting a specific standard
Competence framework	The competence framework is the summary of internal policies, activities and systems in place for the verification company to maintain and assess the skills and knowledge of verifiers to ensure they are able to understand and complete GHG emission verification activities.
Complex sector	Complex sector refers to the types of facilities within the complex sectors for which there are additional requirements for verification companies. 1. Refining of oil and gas, and large scale manufacture of chemical products 2. Manufacture (other than large scale manufacturing) of chemical products 3. Manufacture of semiconductor devices and wafers
Control activity	Control activity means any act or measure that mitigates any inherent risk.
Control risk	Control Risk is the risk that any quality management framework provided for in an approved Monitoring Plan may be applied incorrectly or may fail.
Conversion factors	A conversion quantity, conversion ratio or conversion fraction used to compute direct GHG emissions from activity data.
Conversion factors tiers	The measurement approach used by a facility to obtain a conversion factor can be classified into four conversion factor tiers which reflect increasing accuracy of analysis. The facility shall use a conversion factor tier that is appropriate and ensures the direct GHG emissions are accurately computed. • Tier 1: Default • Tier 2: Analysis done less frequently than once a year • Tier 3: Analysis done once every year or more frequent

	• Tier 4: Representative analysis
Corporation	The term corporation has been used in the guidelines to refer to the organization with operational control of the business activity (or "facility") whose direct emissions are equal to or exceeding the emissions threshold of 25,000 tonnes of carbon dioxide equivalent.
Corporate group	Corporate group refers to the network of firms to which a verification company belongs. The network of firms the verification company belongs to could mean a member firm of the verification company's network, or a legal entity within the verification company's group which apply similar governance, policies, procedures and quality standards
Detection risk	Detection risk in relation to an Emissions Report, means the risk of a verification team not detecting a misstatement in the Emissions Report, assessed based on the control risks and inherent risks relating to the Emissions Report
Emissions Data Monitoring and Analysis (EDMA) system	The online reporting system for registration and submission matters under the Regulations.
Emissions Report (ER)	The ER is a summary report submitted to NEA detailing the scope 1 GHG emissions of the facility within the reporting year, containing information on the facility's activity data, computation for each direct GHG emission source, and the total direct GHG emissions based on the approved Monitoring Plan. The ER is submitted by 30 June of the year following the end of each reporting period.
Facility	The term 'facility' has been used in the Guidelines to refer to a business activity that has direct emissions equal to or exceeding the emissions threshold of 25,000 tonnes of carbon dioxide equivalent (tCO2eq).
Greenhouse gases (GHG)	For the purposes of these Guidelines, GHG refers to the greenhouse gases covered in the Carbon Pricing Act: • Carbon dioxide (CO_2) • Methane (CH_4) • Nitrous oxide (N_2O) • Sulphur hexafluoride (SF_6) • Nitrogen trifluoride (NF_3) • Hydrofluorocarbons (HFCs) • Perfluorocarbons (PFCs)
Independence framework	The independence framework is the summary of internal policies, activities and systems in place for the verification company to assess its independence

	with respect to a facility and corporation, and conflicts of interest of any personnel in order to maintain its objectivity.
Inherent risk	Inherent Risk in relation to an Emissions Report, means the risk of a misstatement in the Emissions Report arising from the collection, computation and management of data, in the absence of quality control over the collection, computation and management of the data.
Materiality	Materiality is a concept used in assurance to evaluate the importance of an identified misstatement and its effect on the overall data being verified. A materiality limit will be stated, setting the maximum magnitude or contribution of any errors to the total before the misstatement becomes significant in issuing the verification opinion statement.
Monitoring Plan (MP)	The Monitoring Plan is the document submitted by the corporation to NEA which identifies and describes the facility's GHG emission sources and emission streams, emissions quantification methods, alternative methods, quality management procedures and uncertainty. It is used as a blueprint to prepare the annual ER.
Misstatement	A misstatement means any error or omission made in an Emissions Report.
Non-compliance	A non-compliance occurs where the actions of a facility or of a verification company are not in line with the relevant Regulations.
Non-conformity	A non-conformity means where the actions of a facility, the contents or preparation of an ER, or the activities of a verification company are not consistent with the approved MP (including the QMF) and/or the Regulations and guidelines.
Population	Population refers to the entirety of the data within a data set. The population size is the number of individual pieces of information or data points within the population. The population size will depend on the frequency of a measurement or activity and the number of separate data points or pieces of documentation (items) produced as a result of the measurement.
Quality Management Framework (QMF)	The QMF is the summary of the control activities and procedures in place within the facility, which must be approved by NEA as part of the MP.
Reasonable level of assurance	Reasonable level of assurance means a level of verification where a verification team has accumulated sufficient evidence to substantiate a positive verification opinion statement in its verification report.
Sampling	Sampling is an analytical procedure used to infer characteristics of a population using a specified subset of the data within that population.

Scope of accreditation	The scope of accreditation refers to the types of facilities the verification company is permitted to engage with in verification activities. Specifically, it refers to either general accreditation, or any of the complex sector accreditation(s).
Strategic assessment	Strategic assessment means an analysis to determine the nature, scale and complexity of verification activities to be performed in order to verify an Emissions Report.
Third-party verification	Verification involves an independent and objective assessment of the accuracy of the ER based on the way the MP, including the implementation of the QMF and the data sources that have been used to collect and collate the data in the ER.
Verification activities	Verification activities are the activities carried out to verify, to a reasonable level of assurance, an Emissions Report, including the planning of the activities and the issuing of the verification report.
Verification company	A registered legal entity acting as an independent verification body or institution with responsibility to perform and report on the third-party verification of GHG emissions.
Verification engagement	A verification engagement means an undertaking to verify, to a reasonable level of assurance, an Emissions Report for each reporting period.
Verification opinion statement	The verification opinion statement is the conclusion of the verification process expressing whether the information in an Emissions Report has been verified to a reasonable level of assurance, given the verification activities performed.
Verification risk	Verification risk is the risk of an inaccurate verification opinion statement being issued.
Verification report	The verification report is the output of the verification process to be submitted to NEA. It is a summary of the activities and findings of the verification.
Verification team	The verification team consists of the lead verifier, and if applicable, other verifiers and the TEs who perform the verification activities.
Verifier	Any person conducting verification activities used to determine the verification of data or assertions in a verification engagement.

Annex A: Consecutive Verification Efficiency

The purpose of this annex is to illustrate which of the verification activities undertaken within reasonable level of assurance of a facility's GHG Emissions Report may be simplified in consecutive verification engagements where no significant changes have been made to the approved Monitoring Plan or the facility or corporation's operation or management. Due care and professional judgement should be used to decide where greater efficiency can be achieved while still achieving reasonable level of assurance.

Illustrative verification tasks	Year 1 – Reasonable Level of Assurance	Year 2 – Reasonable Level of Assurance (consecutive verification)
VERIFICATION PLANNING		
Understand the design of monitoring methodology (MP and supporting documents)	Full document review and inquiries with facility, on all elements of the monitoring methodology and the boundaries of the facility.	Only update / provide confirmation of main elements of monitoring methodology
Perform strategic and risk assessment	Assess strategic risks based on the understanding of procedures performed in relation to complexity of facility, knowledge level / competence of responsible staff, management system (control system) to identify general risks	Update strategic analysis based on prior year experience, knowledge of the facility and changes identified
	Perform a risk assessment to evaluate based on our understanding the inherent risks for all elements in the verification: - Non-conformities with approved monitoring methodology - Completeness of emission sources - Inaccurate activity data - Inaccurate application of conversion factors and calculations - Significant uncertainties in measurement equipment (inaccuracy or discontinuity due to metering malfunction) - Inaccurate aggregation of data in ER	Update risk assessment based on prior year experience, knowledge of the facility and changes identified
CONDUCTING VERIFICATION		
Understand implementation of monitoring methodology - walkthrough	In order to understand and evaluate the process of recording the activity data from primary sources to the ER: - Perform a detailed walkthrough based on inquiry with responsible staff - Document detailed observations of processes, systems (full documentation for first year) - One walkthrough testing sample is required for each process	In order to update the understanding and evaluation of the process of recording the activity data from primary sources to the ER: - Perform a detailed walkthrough based on inquiry with responsible staff - Document detailed observations of processes, systems (update only required as foundation of documentation was performed in previous year)

	- This includes an observation of the emission sources, measurement equipment and if applicable, laboratories (On site is required for this procedure)	- One walkthrough testing sample is required for each process - This includes an observation of the emission sources, measurement equipment and if applicable, laboratories
	Performing a detailed walkthrough based on inquiry with responsible staff and observations of processes, systems and documents to understand and evaluate the determination of all: - conversion factors (e.g. carbon content/calorific values, emission factors) - uncertainty of measurement equipment - calibration of measurement equipment - certification of (on-site) laboratories (if applicable) (On site is required for this procedure)	Perform update of walkthrough based on inquiry and validate factors used or process to determine all factors (e.g. calorific values) (on site required). Only an update is required for the documentation as foundation documentation was performed in previous year.
Understand implementation of monitoring methodology - walkthrough	In order to understand and evaluate the aggregate from source system/spreadsheets to ER for **all** sources streams, perform a detailed walkthrough based on inquiry with responsible staff and observations of processes, systems and documents. (On site is required for this procedure)	Perform update of walkthrough based on inquiry and if needed, re-perform data extraction of emissions data for **all** source streams. Only an update is required for the documentation as foundation documentation was performed in previous year.
	Performing a detailed walkthrough based on inquiry with responsible staff and observations of processes, systems and documents to understand and evaluate all IT systems involved, IT control environment and IT dependencies. (On site is required for this procedure)	Perform update of walkthrough based on inquiry and if needed supporting documentation in cases where there are changes. Only an update is required for the documentation as foundation documentation was performed in previous year.

Sampling data points (based on population >200)	Facility with moderate to good levels of control: Medium comfort: 30-50 samples Facility with lower levels of control: High comfort: 50-100 samples Take a sample of items from the test population (depends on monitoring methods e.g. invoices, meter readings, stock counts, lab results) and verify that the reported data points reconcile to a source document as described in the MP	Facility moderate to good levels of controls: Low comfort 20-30 samples Facility with lower levels of control: Medium comfort: 30-50 samples Take a different sample of items from the test population from previous year (depends on monitoring methods e.g. invoices, meter readings, stock counts, lab results) and verify that the reported data points reconcile to a source document as described in the MP