EMISSIONI FUGGITIVE – IMPLEMENTAZIONE PROGRAMMA LDAR

Roma, 24 novembre 2022

Normativa di riferimento e brevi cenni storici attinenti LDAR

Analisi della EN 15446:2008

- Requisiti
- Norma US-EPA 453/95, cenni
- Analisi indicatori qualitativi
- Metodologia di computo
- Analisi report

Strumentazione da campo per COV

- Taratura
- Calibrazione giornaliera
- Condizioni a corredo

Strumentazione da campo AWP ed emergenti

- Tipologia
- Limiti
- Condizioni a corredo

Presentazione della NTA 8399:2015

- Requisiti
- Esempi pratici

Cenni riguardanti l’approccio di altri Paesi UE ed extra UE

Question time

Relatori

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CARRARA
GLOBAL SEALING SOLUTIONS

F.E.R.P.

Valgasket
VALVES COMPONENTS

PLANICHEM
SICHEM SOLUTIONS

filtes international

CARRARA GROUP

Qualifiche, certificazioni

Carrara S.p.A.

- Certificata ISO 9001:2015
- Certificata ISO 45001
- In corso di certificazione ISO 14001 (IQ 2023)
- Divisione Ferp certificata MASE
- Divisione Ferp certificata VLAREL
- Associata ESA, VITO, MASE
- In corso di certificazione UNI CEI EN ISO/IEC 17025:2015 (IIQ 2023)
- Qualificata OIMS

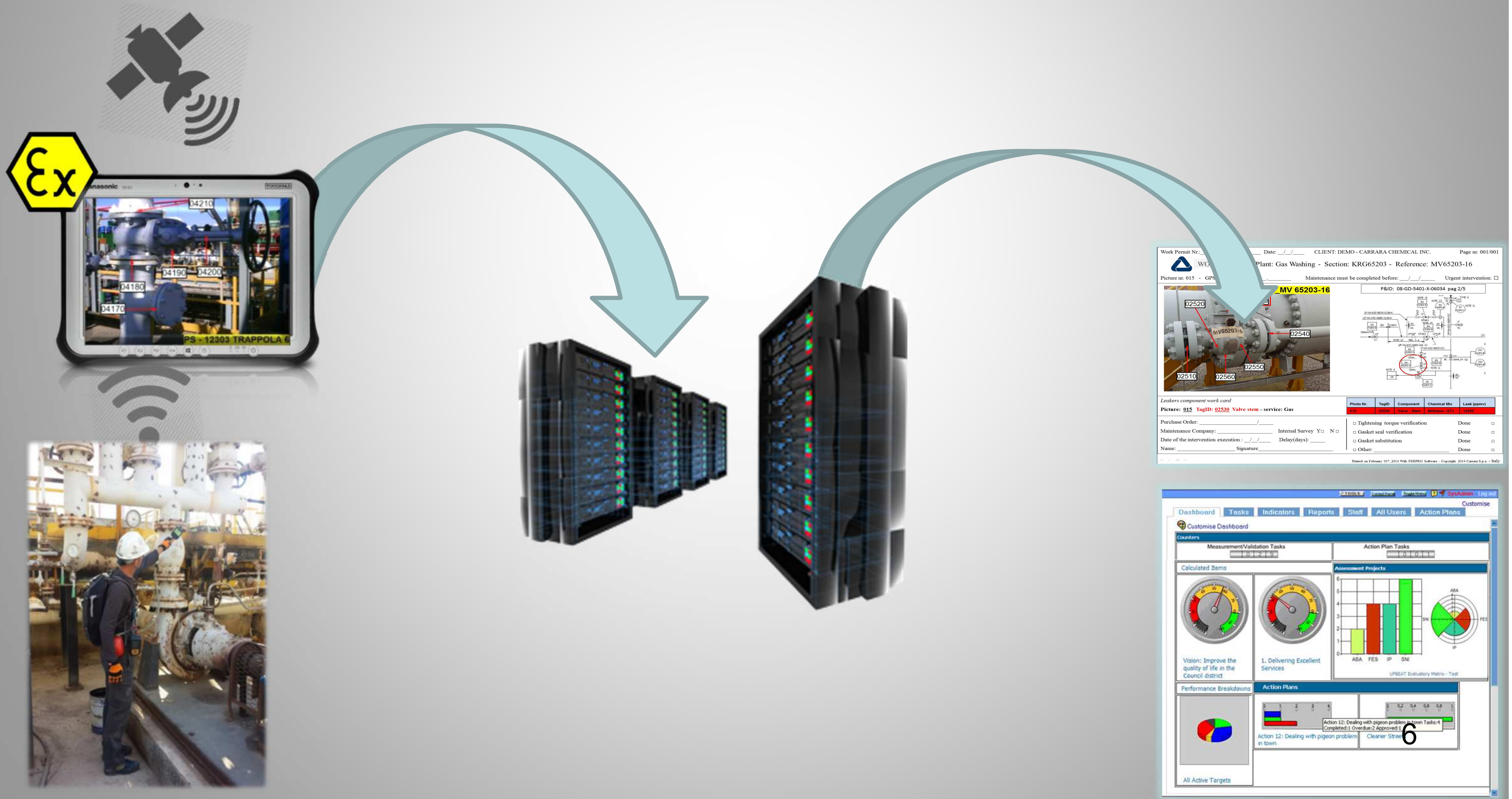
I tecnici Carrara hanno conseguito le seguenti:

- VCA-VOL (BE-NL)
- BOSIET-OPITO
- Ambienti sospetti di inquinamento o confinati (D.P.R. 177/2011)
- DPI III cat., lavori in quota
- ISO 9712 (non destructive testing)
- Thermography Basic and Advanced
- Ultrasound inspections
- Risques chimique N1 e N2 (FR)

Quanto sopra in aggiunta alla formazione prevista dalla normativa vigente


Fugitive Emissions LDAR
Storage tanks OGI
Through-valve loss VLAD
Steam traps and Energy Saving
Underground utility checking
Pipe Marking

LDAR - Sintesi



GLOSSARIO

• **CWP Current Work Practice**: tecnica ispettiva di accumulazione punto per punto della lettura emissiva espressa in ppmv. Comunemente riferita all'utilizzo di apparecchiature FID – Flame Ionization Detector – o PID – Photo Ionization Detector. Raro l'impiego di altri rilevatori (es. cella elettrochimica)

• **AWP Alternative Work Practice:** tecnica ispettiva remota impiegabile per il rilievo delle emissioni dalle sorgenti potenzialmente emissive regolata inizialmente dal dispositivo US 40 CFR Parts 60, 63, 65 EPA-HQ-OAR-2003-0199 - FRL-8754-5 - RIN 2060-AL98 Final Rules. AWP Citata da ISPRA Allegato H alla 18712; normato dalla guideline NL NTA 8399. Comunemente si fa riferimento all'impiego di una telecamera 'OGI' – Infrared Remote Optical Gas Imaging

• **Fase di catalogazione e monitoraggio estensivo**: fase introduttiva della routine LDAR, solitamente regolata dal dispositivo AIA (AUA,…); può essere anticipato dai contenuti espressi nel PMC. In questa fase si provvede al censimento completo dell'inventario ed alla compilazione del database, accumulando per ogni componente almeno una lettura secondo tecnica CWP. I campi minimi sono normati dalla EN 15446:2008

• **Inventario censito:** insieme dei componenti potenziali emettitori, classificati come da EN 15446:2008 che saranno oggetto di controllo tramite la routine LDAR

• **Database:** elenco organizzato su supporto informatico nel quale è archiviato l'inventario censito e tutte le informazioni che lo riguardano. I campi sono normati da EN 15446:2008.

• **Componente isolato:** componente coibentato o racchiuso in un 'sarcofago' che non potrà essere oggetto di ispezione CWP (EN 15446:2008 6.3.1 punto 3)

• **Componente non monitorabile:** componente non monitorabile con tecnica CWP perché in quota, pericoloso da monitorare o fisicamente non raggiungibile con l'ispezione EPA Method 21 (EN 15446:2008 6.3.1 punto 3)

• **PMC:** Piano di Monitoraggio e Controllo

GLOSSARIO

- **Inventario ispezionabile EPA Method 21:** sottoinsieme dell'inventario censito che é ispezionabile con tecnica CWP
- **Inventario ispezionabile OGI:** sottoinsieme dell'inventario censito che è ispezionabile con tecnica OGI;
- **Leak Definition**: valore soglia perdita che discrimina un componente come Leaker o no-Leaker;
- **Leak Frequency**: indice percentuale rispetto all'inventario monitorabile dei componenti rilevati divergenti. La divergenza è segnalata rispetto alla Leak Definition
- **Fattore di risposta**: correlazione tra la concentrazione attuale del/dei COV presente/i e la lettura in campo (trad, 15446 vd cap 3.8)
- **Componente divergente**: componente rilevato divergente con tecnica CWP rispetto alla Leak Definition o con tecnica OGI che dovrà essere oggetto di azione correttiva (riparazione).
- **Componente cronico**: componente rilevato per almeno due volte su quattro consecutivi trimestri in condizioni di divergenza rispetto alla Leak Definition. Questa definizione necessita di dovuti approfondimenti.
- **Indice di successo di riparazione**: indica il valore percentuale delle sorgenti divergenti rispetto alla Leak Definition che sono state riparate con successo
- **Efficacia del piano LDAR**: misura analitica dell'efficacia del piano LDAR implementato; calcola la percentuale di riduzione delle emissioni complessive. Come risultato secondario si ottiene la riduzione stimata in massa delle emissioni (U.M.: kg/anno)
- **Frequenza ispettiva**: indica il periodo di tempo che intercorre tra due successive ispezioni presso lo stesso componente o gruppi di componenti
- **Pegged value:** fattore emissivo attribuito per lettura strumentale CWP pari a 50.000 o 100.000 ppmv (funzione del fondoscala strumentale)
- **Thermal tuning:** regolazione della camera in modo che i colori o le sfumature della palette siano distribuiti in modo ottimale attorno all'oggetto (tipicamente comando 'NUT' di FLIR. Diverso da HSM).

Sintesi del prologo normativo - Estratto

La Direttiva Europea 2008/1/CE del Parlamento Europeo e del Consiglio del 15 gennaio 2008 riguardante la prevenzione e la riduzione integrate dell'inquinamento sostituisce la direttiva 96/61/CE del Consiglio del 24 settembre 1996 avente il medesimo oggetto; entrambe sono comunemente indicate come '*direttiva IPPC*'.

Nel periodo 2005-2009, tali direttive sono state oggetto di vari assessment. A seguito di ciò è stata pubblicata nel 2010 una formulazione rivista, integrata con altre 6 direttive europee che regolano i grandi siti industriali: la Direttiva sulle Emissioni Industriali (IED, Industrial Emissions Directive).

L'Ufficio Europeo IPPC venne fondato per organizzare il necessario scambio di informazioni e produrre i documenti di riferimento riguardanti le migliori tecniche disponibili "BREF" che gli Stati membri sono tenuti a prendere in considerazione nelle valutazioni e nelle prescrizioni.

In aggiunta alla normativa italiana di riferimento (a partire dai D.P.R. 203/88, D.Lgs. 152/2006 e s.m.i., …), si citano i seguenti:

- European Directive IPPC 96/61/EC (Recepimento tramite D. Lgs. 372/99)
- European Directive IPPC 2008/01/EC
- EPA 453/95 protocol and attachments (update to the previous 453/R-93-026, 1993)
- UNI EN15446:2008
- BREF Monitoring "Integrated Pollution Prevention and Control (IPPC) Reference Document on the General Principles of Monitoring" e smi, "Large volume organic chemical industry", BREF Refinery ed altri in funzione del settore specifico.
- "Preferred and alternative method for estimating fugitive emissions from equipment leak's - EIIP Environment Inventory Improvement Program – EPA"
- Ispra 18712-01/06/2011 'Definizione di modalità per l'attuazione dei Piani di monitoraggio e controllo – II emanazione' e relativi allegati

UNI EN 15446:2008

NORMA EUROPEA

Emissioni da fughe e diffuse relative ai settori industriali

Misurazione delle emissioni da fughe di composti gassosi provenienti da perdite da attrezzature e tubazioni

UNI EN 15446

LUGLIO 2008

Fugitive and diffuse emissions of common concern to industry sectors

Measurement of fugitive emission of vapours generating from equipment and piping leaks

La norma si applica alle misurazioni di emissioni da fughe di composti organici volatili (VOC) provenienti da attrezzature di processo. Le sorgenti di emissioni includono, ma non sono limitate a, valvole, flange e altre connessioni, limitatori di pressione, sistemi di drenaggio, valvole di carico, guarnizioni e sistemi di tenuta di pompe e compressori, agitatori e passi-d'uomo. Essa non si applica ai raccordi delle tubazioni degli strumenti.

PREMESSA NAZIONALE

La presente norma costituisce il recepimento, in lingua inglese, della norma europea EN 15446 (edizione gennaio 2008), che assume così lo status di norma nazionale italiana.

La presente norma è stata elaborata sotto la competenza della Commissione Tecnica UNI
Ambiente

La presente norma è stata ratificata dal Presidente dell'UNI ed è entrata a far parte del corpo normativo nazionale il 17 luglio 2008.

Introduction

A portable instrument is used to detect VOC leaks from individual sources. Any detector type is allowed, provided it meets the specifications and performance criteria contained in Clause 5. This procedure is intended to locate the leaks, and to estimate the mass emission rate from individual sources and the total emission of the industrial facility over a reporting period by using:

— EPA or user-defined correlations whenever possible;

— fixed emission factors, in all other cases.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 5725-2, *Accuracy (trueness and precision) of measurement methods and results - Part 2: Basic method for the determination of repeatability and reproducibility of a standard measurement method (ISO 5725-2:1994 including Technical Corrigendum 1:2002)*

1 Scope

This standard applies to the measurement of fugitive emissions of volatile organic compounds (VOCs) from process equipment. The leak sources include, but are not limited to, valves, flanges and other connections, pressure relief devices, process drains, open-ended valves, pump and compressor seal systems, agitator seals, and access door seals. It does not apply to instrument tubing connections.

This standard applies to all products of which at least 20 % by weight has a vapour pressure higher than 0,3 kPa at 20 °C. For the petroleum industry, this includes all light products and excludes kerosene and all heavier products.

The standard is based on the measurement of the gas concentration at the interface of a leak. This concentration is measured with a portable instrument. It is converted to a mass emission rate by use of a set of correlations. The scope of this standard includes the complete data processing, from the initial concentration measurement up to the generation of an emission report over a reporting period (which is generally one year)[1]).

0,3 kPa = 0,003 Bar = 0,03 N/cm2 = 0,00305 Kgf/cm2 = 0,043 psi = 300 Pascal

This standard does not prescribe the number of potential emission points that should be screened each year nor the frequency at which these points should be screened. This sampling strategy shall indeed take into account the plant characteristics and the required level of control over fugitive emissions.

Optical methods are currently under development to ease the detection of leaks in plants and use of this standard in conjunction with these methods might be possible. In any case, measurements have to be performed according to the requirements of this standard. To enable direct quantification of total fugitive emissions based only on these methods, a subsequent revision of this standard will be needed.

3.4
threshold concentration
pre-set performance target for the individual sources

3.5
reference compound
VOC substance selected to express the screening value concentration

3.6
calibration gas
VOC substance used to adjust the instrument meter reading to a known value

NOTE The calibration gas is usually the reference compound at a predefined concentration.

3.7
response factor
ratio between the actual concentration of VOC present at the location where a screening measurement is made and the observed meter reading

NOTE This ratio represents the correction that shall be applied to the meter reading to take into account that the meter has been calibrated with a calibration gas that can be different from the substance or mix of substances present in a leak.

3.8
calibration precision
degree of agreement between several measurements of calibration gas with the same known concentration

NOTE It is the ratio of the average absolute value of the difference between the meter readings and the known concentration to the known concentration, expressed in percent.

3.9
response time
time interval from a step change in VOC concentration at the input of the sampling system to the time at which 90 % of the corresponding final value is reached as displayed on the instrument readout meter

4.1 Specifications of equipment

1) VOC instrument detector shall respond to the compounds being screened. Detector types that may meet this requirement include, but are not limited to, catalytic oxidation, flame ionisation, infrared absorption, and photo ionisation.
2) Maximum admissible lower detection limit of the detector provided by the manufacturer shall be 10 ppm.
3) Scale resolution of the instrument meter shall be ± 5 % of the threshold concentration.
4) Instrument shall be equipped with a pump so that a continuous sample is provided to the detector. The nominal sample flow rate shall be 0,2 l/min[2)] to 1,2 l/min[2)].
5) Instrument shall be intrinsically safe for operation in explosive atmospheres.
6) Instrument shall be equipped with a probe or probe extension for sampling with a maximum outside diameter of 6,4 mm, with a single end opening for admission of the sample.
7) Instruments used for quantification of fugitive emissions shall have a minimum measurement range up to 50 000 ppm.

4.2 Performance criteria

1) Instrument response factors for the individual compounds to be measured shall be less than 10.

2) Instrument response time shall be equal to or less than 5 s. The response time shall be determined for the instrument configuration to be used during screening.

3) Calibration precision shall be lower or equal to 10 % of the calibration gas value.

4) Evaluation procedure for each of these parameters is given in Annex A.

6.3.1 Scope of survey

1) All leak sources in process service within the vapour pressure limits, as indicated in the scope of this standard, shall be screened.

2) Exclusions are:
items under vacuum (since fugitive emissions from items under vacuum are non-existent).

3) General practice is also to exclude:
items not accessible (i.e. requiring special measures to be monitored, such as scaffolding, ...),
items for which monitoring would require some dismantling, e.g. of insulation,
and items for which monitoring could entail safety issues.
In petroleum refineries, items lower or equal to 50,8mm are normally excluded from sniffing measurements.

4) When specific categories of equipment are excluded from screening, emissions from these points will be based on the methodology described in 6.5, articles 5 and 6.

6.3.2 Screening procedure

1) Place the probe inlet at the surface of the point of equipment where leakage could occur.

2) Move the probe along the interface periphery while observing the instrument readout.

3) If an increased meter reading is observed, slowly sample the interface where leakage is indicated until the maximum meter reading is obtained.

4) Leave the probe inlet at this maximum reading location for approximately twice the instrument's response time, record the results as screening value (ppm).

5) Care should be taken to minimize the effect of the wind when the wind speed exceeds 0,5 m/sec, particularly when working in elevation.

6) Examples of the application of this general technique to specific equipment types are described below and illustrated in Chapter 3 of Reference 1:

— Valve stem: Leaks can occur at the interface between the seal and the stem or the seal and the stuffing box. Place the probe at the interface where the stem exits the packing and sample the stem circumference. Repeat for packing gland nose.

— Flange and other connection (including valve bonnet, valve flanges and body flanges of equipment): Place the probe at the outer edge of the flange-gasket interface and sample the circumference of the flange or connection.

— Pump or compressor seal: Place the probe at the interface of the seal with the shaft and sample the circumference, maintaining the probe tip within 1 cm of the shaft-seal interface. A spacer can be used to avoid direct contact of the probe tip with rotating parts.

— Pressure relief device: For those devices discharging to atmosphere, place the probe inlet at approximately the centre of the exhaust area to the atmosphere. This measures leakage through the normal pressure relief discharge path. No other leakage path is normally expected on these devices.

— Process drains: For open drains, place the probe inlet as near as possible to the centre of the area open to the atmosphere. For covered drains, locate probe at the surface of the cover and move around the periphery.

— Open-ended lines or valves: Place the probe inlet approximately at the centre of the opening to the atmosphere.

— Access door seals: Place the probe inlet at the surface of the door seal interface and move around the periphery.

5 Chemicals / Calibration gases

1) Monitoring instrument is calibrated in parts per million by volume [ppm(*v/v*)] of the reference compound specified in the applicable regulation when possible, or with another calibration gas.

2) Gases required for monitoring and instrument performance evaluation are:

   – zero gas (air, less than 10 ppm VOC);

   – mixture of calibration gas in air with a concentration approximately equal to the threshold concentration specified in the regulation (two different concentrations are used, usually 1 000 ppm and 10 000 ppm).

3) If cylinder calibration gas mixtures are used, the concentration in calibration gas shall be analysed and certified by the manufacturer to be within ± 2 % accuracy, and a shelf life should be certified. Cylinder standards shall be either reanalysed or replaced at the end of the specified shelf life. Alternatively, calibration gases may be prepared by the user according to any documented gas preparation procedure that will yield a mixture accurate to within + or - 2 %. Prepared standards will be replaced each day of use unless it can be demonstrated that no degradation occurs during storage.

4) Calibration may be performed using a compound other than the reference compound provided a conversion factor is determined for that alternative compound in order to convert the resulting meter readings during emission surveys to reference compound measurements.

6.2 Check and adjustment

1) Assemble and start up the VOC analyser according to the manufacturer's instructions. After the appropriate warm-up period and zero internal calibration procedure, introduce the calibration gas into the instrument sample probe.

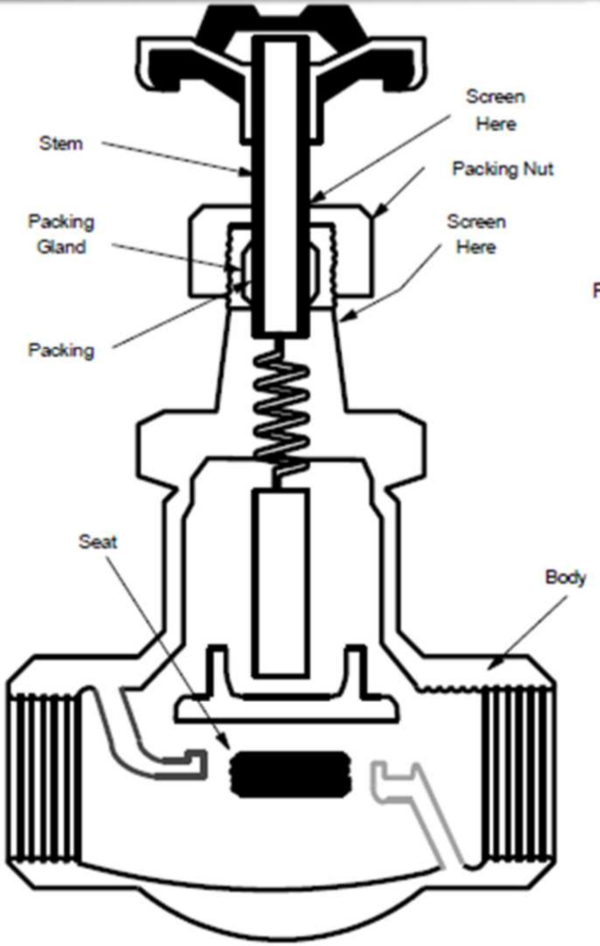
2) Introduce the calibration gas with the highest concentration into the instrument sample probe and adjust the instrument meter readout to correspond to the calibration gas value.

3) If the meter readout cannot be adjusted to the proper value, a malfunction of the analyser is indicated and corrective action should be taken before use.

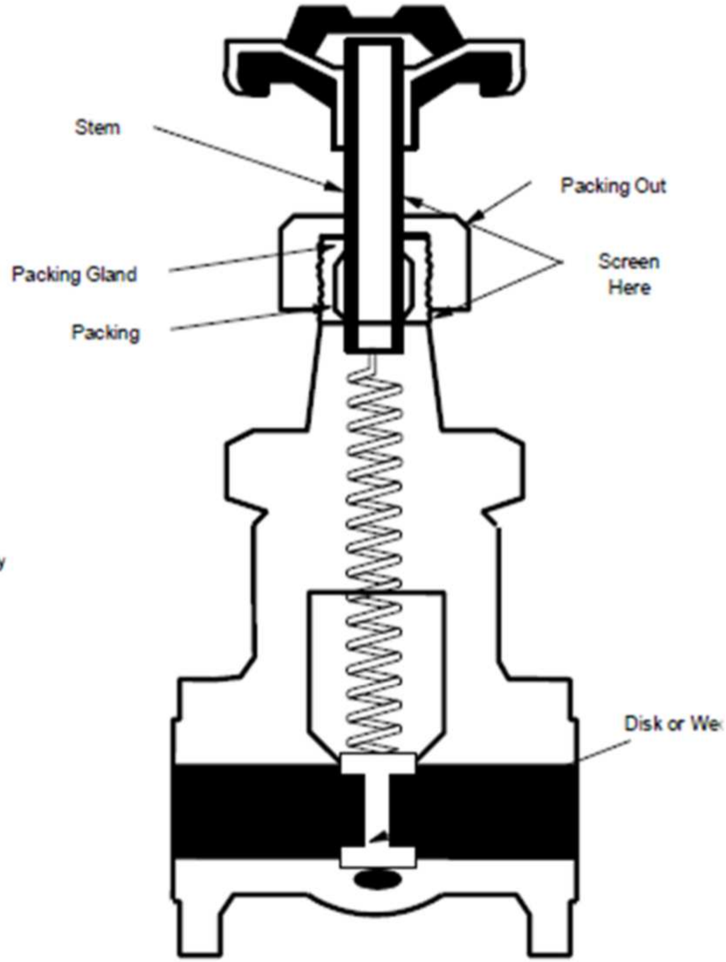
4) Check the instrument with the calibration gas with the lower concentration, according to the manufacturer's instructions[3]). If the reading is within 10 % of the calibration gas concentration, the check is accepted. Otherwise the check procedure needs to be restarted or corrective action is required.

5) Checking of the VOC analyser as per articles 1 to 4 in clause 6.2 should be performed at least once a day, before starting the measurements. If checks are performed during the day and the reading is found to be deviating from the calibration gas concentration by more than 10 %, the instrument needs to be adjusted and re-checked, and screening values obtained since the last correct check will be discarded.

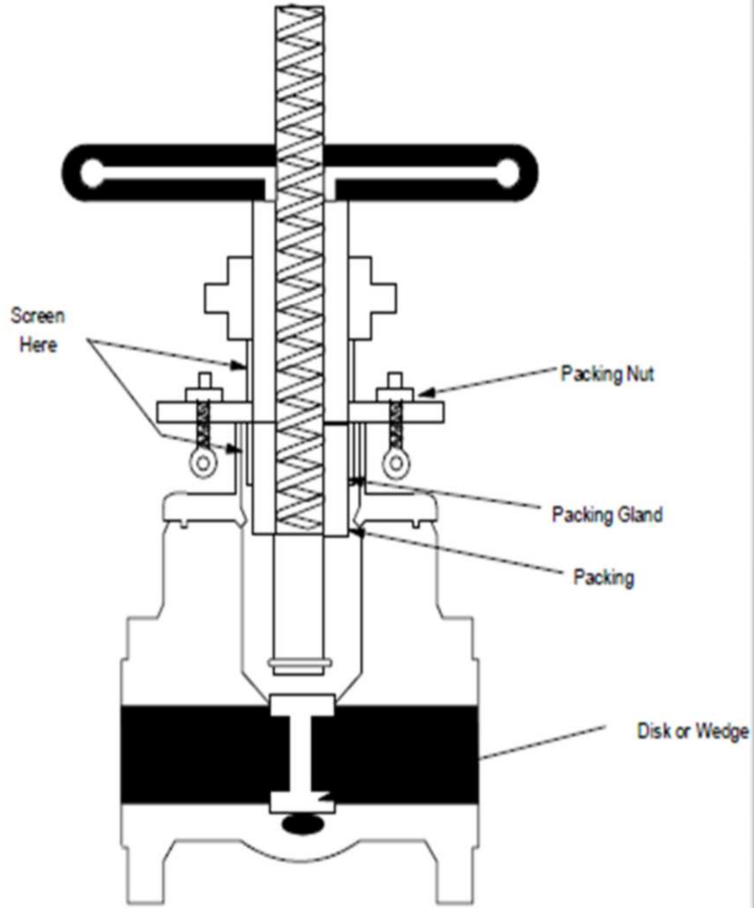
6) A last check shall be performed after the last measurement. Screening values measured since the last correct check with an instrument that is not properly adjusted will be discarded.



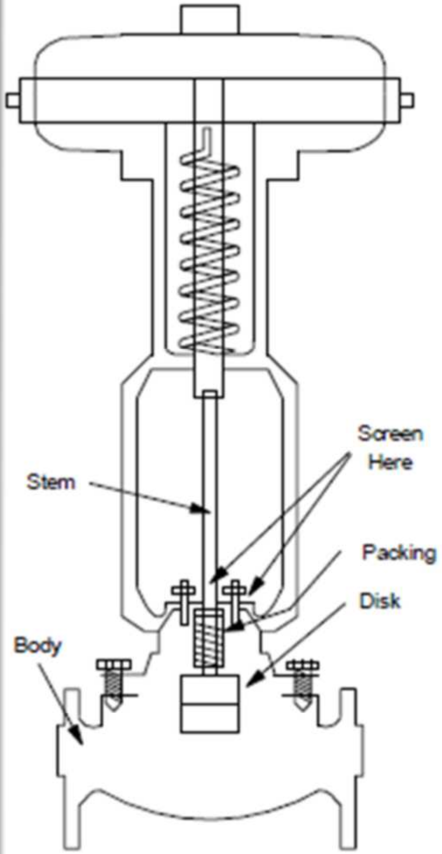
Manual Globe Valve



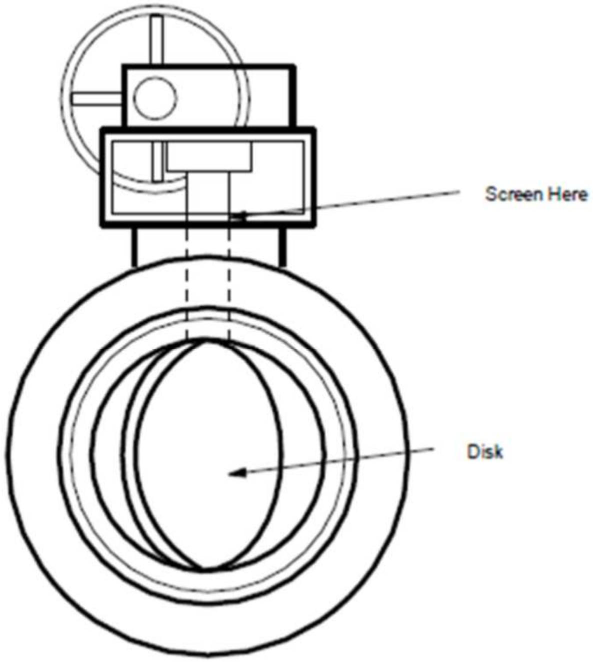
Nonrising Stem Type



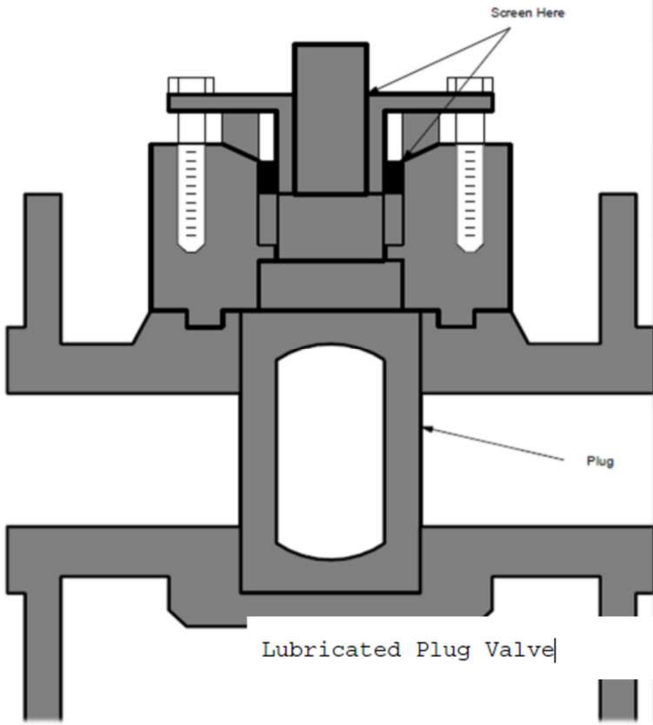
Rising Stem Type



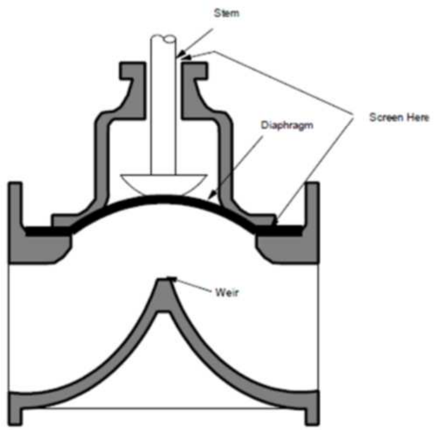
Globe Type Control Valve



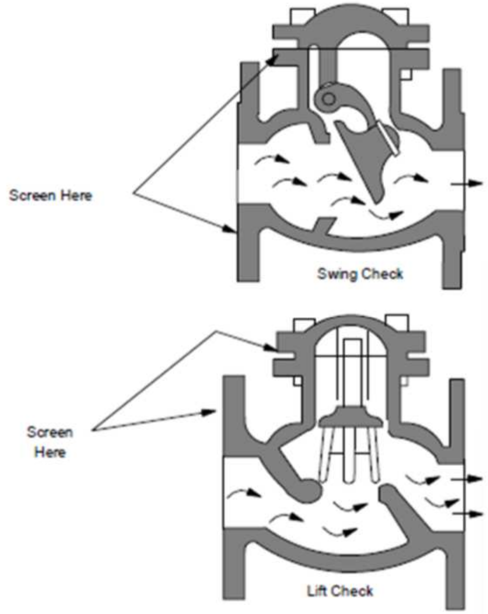
Butterfly Valve



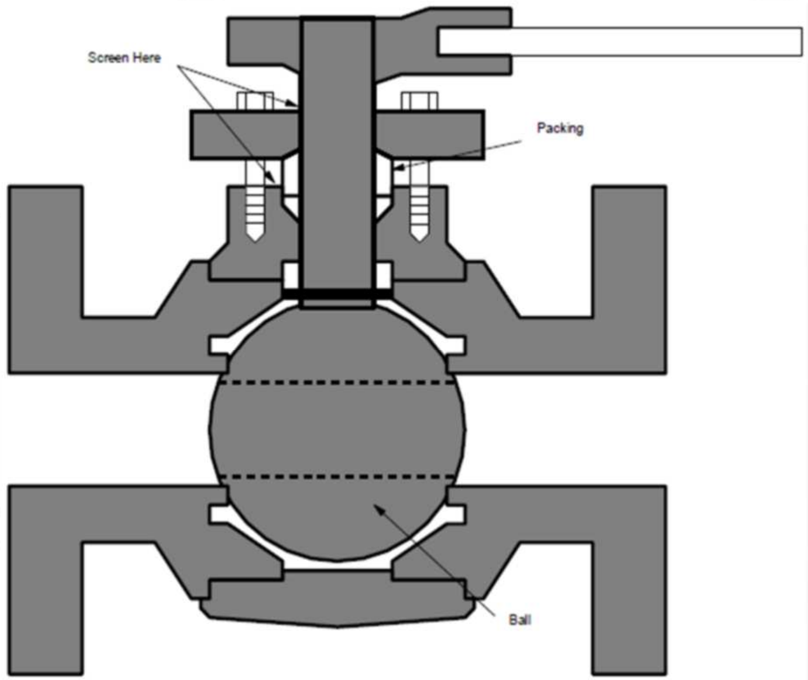
Lubricated Plug Valve



Weir-Type Diaphragm Valve



Check Valves



Ball Valve

United States
Environmental Protection
Agency

Office of Air Quality
Planning and Standards
Research Triangle Park NC 27711

EPA-453/R-95-017
November 1995

Air

EPA

Protocol for Equipment Leak Emission Estimates

FOREWORD

The EPA's protocol for estimating equipment leak emissions is the result of detailed information gathering and data analysis. The protocol was written to provide a thorough understanding of acceptable approaches to generating process unit-specific emission estimates. In preparing this document, the EPA has encouraged knowledgeable individuals in industry and the regulatory community to provide comments.

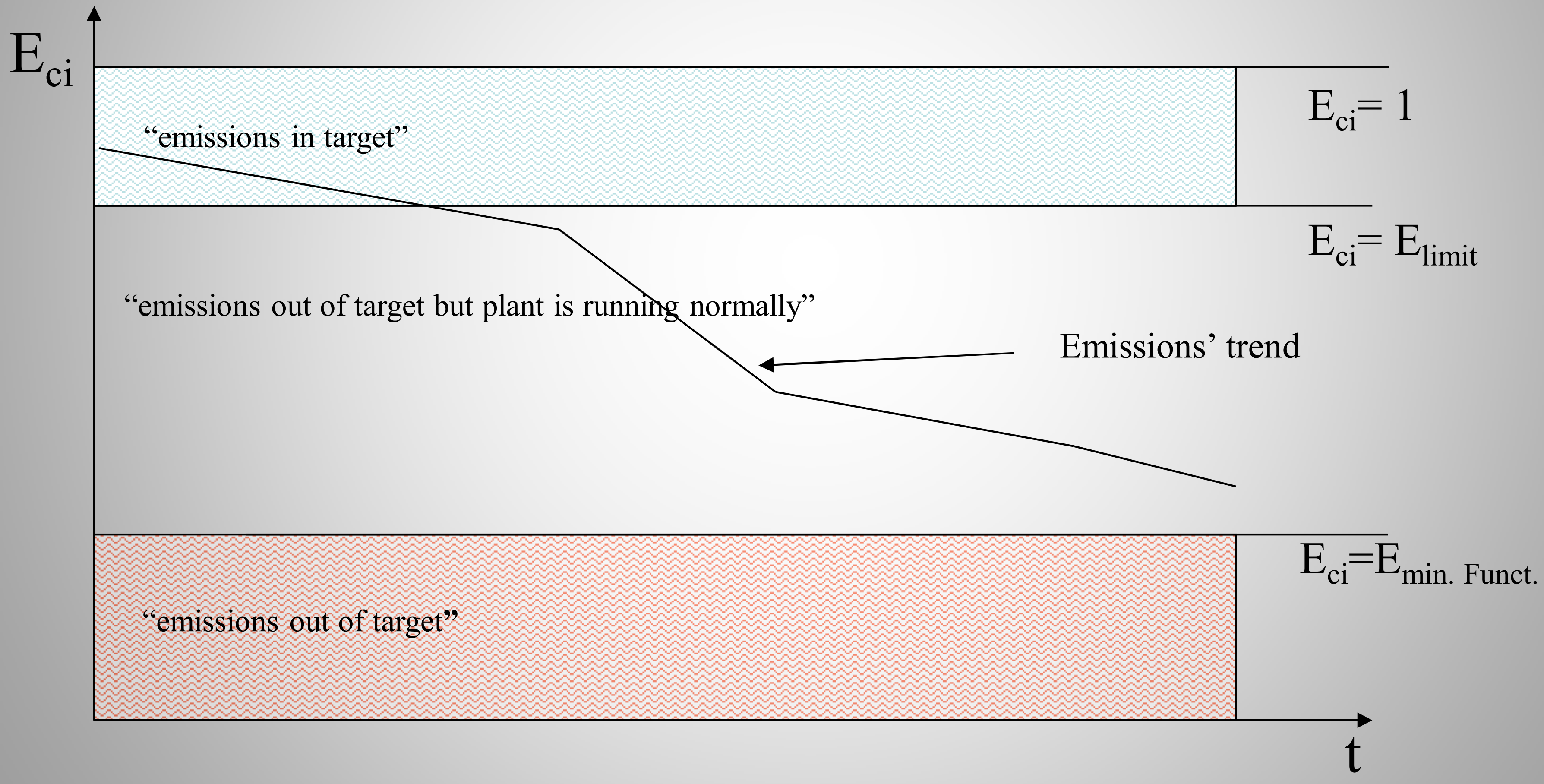
The EPA has put forth considerable effort to make this document as comprehensive as possible. However, it should be understood that not all details and topics pertaining to equipment leaks could feasibly be included in this document. Additionally, it should be understood that the procedures presented in this document are not necessarily suitable for all applications. There will be cases where it will be necessary for the user of the document to make a professional judgement as to the appropriate technical approach for collecting and analyzing data used to estimate equipment leak emissions.

Additional data on equipment leak emissions continues to be collected. It is the intent of the EPA to periodically update this document after analysis of the data warrants such an update. For example, data recently collected in the petroleum industry has been used to revise the existing refinery correlations, which are based on data collected in the late 1970s. Furthermore, as new techniques for collecting and analyzing data are developed, they will be included in updated versions of this document.

Mention of any manufacturer or company name within this document does not represent endorsement by the EPA.

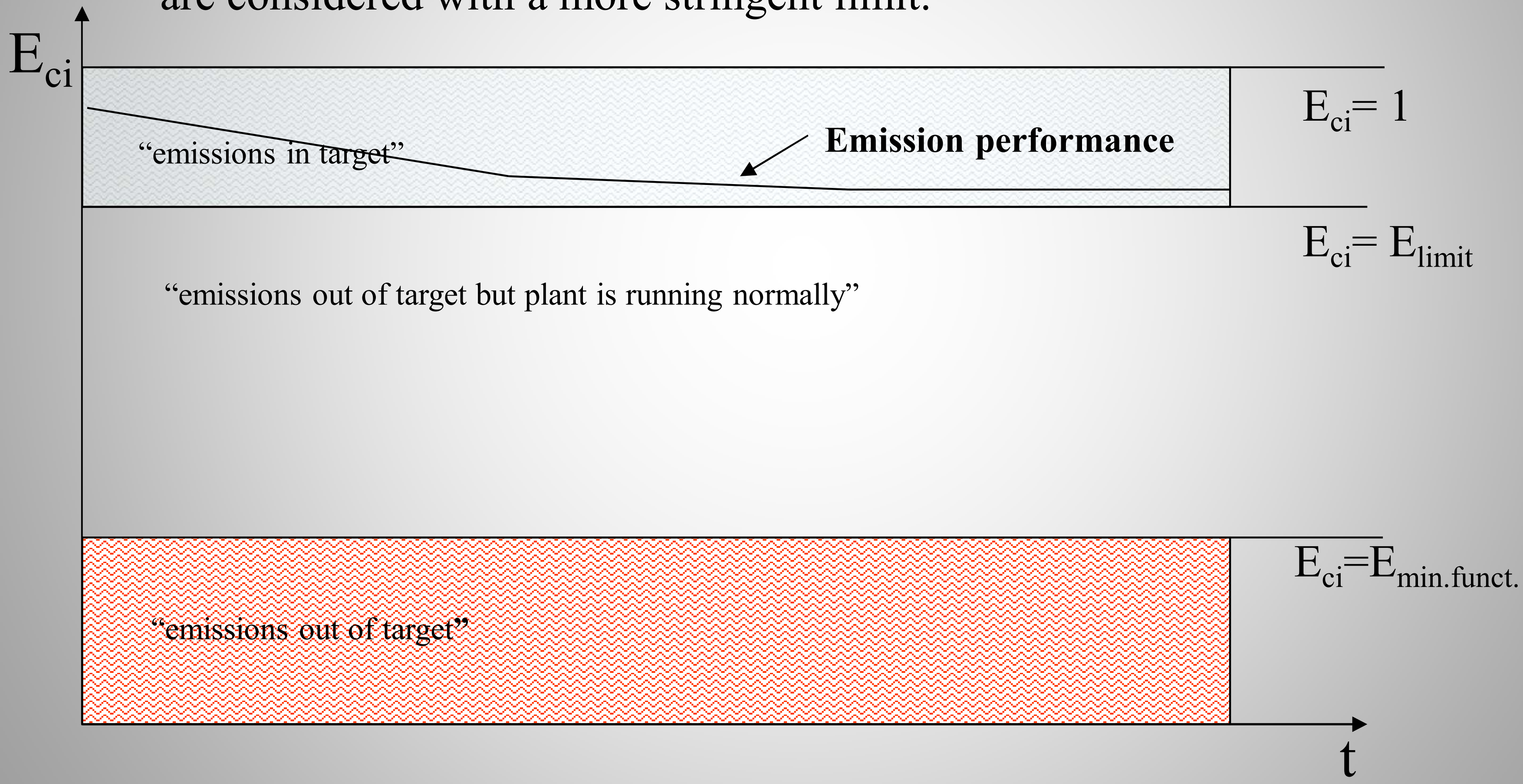
Maintenance target

The goal is to guarantee plant's functioning without out of service.



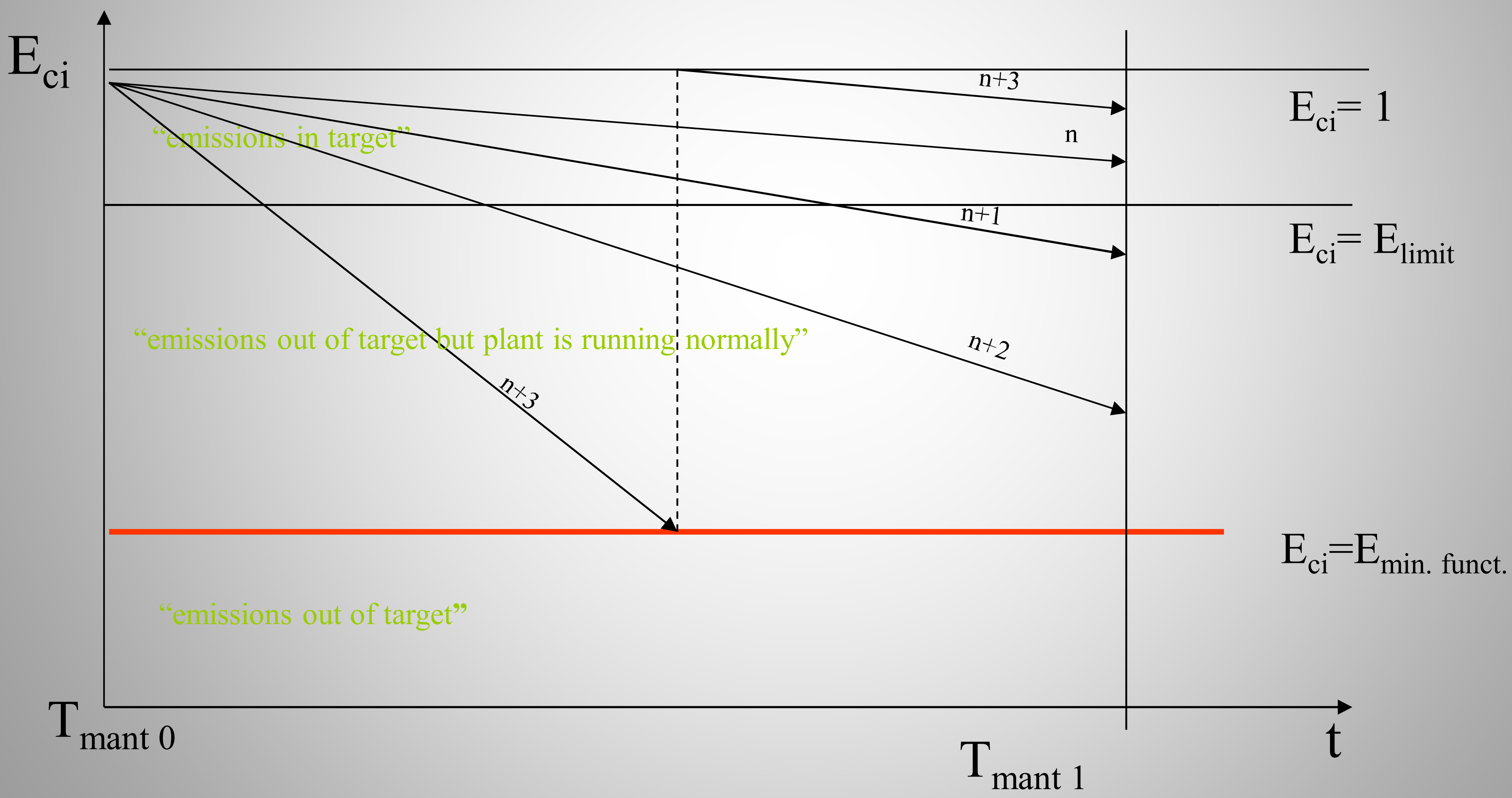
Environmental Target

The goal is to guarantee plant's functioning without out of service and with more stringent control of plant's emissions. The emissions are considered with a more stringent limit.



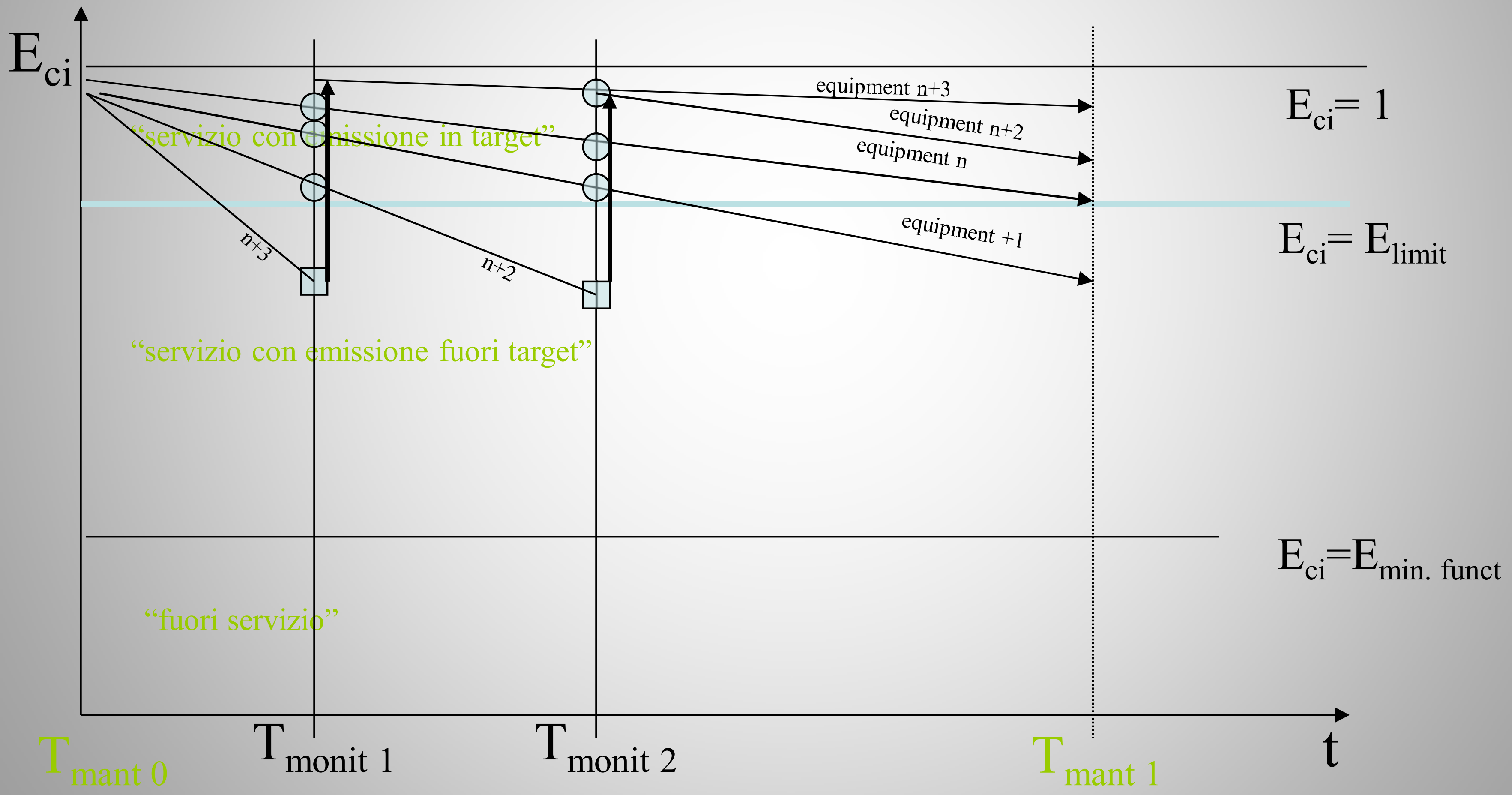
Emissions from process equipment and maintenance target.

The equipment's efficiency (low emissions) decreases time by time. However practically all equipments' performance satisfy maintenance target.



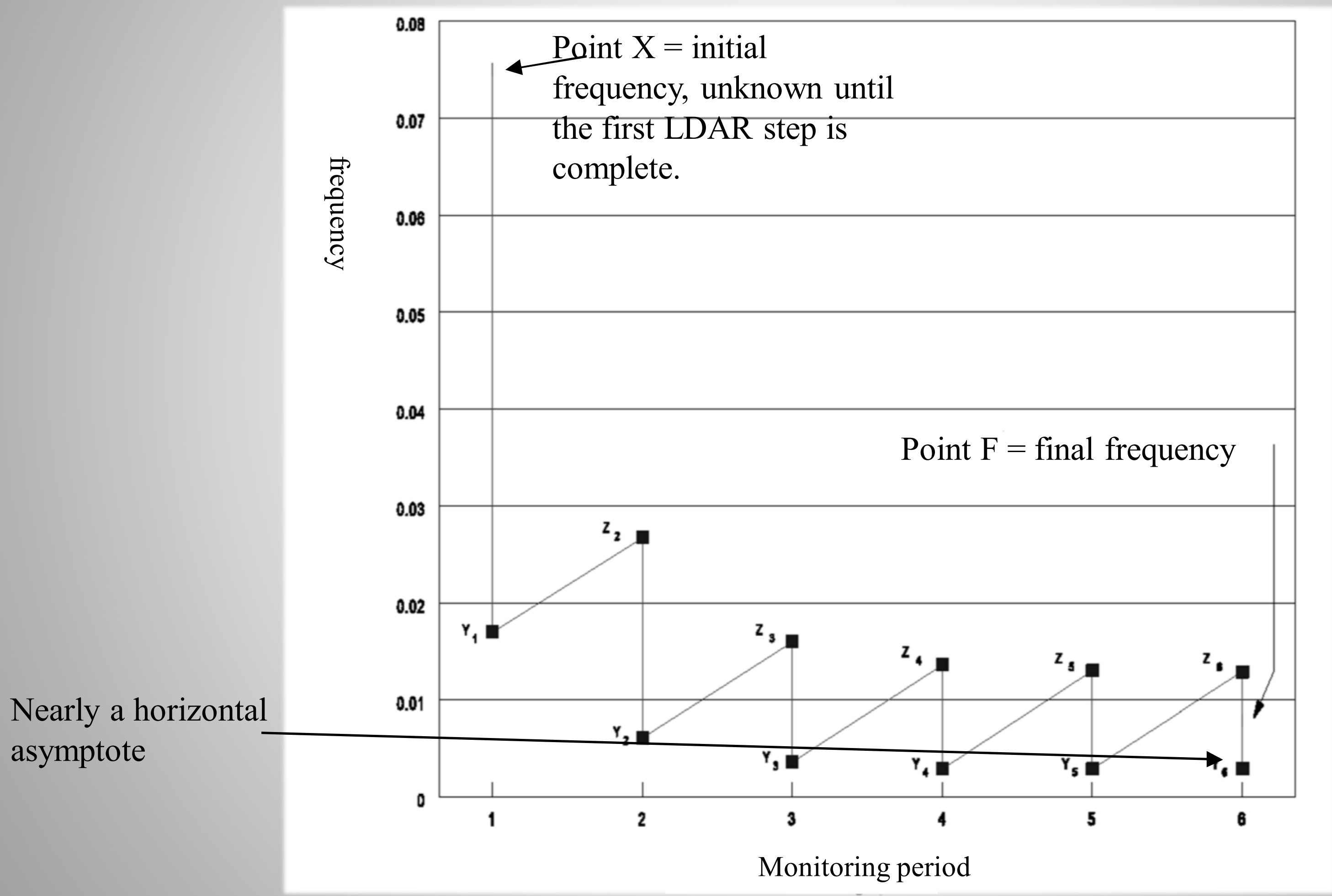
Equipment leak and environmental target

The equipment's efficiency (low emissions) decreases over time. With periodic controls we find the leaks one by one, and we use individual corrective actions in order to restore optimal performance.



LDAR planning

We have to minimize the frequency of equipment's "leak out of the limit" alias 'over the threshold' and improve the global emission performance.



Source: EPA 453/95

Step necessari all'implementazione di un programma LDAR, secondo EPA 453/95

- **Selection of the pertinent process area** (depending on laws, rules, internal targets and policies, etc …);

  Analisi della planimetria generale d'impianto al fine di comprendere le denominazioni in uso ed orientarsi geograficamente al fine di non tralasciare alcune aree o parti di esse.

  - analisi del processo + survey del perimetro

  Verifica della sussistenza di un inventario completo, rispondente ai requisiti della norma, per tutte le aree indicate nella planimetria

- **Selection of P&I/P&ID** (Process and Instrumentation Diagram);

- **Creation of the inventory**, based on the information useful to estimate the emissions (but not only);

- **Collection of screening data** by using a portable monitoring instrument to sample air from potential leak interfaces on individual pieces of equipment ("*LEAK DETECTION-*" in the LDAR's acronym);

- **Data Management**, including **on-site repair operations** ("*-AND REPAIR*" in the LDAR's acronym);

- Creation of an **improvement plan**;

- Emissive status **Report**.

- CHI

  – Criteri di scelta del fornitore

    - Nelle gare d'appalto → il criterio più utilizzato è quello del massimo ribasso
      – Sebbene siano inseriti criteri di valutazione tecnica, questi si limitano abitualmente ad un parere soggettivo della funzione preposta
      – E' comune richiedere una semplice dichiarazione di conformità alla specifica tecnica del Committente
      – Sbilanciamento tra documentazione amministrativa e documentazione tecnica
      – Nonostante LDAR sia implementato da anni e sia prescritta pressoché universalmente la formazione del personale, incluso quello non coinvolto direttamente, le specifiche tecniche:
        » Mancano di requisiti qualificanti il soggetto Appaltatore
        » Richiedono certificazioni et similia non coerenti con l'oggetto
        » Non tengono conto dell'importanza della <u>conservazione del dato</u>

→

- CHI

- In presenza di un migliore bilanciamento tra valutazione tecnica ed economica:
  - I costi aggiuntivi derivanti dalla rigorosa applicazione delle procedure possono essere riconosciuti dal Committente e valorizzati nelle sedi opportune
  - L’introduzione di un criterio oggettivo di valutazione tecnica offre la possibilità di motivare criticamente l’extra-price rispetto al bottom di mercato

  Tale situazione è frequente quando il Committente ha un controllo diretto sull’operatività dell’Appaltatore o esiste un sistema di valutazione approfondito del fornitore, che va oltre la semplice qualifica documentale

- Valutazione della disponibilità ad effettuare attività ‘flessibili’
  - Intervento di ripristino contestuale alle attività di survey
  - Monitoraggio, manutenzione e ri-monitoraggio effettuate dal medesimo soggetto

→

- CHI

  – Punti di forza del fornitore
    - **Qualifiche** di terza parte
    - **Audit documentali** effettuati da terza parte ed interni
    - **Audit in campo** effettuati da terza parte ed interni
    - **Audit di validazione modelli ed algoritmi** di computo

  – Elenco dei tecnici incaricati di effettuare le attività
    - Qualifiche professionali conseguite
    - Abilitazioni ad operare con gli strumenti prescritti
    - Verifiche cadenzate di conformità alle procedure

- QUANDO

  - Data inizio e data fine della campagna di monitoraggio
    - Elemento di verifica:
      - Permessi di lavoro
      - Audit in campo
      - Congruenza mediante analisi delle medie (punti/giorno) ed analisi dello storico

  - Data di presentazione delle risultanze
    - Data di rilascio formale dei report emissivi definitivi e relativi elenchi delle sorgenti fuori soglia

  - Data di presa in carico
    - Sopralluogo tecnico
    - Analisi fattibilità

→

- QUANDO

  - Data di effettuazione delle attività di manutenzione
    - Registrazione delle attività effettuate

      Elemento di verifica:
      - Permessi di lavoro
      - Distinta componenti lavorate o sostituite
    - Valutazione del carico emissivo derivante da uno slittamento

  - Data di ri-monitoraggio
    - In caso di auto-misura: valutazione del soggetto preposto all'effettuazione delle misure ('Chi, Quando')
    - Registrazione del dato ('Come')
    - Riformulazione della stima emissiva ('Quanto')

  - Condizioni meteo
    - Limiti strumentali
    - Limiti o suggerimenti contenuti nella Norma di riferimento

- COME

CENSIMENTO → MONITORAGGIO → RI-MONITORAGGIO → REPORT

- Presenza di procedure scritte assoggettate a controllo di terzi (UNI/ISO,…)
  - Selezione e formazione del personale
    - Training iniziale, analisi dei fabbisogni formativi
    - Test in itinere
    - Integrazione con formazione esterna
    - Attestazione avvenuto completamento della formazione a riguardo di specifiche norme implementate
  - Verifica cadenzata del livello raggiunto e mantenimento dello standard
    - Test teorici e pratici, registrazione
  - Conoscenza della norma
    - Test teorici e pratici, registrazione
    - Audit in campo, azioni correttive
  - Analisi ripetibilità e riproducibilità
    - First/Second/Third Line control

→

- COME

  – Registrazione degli errori, dei reclami e delle azioni correttive

  – Conformità degli strumenti di misura utilizzati
      – Rispondenza ai requisiti della norma
      – Verifica cadenzata del funzionamento

  – Raccolta dati in campo
    - Censimento:
      – Acquisizione fotogrammi digitali a totale copertura del progetto
      – Acquisizione informazioni dai P&I e dai PFD
      – Acquisizione dati contestualmente alla creazione dell'archivio LDAR
    - Monitoraggio
      – Verifica disponibilità di fattori di risposta forniti dal produttore dello strumento
      – Creazione dei coefficienti A e B per la miscela oggetto di analisi
      – Acquisizione dei valori di background
      – Acquisizione delle letture *i*-esime tramite idonea strumentazione

→

- COME

  - Validazione dei dati raccolti
    - Verifica dati calibrazione giornaliera (inizio e fine turno)
    - Verifica completa mappatura del progetto

  - Analisi qualitativa pre-attività, in itinere e post
    - Analisi di applicabilità
    - Rispetto dei requisiti
    - Dove necessario, valutazione di quanto riportato in norme maggiormente descrittive (es. EPA 453/95)

L'Appaltatore può svolgere una azione di analisi e di persuasione tecnica ma non prescrittiva. In ultima istanza sarà il Gestore a decidere il perimetro entro il quale la procedura sarà implementata.

• QUANTO

- Metodologia di computo
  - Procedure di raccolta dati validate internamente e da Enti terzi
  - Registrazione e conservazione dei dati
  - Analisi delle anomalie
    - Anomala ricorrenza di valori interi
    - Anomala ricorrenza di valori doppi
    - Sequenze ripetute
    - Valori emissivi attribuiti a sorgenti isolate o non monitorabili
    - Valori attribuiti a sorgenti rimossi o notoriamente fuori servizio nel periodo oggetto di ispezione
  - Motivazioni circa l’assenza di letture nei database, i ‘buchi’ negli archivi

→

FID (FLAME IONIZATION DETECTOR)

TVA (Toxic Vapour Analyzer)-1000B

Sia FID che PID

FID (FLAME IONIZATION DETECTOR)

Flame Ionization Detection (FID)

A Flame Ionization Detector (FID) measures organic compounds by utilizing a flame produced by the combustion of hydrogen and air. When hydrocarbons in the sample are introduced to the detection zone, ions are produced by the following reaction:

$$RH + O \rightarrow RHO^{+} + e^{-} \rightarrow H_2O + CO_2$$

where

R = carbon compound

A collector electrode with a polarizing voltage is also located within the detector chamber, and the ions produced by this reaction are attracted to it. As the ions migrate towards the collector, a current is produced which is directly proportional to the concentration of hydrocarbons introduced to the flame. This current is then amplified and sent to a microprocessor and/or analog readout device.

The FID has a wide dynamic range. The effective dynamic range can be further expanded by use of a dilutor kit which reduces very high volatile organic compounds (VOC) concentrations to within the dynamic range (or even linear range) of the analyzer. The dilutor kit can also be used to enrich oxygen deficient samples by adding ambient air that is rich in oxygen (20.9% usually). Low oxygen can affect the characteristics of the hydrogen flame, causing readings to be artificially elevated and possibly extinguishing the flame. As a general rule of thumb, greater than 16% oxygen is required to support the flame. If underground gases or samples in gas bags are to be measured by an FID, it is advised that the dilutor be used to combat the problem.

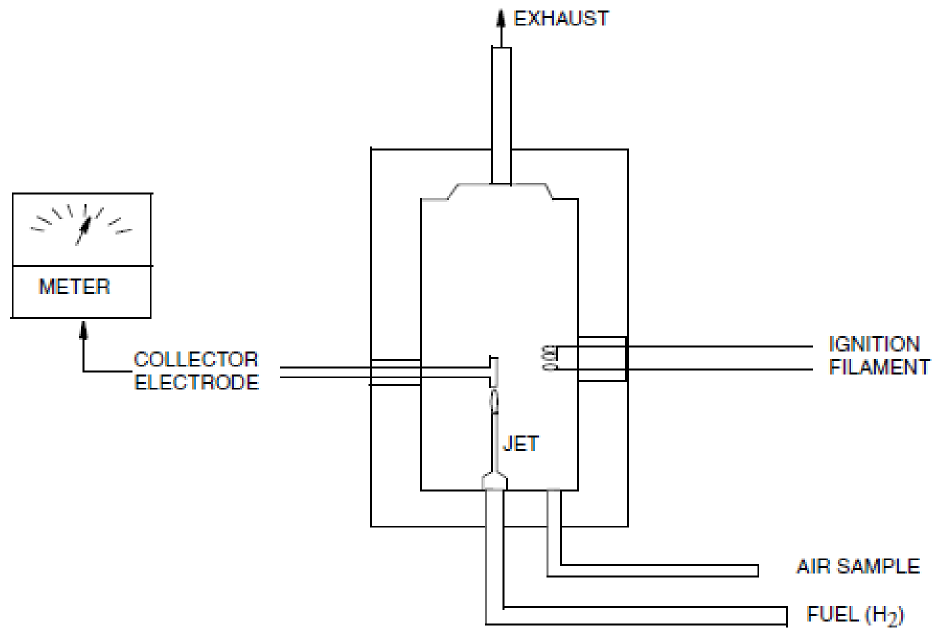


Figure 2. Typical Flame Ionization Detector

PID (PHOTOIONIZATION DETECTOR)

Photoionization Detection

A Photoionization Detector (PID) consists of an ultraviolet (UV) lamp of a specific energy and an ionization chamber. Compounds passing through the chamber are excited by photons of UV energy and ionized according to the following equation:

$$R + h\upsilon \rightarrow R+ + e^-$$

where

R = most organic/inorganic compounds

These ions are attracted to a collecting electrode, producing a current proportional to the concentration of the compound.

Whether or not a compound can be detected by a PID depends upon the energy required to remove an electron from the compound (its ionization potential). If the lamp energy is greater than the compound's ionization potential, the PID will detect it. The standard lamp in the TVA-1000B is 10.6 eV. Other lamps (9.6 and 11.8 eV) are also available. The 11.8 eV lamp permits detection of many compounds not ionized by the standard lamp. The lower energy (10 eV) lamps, however, allow more selectivity by not responding to undesired compounds with a higher ionization potential.

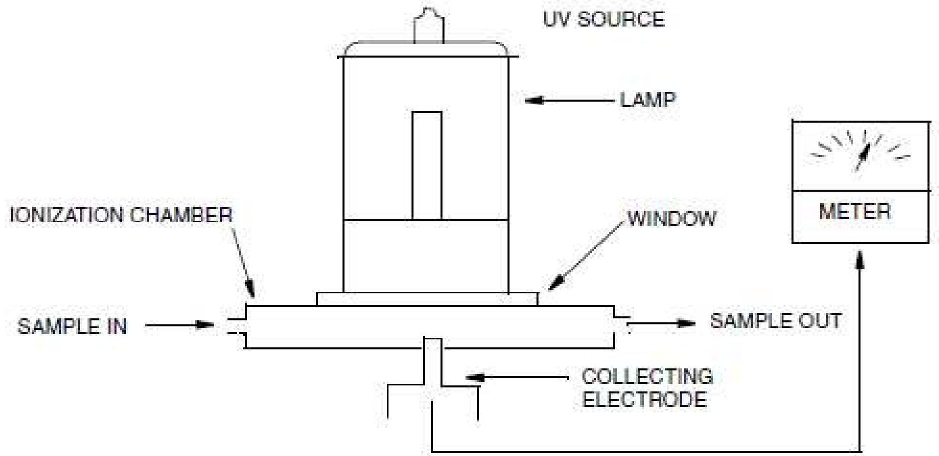


Figure 3. Typical Photoionization Detector

TVA – 1000B

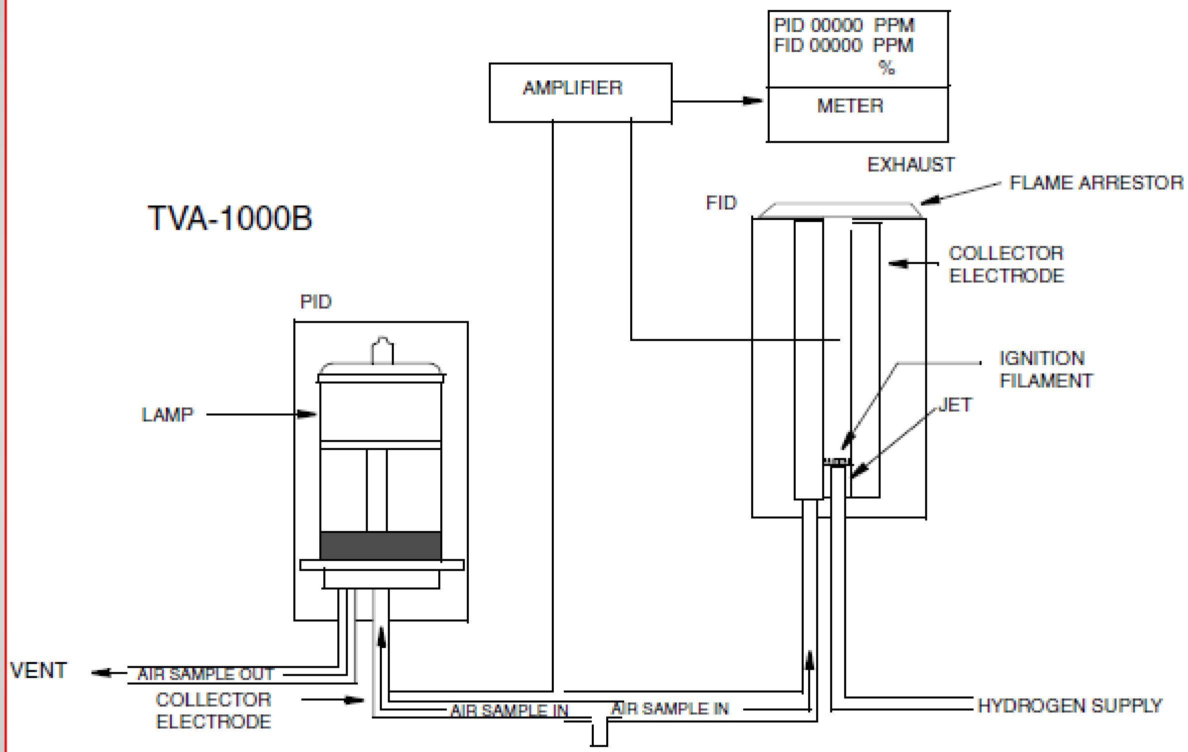


Figure 4. TVA-1000B Dual Detector Configuration

FID (FLAME IONIZATION DETECTOR)

4.1 Specifications of equipment

1) VOC instrument detector shall respond to the compounds being screened. Detector types that may meet this requirement include, but are not limited to, catalytic oxidation, flame ionisation, infrared absorption, and photo ionisation.

2) Maximum admissible lower detection limit of the detector provided by the manufacturer shall be 10 ppm.

3) Scale resolution of the instrument meter shall be ± 5 % of the threshold concentration.

4) Instrument shall be equipped with a pump so that a continuous sample is provided to the detector. The nominal sample flow rate shall be 0,2 l/min[2)] to 1,2 l/min[2]).

5) Instrument shall be intrinsically safe for operation in explosive atmospheres.

6) Instrument shall be equipped with a probe or probe extension for sampling with a maximum outside diameter of 6,4 mm, with a single end opening for admission of the sample.

7) Instruments used for quantification of fugitive emissions shall have a minimum measurement range up to 50 000 ppm.

Source: EN 15446:2008

FID (FLAME IONIZATION DETECTOR)

6.2 Check and adjustment

1) Assemble and start up the VOC analyser according to the manufacturer's instructions. After the appropriate warm-up period and zero internal calibration procedure, introduce the calibration gas into the instrument sample probe.

2) Introduce the calibration gas with the highest concentration into the instrument sample probe and adjust the instrument meter readout to correspond to the calibration gas value.

3) If the meter readout cannot be adjusted to the proper value, a malfunction of the analyser is indicated and corrective action should be taken before use.

4) Check the instrument with the calibration gas with the lower concentration, according to the manufacturer's instructions[3]). If the reading is within 10 % of the calibration gas concentration, the check is accepted. Otherwise the check procedure needs to be restarted or corrective action is required.

5) Checking of the VOC analyser as per articles 1 to 4 in clause 6.2 should be performed at least once a day, before starting the measurements. If checks are performed during the day and the reading is found to be deviating from the calibration gas concentration by more than 10 %, the instrument needs to be adjusted and re-checked, and screening values obtained since the last correct check will be discarded.

6) A last check shall be performed after the last measurement. Screening values measured since the last correct check with an instrument that is not properly adjusted will be discarded.

Source: EN 15446:2008

FID (FLAME IONIZATION DETECTOR)

Calibrazione dello strumento → Ogniqualvolta sia messo in servizio

5 Chemicals / Calibration gases

1) Monitoring instrument is calibrated in parts per million by volume [ppm(*v/v*)] of the reference compound specified in the applicable regulation when possible, or with another calibration gas.

2) Gases required for monitoring and instrument performance evaluation are:

   – zero gas (air, less than 10 ppm VOC);

   – mixture of calibration gas in air with a concentration approximately equal to the threshold concentration specified in the regulation (two different concentrations are used, usually 1 000 ppm and 10 000 ppm).

3) If cylinder calibration gas mixtures are used, the concentration in calibration gas shall be analysed and certified by the manufacturer to be within ± 2 % accuracy, and a shelf life should be certified. Cylinder standards shall be either reanalysed or replaced at the end of the specified shelf life. Alternatively, calibration gases may be prepared by the user according to any documented gas preparation procedure that will yield a mixture accurate to within + or - 2 %. Prepared standards will be replaced each day of use unless it can be demonstrated that no degradation occurs during storage.

Source: EN 15446:2008

FID (FLAME IONIZATION DETECTOR)

09/04/2021

Messers

CARRARA S.P.A
Via Provinciale 1/E
25030 ADRO
BS

Delivery address	Via Provinciale 1/E 25030 ADRO BS
Certificate nr.	4898 (258095 / 1663)
Customer reference	?17?/?02?/?2021 — Customer order date 17/02/2021
Mixture type	Miscela in Lightcyl SmallBombole da 1 L, ALL, Gas — Certified Mixture

Certified composition

Components		Requested		Certificated value	Expanded Uncertainty
METHANE	=	0,4000 %vol	=	0,3987 %vol	0,0078 %vol
NITROGEN		Balance		Balance	
OXYGEN	=	20,85 %vol	=	20,85 %vol	0,17 %vol

The reported uncertainties of the results are based on the standard uncertainties multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95%.

ADR Classification	UN 2037 RECEPTACLES, SMALL, CONTAINING GAS (GAS CARTRIDGES) without a release device, non-refillable
MSDS number	SI-2037_34 — Code for preparation ISO 6142 — Code for analysis ISO 6143
Traceability	Mixture prepared with gravimetric method. The masses used to calibrate the scales has been calibrated by ACCREDIA LAT Centre 55 . Certificate number: 511, 512, 2567, 2568, A1179.

Expanded Uncertainty

0,0078 %vol

0,17 %vol

Mixture prepared with gravimetric method. The masses used to calibrate the scales has been calibrated by ACCREDIA LAT Centre 55 . Certificate number: 511, 512, 2567, 2568, A1179.

FID (FLAME IONIZATION DETECTOR)

Analysis date **18/02/2021**

Guarantee of stability until **18/02/2024**

Notes

Analyst **Monouso**

Analysis date **18/02/2021**

Guarantee of stability until **18/02/2024**

Minimum temperature for use and stock **-20 °C**

Minimum pressure for use **10% Press -25% peso**

Maximum temperature for use and stock **50 °C**

Cyl. capacity (l) **1,0**

Cyl. pressure (bar abs) **12,00**

Cylinders of batch ARQ0318021

da 0001-1663-2021 a 0012-1663-2021

The real pressure in the small capacity cylinders (smaller than 5 liters) can vary from the one stated on the certificate as this one represents the value at the moment of the filling of the mixture. The real pressure might be lower because of the gas used for the required analyses. For the cylinders equal or smaller than 1 liter, if not differently specified, the minimum guaranteed pressure is 100 bar.

Cylinders of batch ARQ0318021

da 0001-1663-2021 a 0012-1663-2021

FID (FLAME IONIZATION DETECTOR)

CARRARA GLOBAL SEALING SOLUTIONS	CALIBRATION OF VOC ANALYZER			MOD110
Verified by:	P. Corsini	Approved by:	I. Ravasio	V2

Strumento codice / Instrument code: 12

NOTA: prima dell'uso del FID è necessario calibrare lo strumento. Se dopo tre consecutivi test di calibrazione, lo strumento risulta essere fuori tolleranza, inviare lo stesso ad una taratura certificata / Before using the FID it is necessary to calibrate the instrument. If, after three consecutive calibration tests, the instrument is found to be out of tolerance, send it for a certified calibration.

Calibrazione / Calibration			Gas zero Calibration (0,0 ppmv)	Highest Gas Concentration	Lowest Gas Concentration	OK / NOT OK	Firma operatore / Operator sign
Data e ora / Date and hour	First check	Last check	*Instrumental Value*	*Instrumental Value*	*Read Value [ppmv] (tolerance ± 10 %) -Vedi NOTA -*		
10/05/22 07:35	X		4311	2145627	4088	OK	[signature]
10/05/22 16:55		X	4337	2146552	4111	OK	[signature]
11/05/22 07:40	X		4328	2146407	4094	OK	[signature]
11/05/22 11:47		X	4323	2146211	4092	OK	[signature]

FID (FLAME IONIZATION DETECTOR)

SIAD

ACCREDIA
L'ENTE ITALIANO DI ACCREDITAMENTO

LAT N° 143

Cod. strumento: 830233030

Certificato: S/0070/21

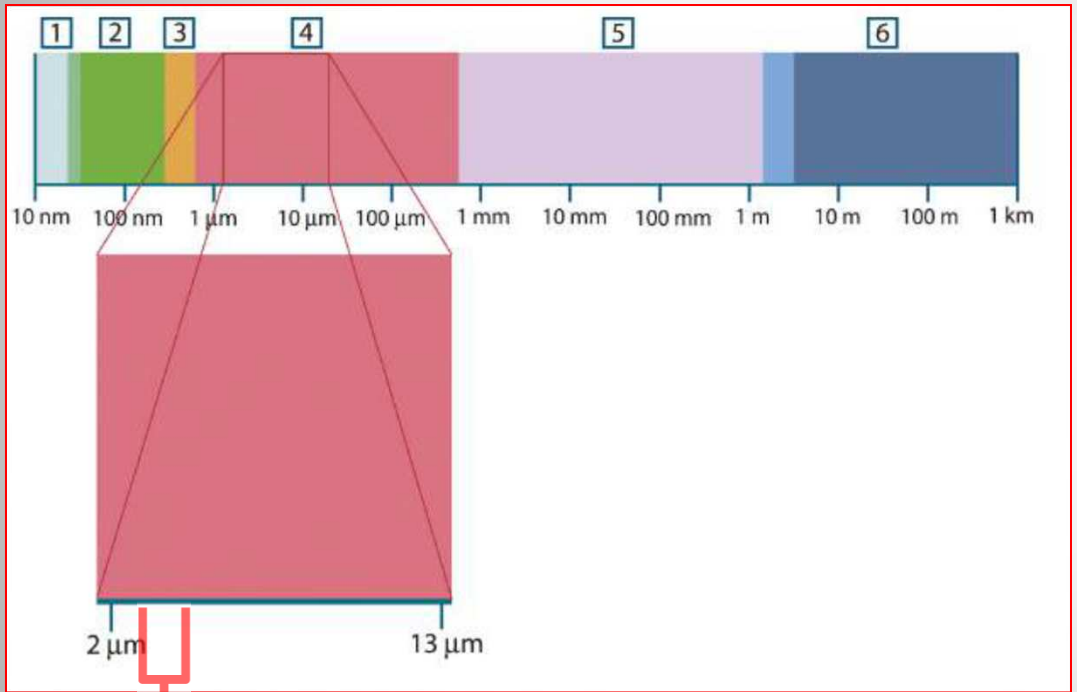
Data Taratura 2021-04-19

Intervallo di taratura :

da : 0,00001 mol/mol a : 0,015 mol/mol

Incertezza massima relativa percentuale: 3,2E+00 %

OGI (OPTICAL GAS IMAGING)



3,2 ÷ 3,4 µm

OGI (OPTICAL GAS IMAGING)

A.1.3 Simple on-site test

A.1.3.1 General

Carry out a simple test to check that the camera is functioning properly at the start of every day of measurements and, if necessary, at intervals throughout the day.

A.1.3.2 Test steps

Rub your hands with hand gel containing alcohol (at least 50 % of ethanol).

Adjust the camera to its most sensitive setting.

Make a recording from a position 2 m from the source of emission.

Store the recording and refer to it in the report.

Shorten the 2 m distance if the emission cannot be made visible.

Document the distance from where the vapour can be seen.

Carry out the extensive laboratory test if the vapour cannot possibly be made visible.

Source: NTA 8399:2015

I PARAMETRI CHE INFLUENZANO LA MISURA

NTA 8399:2015

Decide in advance under what conditions the measurements will or can be carried out. Possible factors include:

— air temperature;

— wind speed;

— humidity;

— process pressure;

— storage temperature;

— how full the tank is;

— manipulation while measuring;

— cloud cover;

— solar strength.

Source: NTA 8399:2015

I PARAMETRI CHE INFLUENZANO LA MISURA

Manuale TVA 1000b

Limiti	Temperatura [°C]	Umidità relativa [%]
Minimo	0	15
Massimo	50	95

EN 15446:2008 - Par. 6.3.2

5) Care should be taken to minimize the effect of the wind when the wind speed exceeds 0,5 m/sec, particularly when working in elevation.

NTA 8399:2015

NOTE 2 It is recommended that no measurements be conducted of emitting sources that have been exposed to fog, precipitation and/or wind force 4 or higher (moderate wind with wind speeds of between 20 km/h and 28 km/h). The visibility of a VOC emission strongly depends on whether it has possibly been blown about and diluted by wind. Laboratory research proves that the detection limit of methane increases from 2 g/h at a wind speed of 7,2 km/h up to 11 g/h at a wind speed of 13,7 km/h.

I PARAMETRI CHE INFLUENZANO LA MISURA

CARRARA®
GLOBAL SEALING SOLUTIONS
Via Provinciale, 1/E – 25030 Adro (BS) Italy
Tel. (+39) 030 7451121 / 030 7457821
Fax (+39) 030 7453238 / 030 7457829
http://www.carrara.it - E-mail: ferp-ldar@carrara.it

ACCREDIA | ISO 9001 BUREAU VERITAS Certification | OHSAS 18001 BUREAU VERITAS Certification | UKAS 008 | Fugitive Emissions Reduction Program F.E.R.P.

mod013 rev.01 dated 20/04/18

TEXT OF SUITABILITY TO OPERATE LDAR SOUNDINGS IN THE FIELD
VLAREM II, Section 4.4.6., version valid from 01.10.2019

Theoretical examination: multiple choice examination, total of 15 questions

To be read carefully

1. The examination questions refer to the training programme for technicians of the FERP division.
2. The outcome of the examination will be indicative of the effectiveness of the training.
3. Mark the answer you consider to be correct with a tick.
4. For the statistic evaluation of the results, the following procedure will apply:
   - Test with **correct answer**: 1 point for each correct answer
5. **ADVICE I)** Firstly, read all the examination questions without answering, in order to introduce yourself to the subject matter. **II)** Before handing your paper in check that you have answered all the questions.
6. Blank test papers devoid of any answer, or with crossed out or substituted answers, or with all the answers ticked, will not be entered into the evaluation statistics.
7. The maximum mark for all correct answers is 15 points. The minimum mark for passing the test is 10 points

I PARAMETRI CHE INFLUENZANO LA MISURA

Par. 5.2

NTA 8399:2015

For the measurements to be conducted properly and the images to be interpreted correctly, the measurement engineer shall have knowledge of infra-red thermography as well as of the installations on which the measurements are carried out. The engineer shall have at least taken a basic training course in infra-red thermography and shall be able to prove this.

NOTE Various training courses on infra-red thermography are available, such as level 1, 2 and 3 training courses or a more specific gas detection course.

Source: NTA 8399:2015

I PARAMETRI CHE INFLUENZANO LA MISURA

NDT OPERATOR QUALIFICATION CERTIFICATE

RINA

No. **20VE00779PN2**

Operator	**FISOGNI DIEGO**		
Born in	**BRESCIA (BS)**	on	**23/10/1985**
Employed by	**CARRARA SPA**		
Located in	**Adro (BS)**		

THIS IS TO CERTIFY that the non destructive test operator is qualified by examinations at the LEVEL 2 according to UNI EN ISO 9712:2012 standard and to RINA Rule RC/C 14

in the method:

INFRARED THERMOGRAPHIA

I PARAMETRI CHE INFLUENZANO LA MISURA

6.3.2 Screening procedure

1) Place the probe inlet at the surface of the point of equipment where leakage could occur.

2) Move the probe along the interface periphery while observing the instrument readout.

3) If an increased meter reading is observed, slowly sample the interface where leakage is indicated until the maximum meter reading is obtained.

4) Leave the probe inlet at this maximum reading location for approximately twice the instrument's response time, record the results as screening value (ppm).

Source: NTA 8399:2015

NTA 8399:2015 | 8 Practical aspects of conducting the measurements

— Perform an accurate and systematic round of measurements on the basis of the measuring plan, while preventing exposure to released VOC emissions as much as possible.

— Record a continuously emitting source for at least 10 s (per recording mode and filming position).

— Record a fluctuating emission source for at least 10 s or for as much longer as is necessary to make its fluctuating character visible (per recording mode and filming position).

— If possible, film around the emitting source.

— Make a visual recording (non-IR) of the emission source. The visual recording of the source shall also make the surroundings of the source visible, so that the reason for the leak becomes as clear as possible.

NOTE A visual recording of the emitting source may be a photo or a film lasting at least 5 s.

METODOLOGIA DI COMPUTO

EN15446:2008

FID (Flame Ionization Detector) → ppmv come metano

6.4 Determination of the mass emission rate

6.4.1 Response factor

1) Response factors should be used whenever possible to correct the screening value indicated by the instrument for differences in response between the vapour being measured and the gas used for calibration. These may be provided by equipment manufacturers either as single values or per strata of concentration.

2) For pure chemicals, response factors corresponding to the measured concentration strata provided by the instrument manufacturer shall be used. If not available, response factors shall be determined by measurement of samples of the vapour to be screened having a known composition. Alternatively, response factors can be approximated by analogy with similar chemical species.

3) For chemical mixtures, a theoretical calculation of the response factor of the mix can be used as an alternative to direct measurement. This calculation shall be based on a reasonable approximation of the stream composition and on the response factors provided by the equipment manufacturer (or determined by the user) for each individual component. The calculation method is provided in Annex B.

4) Depending on the instrument, the response factors of streams present in most refinery or petrochemical units will usually be in the range of 0,5 to 1,3. In this case the use of response factors is optional[4]).

Source: EN 15446:2008

METODOLOGIA DI COMPUTO

EN15446:2008

Screening Value → SVA (Screening Value Adjusted)

→ RF

⇩

Response Curve

Response factors can change as concentration changes. The response factor for a compound determined at 500 ppm may not be the same as the response factor determined at 10,000 ppm. By using a *response curve,* you can characterize a compounds response over a broader range of concentrations. If the actual concentration is plotted as Y vs. X (measured concentration), the resulting curve can be represented by the rational equation

$$Y = \frac{AX}{\left(1 + \frac{BX}{10000\text{ppm}}\right)}$$

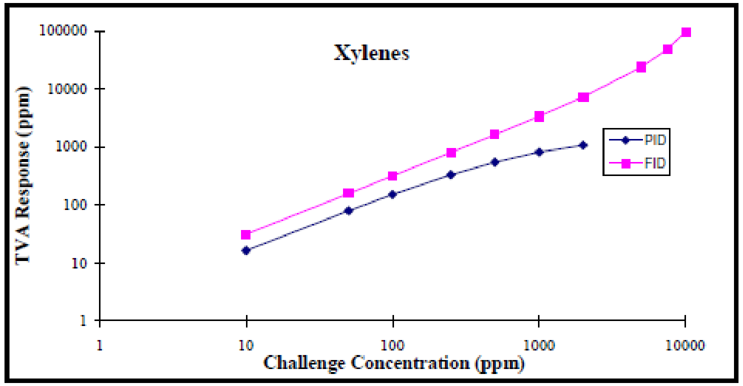
Source: EPA 453_R_95_017

METODOLOGIA DI COMPUTO

EN15446:2008

Xylenes

Challenge Concentration (ppm)	Thermo/TVA-1000A (or equivalent) Relative Response Factor PID	FID	EPA/TVA-1000B (or equivalent) Response Factor Multiplier PID	FID
10	1.603	2.790	0.605	0.319
50	1.569	2.802	0.630	0.318
100	1.529	2.817	0.662	0.317
250	1.420	2.860	0.758	0.314
500	1.269	2.933	0.917	0.308
1000	1.046	3.079	1.236	0.298
2000	0.774	3.371	1.873	0.276
5000		4.246		0.212
7500		4.975		0.158
10000		5.704		0.104



PID Lamp (eV): 10.6

TVA-1000B Response Curve Coefficients:		A	B
	PID	0.60	-6.38
	FID	0.32	0.21

Source: Thermo Fisher Scientific

METODOLOGIA DI COMPUTO

EN15446:2008

Annex B
(normative)

Calculation of response factor for mixtures

The response factor of a mixture can be based on the response factor of each individual component through the equation:

$$RFm = 1 / (X1/RF_1 + X_2/RF_2 + \ldots + X_n/RF_n) \quad \text{(B.1)}$$

where:

RFm	is the response factor of the mixture;
X_1, X_2, … Xn	is the mole fraction of the various constituents in the mixture;
RF_1, RF_2,… RF_n	are the response factors of the various constituents in the mixture.

Source: EN 15446:2008

METODOLOGIA DI COMPUTO

EN15446:2008

Par. 6.4.2.7

Background concentration

Le misurazioni devono essere rilevate al netto del “rumore di fondo” (valore in ppmv misurato dallo strumento nei camminamenti nell’intorno delle linee di processo)

METODOLOGIA DI COMPUTO

EN15446:2008

6.4.2 Correlation

1) Screening values (in ppm) corrected by response factors as required in 6.4.1 shall be converted into leak rates (in kg/h per leak) by using correlations. Several sets of correlations are available. The most frequently used sets of correlations are these published by the US EPA, namely the SOCMI correlations (developed for the Chemical industry) and the Petroleum Industry correlations. These are described in Annex C.

↓

$$kg/h = A \times (SVA)^{\wedge B}$$

METODOLOGIA DI COMPUTO

EN15446:2008

Table C.1 – US EPA SOCMI correlation parameters and factors

Source	Service	*A*	*B*	Pegged value at 10.000 ppm (kg/h)	Pegged value at 100.000 ppm (kg/h)	Average factor (kg/h)
Valve	Gas	$1{,}87 \times 10^{-6}$	0,873	0,024	0,110	0,00597
Valve	Light liquid	$6{,}41 \times 10^{-6}$	0,797	0,036	0,150	0,00403
Pump seal[6])	Light liquid	$1{,}90 \times 10^{-5}$	0,824	0,140	0,620	0,0199
Connector	All	$3{,}05 \times 10^{-6}$	0,885	0,044	0,220	0,00183

Additional average emission factors are available for the following components:

compressor seals (gas service): 0,228 kg/h

relief valves (gas service): 0,104 kg/h

open ended lines (all services): 0,0017 kg/h

sampling connections (all services): 0,015 kg/h

METODOLOGIA DI COMPUTO

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Table C.2 – US EPA Petroleum Industry correlation parameters and factors

Source	Service	*A*	*B*	Pegged value at 10.000 ppm (kg/h)	Pegged value at 100.000 ppm (kg/h)	Average factor (kg/h)	Average factor for Marketing Terminal Equipment (kg/h)
Valve	Gas	$2,29 \times 10^{-6}$	0,746	0,064	0,140	0,0268	0,000013
Valve	Light liquid	$2,29 \times 10^{-6}$	0,746	0,064	0,140	0,0109	0,000043
Pump seal	All	$5,03 \times 10^{-5}$	0,610	0,074	0,160	0,114	0,00054
Connector	All	$1,53 \times 10^{-6}$	0,735	0,028	0,030	0,00025	0,000042
Flange	All	$4,61 \times 10^{-6}$	0,703	0,085	0,084	0,00025	0,000042
Open end	All	$2,20 \times 10^{-6}$	0,704	0,030	0,079	0,0023	0,00013
Other[7])	All	$1,36 \times 10^{-5}$	0,589	0,073	0,110	see below	0,00013

Additional average emission factors are available for the following components:

compressor seals (gas service): 0,636 kg/h

relief valves (gas service): 0,160 kg/h

sampling connections (all services): 0,015 kg/h

METODOLOGIA DI COMPUTO

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Par. 6.4.2

5) For screening values exceeding the range of measurements (most frequently 100 000 ppm), a fixed emission factor (so-called "pegged" factor) is used. For US-EPA correlations, pegged factors are provided in Annex C corresponding to a maximum reading of 100 000 ppm. If measurements are made to a maximum that is lower than 100 000 ppm, another fixed ("pegged") emission factor shall be used to calculate emissions corresponding to all screening values above 10 000 ppm (also provided in Annex C). If measurements are made to a maximum that is higher 100 000 ppm, the correlation shall be used for all data that are within the measurement range of the equipment, and pegged values at 100 000 ppm shall be used for values beyond the data range of the equipment.

METODOLOGIA DI COMPUTO

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Non esiste un'emissione pari a Zero

TABLE 2-11. DEFAULT-ZERO VALUES: SOCMI PROCESS UNITS

Equipment type	Default-zero emission rate (kg/hr/source)[a]
Gas valve	6.6E-07
Light liquid valve	4.9E-07
Light liquid pump[b]	7.5E-06
Connectors	6.1E-07

TABLE 2-12. DEFAULT-ZERO VALUES: PETROLEUM INDUSTRY

Equipment type/service	Default-zero emission rates[a,b] (kg/hr/source)
Valves/all	7.8E-06
Pump seals/all	2.4E-05
Others[c]/all	4.0E-06
Connectors/all	7.5E-06
Flanges/all	3.1E-07
Open-ended lines/all	2.0E-06

STIMA EMISSIVA

EN15446:2008

Kg/h → Mg/anno

Ore di funzionamento effettive dell'impianto

8.760 ore/anno

STIMA EMISSIVA

EN15446:2008

Sorgenti «non monitorabili»	→	Isolate/coibentate o non raggiungibili
Sorgenti in manutenzione	→	Non misurabili al momento dell'ispezione

Viene attribuito il fattore emissivo medio calcolato sulla base delle letture disponibili: ad ogni tipo di componente viene assegnato il fattore medio calcolato sui medesimi componenti e con la medesima fase dello stream presso il medesimo impianto

Alternativa → Average factor

STIMA EMISSIVA

EN15446:2008

Tutto Zero Default

Componente	N.ro componenti	Computo emissivo [kg/h]
Flange/Connessioni	4.000	0,00244
Valvole	900	0,00044
Fine linea	50	0,00003
PSV	40	0,00030
Pompe	10	0,00008
	5.000	**0,00329**

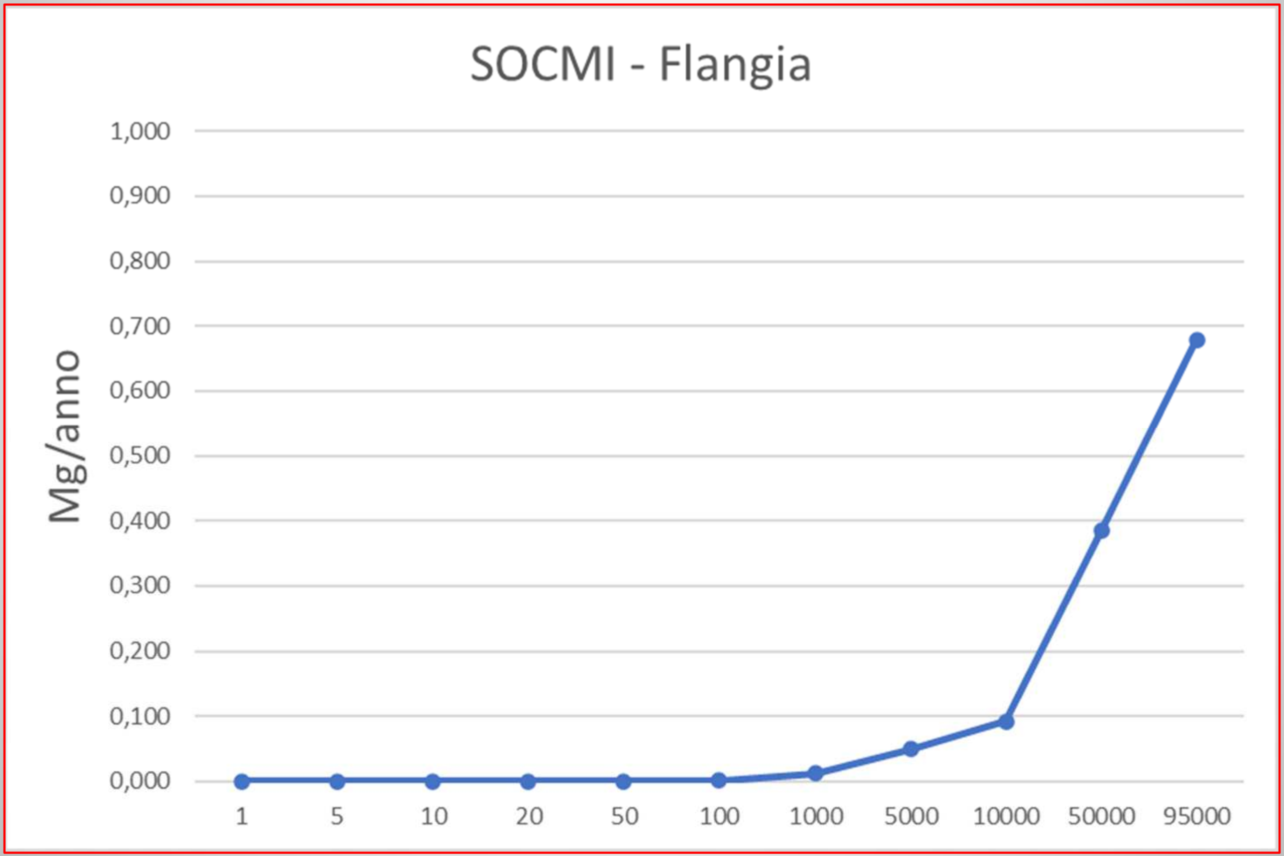
0,029 Mg/anno (8.760h)

Lettura [ppmv]	kg/h COV	Mg/anno COV
1	3,05E-06	2,67E-05
5	1,27E-05	1,11E-04
10	2,34E-05	2,05E-04
20	4,32E-05	3,79E-04
50	9,72E-05	8,52E-04
100	0,00018	0,0016
1000	0,00138	0,0121
5000	0,00573	0,0502
10000	0,01058	0,0926
50000	0,04394	0,3849
95000	0,07755	0,6793
Of	0,22	1,9272

Componente	Pegged value 100.000 ppmv	
	kg/h	Mg/anno
Flange/Connessioni	0,22	1,93
Valvole	0,15	1,31
Fine linea	0,22	1,93
PSV	0,62	5,43
Pompe	0,62	5,43

STIMA EMISSIVA

EN15446:2008



STIMA EMISSIVA

EN15446:2008

Focus su «BIG LEAKERS»

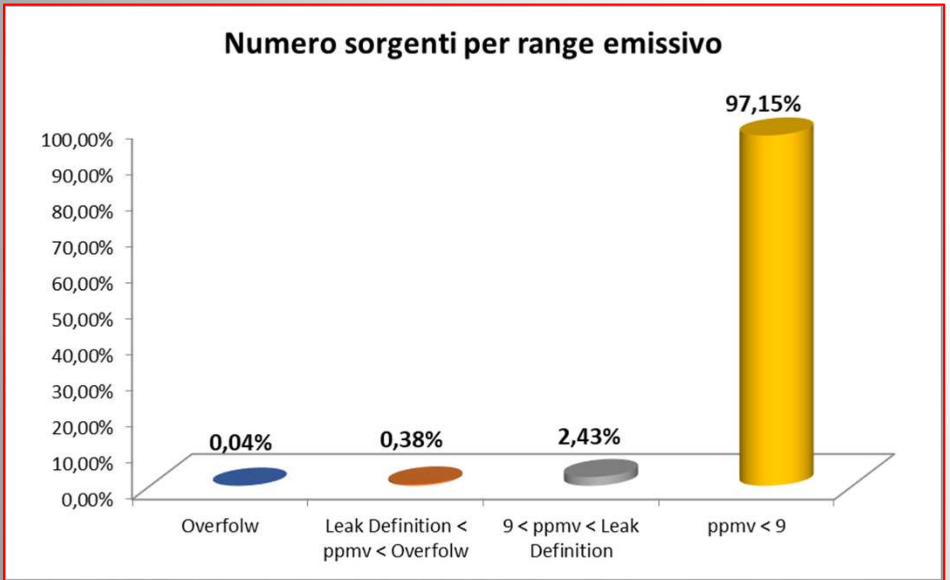
Focus su perdite «croniche»

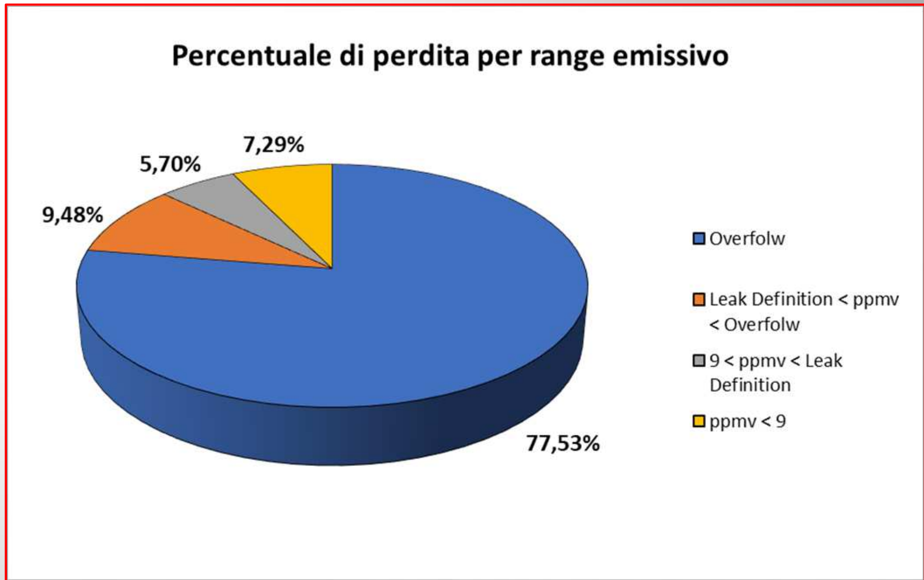
Capire motivazione

STIMA EMISSIVA

EN15446:200

Range emissivo	Nr. Componenti	kg/h COV	Perdita %
Overflow	1	0,0840	77,53%
Leak Definition < ppmv < Overfolw	9	0,0103	9,48%
9 < ppmv < Leak Definition	58	0,0062	5,70%
ppmv < 9	2.319	0,0079	7,29%
Totale	**2.387**	**0,1083**	**100,00%**





LA CURA DEL DATO

Procedure ben definite per la raccolta dati e per la loro registrazione e archiviazione

↓

Software di supporto

↓

Opportunamente validato → Ente terzo?

LA CURA DEL DATO

Sistema di Gestione Qualità

- Riesame della Direzione
- Audit interni
- Audit in campo
- Gestione reclami e NC
- Formazione e valutazione
- First / second / third line control

LA CURA DEL DATO

Third line control

Test ripetibilità

Test riproducibilità

LA CURA DEL DATO

Anomalie nell'acquisizione

- Buchi nel database, mancanza del dato analitico;
- Errori nell'assegnazione delle informazioni; caratterizzanti la singola sorgente;
- Errori nell'attribuzione del stato di accessibilità o di isolamento;
- Errori in campo di rilievo della misura in caso di sorgenti adiacenti.

LA CURA DEL DATO

Anomalie nell'acquisizione

- Anomala ricorrenza di valori interi;
- Anomala ricorrenza di valori doppi;
- Sequenze ripetute;
- Valori emissivi assegnati a sorgenti isolate o non monitorabili;
- Valori emissivi assegnati a sorgenti palesemente fuori servizio;
- Grande numerosità di sorgenti e zero perdite…

ANALISI DEL REPORT FINALE

8 Report

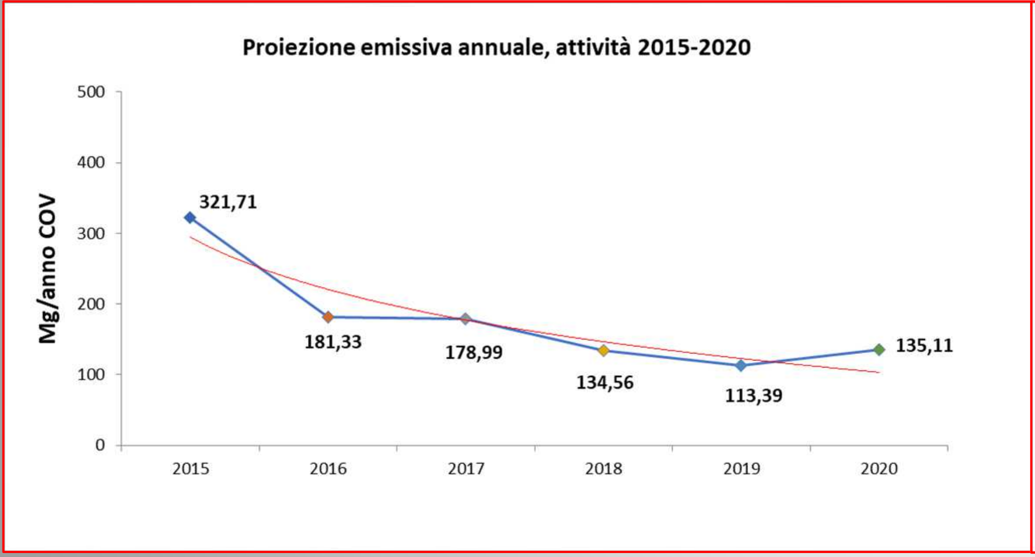
Emission reports shall include the following information:

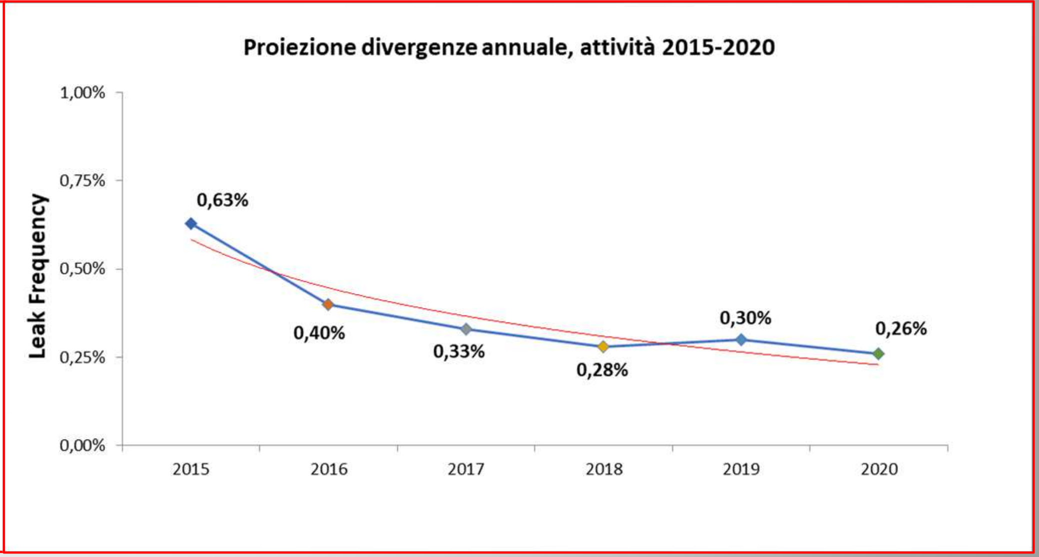
- scope of the report (facility, type and size of equipment measured, streams, purpose, reporting period);
- results expressed in mass per year (indicating how this mass is specified: as reference compound equivalent, carbon equivalent, actual composition of emission ...);
- characteristics of instrument used;
- response factors that have been used. In case these are provided per concentration strata by the manufacturer, these values should be provided. Source of information for response factors. Substances for which response factor is unknown shall be indicated.
- value of the threshold concentration;
- which correlation is used;
- which pegged value is used;
- max. ppm used in correlations;
- number of components measured during the reporting period;
- number of components measured in a previous reporting period;
- number of components never measured;
- handling of equipment not measured;
- grouping of equipment in case average leak rates are derived from plant data.

CASE HISTORY

LEAK DEFINITION = 10.000 ppmv				
Anno	N.ro divergenze	Leak Frequency	kg/h COV	Mg/anno COV
2015	524	0,63%	36,7250	321,7110
2016	334	0,40%	20,7002	181,3338
2017	278	0,33%	20,4329	178,9922
2018	235	0,28%	15,3611	134,5632
2019	257	0,30%	12,9435	113,3851
2020	224	0,26%	15,4236	135,1107

Abbattimento del 58%

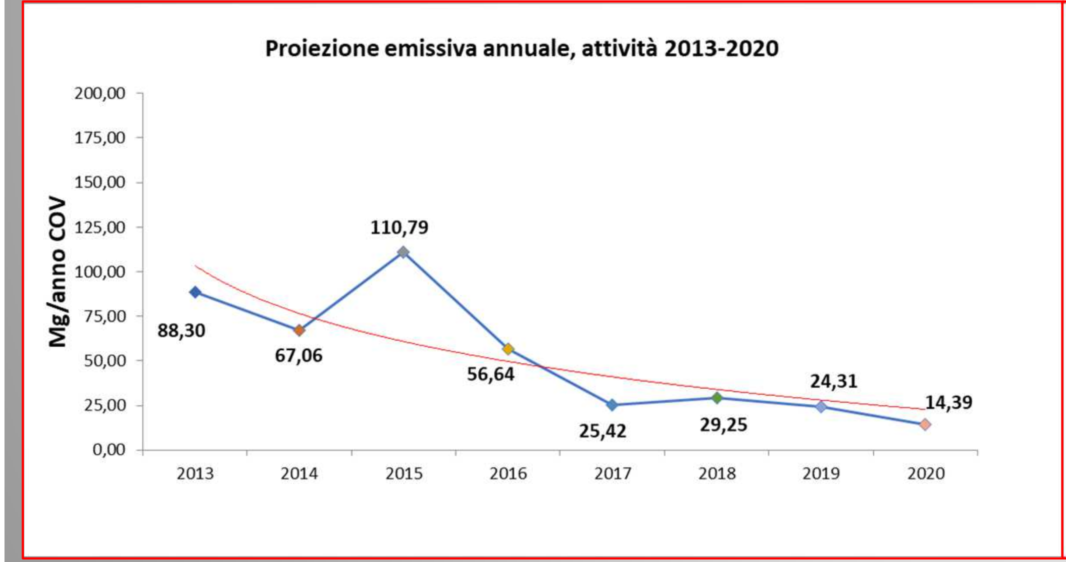


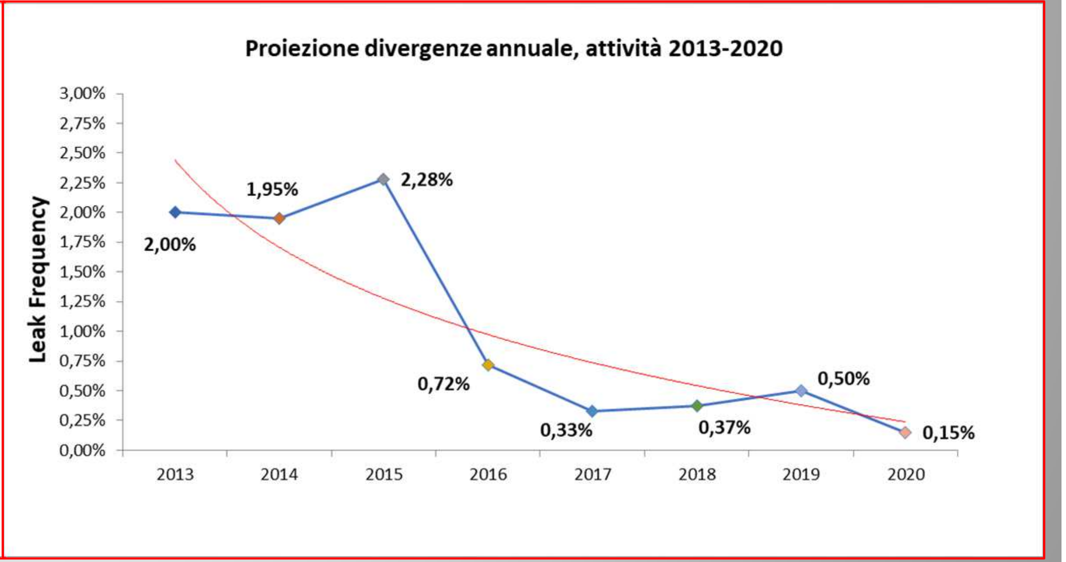


CASE HISTORY

LEAK DEFINITION = 10.000 ppmv				
Anno	**N.ro divergenze**	**Leak Frequency**	**kg/h COV**	**Mg/anno COV**
2013	166	2,00%	10,0800	88,3008
2014	162	1,95%	7,6550	67,0578
2015	189	2,28%	12,6469	110,7868
2016	65	0,72%	6,4656	56,6387
2017	30	0,33%	2,9014	25,4163
2018	34	0,37%	3,3394	29,2531
2019	45	0,50%	2,7753	24,3116
2020	14	0,15%	1,6431	14,3936

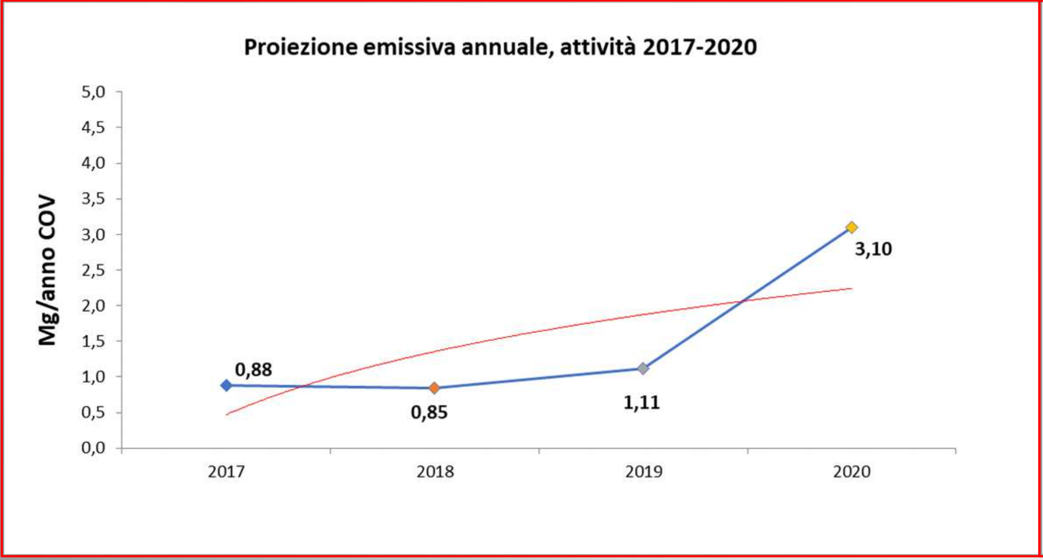
Abbattimento del 83,7%

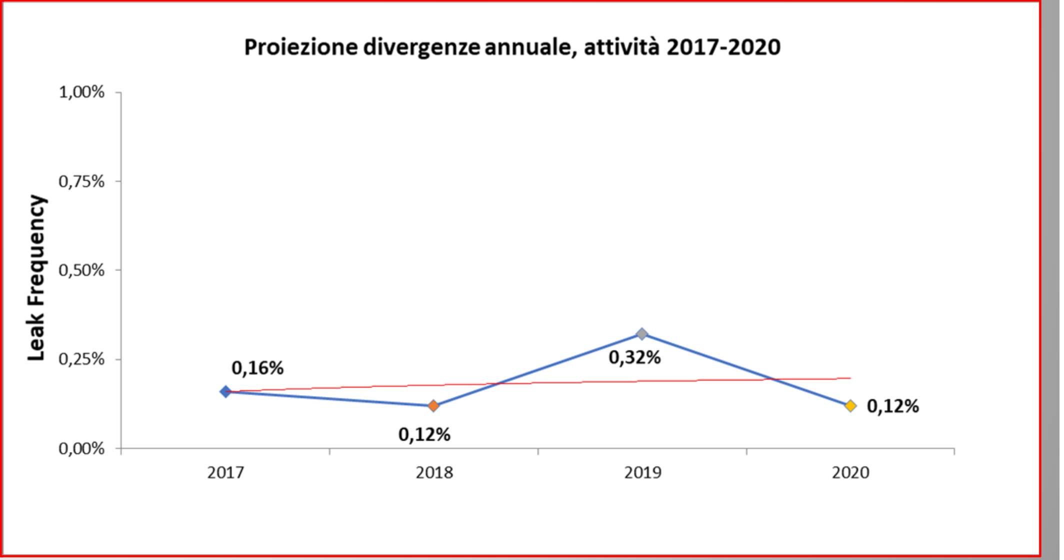




CASE HISTORY

LEAK DEFINITION = 1.000 ppmv				
Anno	N.ro divergenze	Leak Frequency	kg/h COV	Mg/anno COV
2017	4	0,16%	0,1005	0,8804
2018	3	0,12%	0,0968	0,8480
2019	6	0,32%	0,1270	1,1125
2020	3	0,12%	0,3535	3,0967





Netherlands technical agreement

NTA 8399
(en)

Air quality - Guidelines for detection of diffuse VOC emissions with optical gas imaging

Luchtkwaliteit - Richtlijnen voor de detectie van diffuus vrijkomende vluchtige organische stoffen met 'optical gas imaging'

Replaces NTA 8399:2013 en

Contents

1 Scope

This NTA provides guidelines for the detection of diffuse VOC emissions using optical gas imaging (OGI).

The NTA focusses on portable, passive, optical camera systems that enable volatile organic compounds to be made visible in real time. Non-portable, stationary systems that do not allow such flexible use are not included in the scope of this NTA, as these systems often have their own specific scopes.

Different users may have different reasons for using OGI. In general, safety, the environment and loss of product are the drivers for applying OGI.

OGI can be used in different ways (see also annex C):

— as part of an LDAR (leak detection and repair) programme;

— to visualize diffuse VOC emissions of storage tanks;

— to visualize diffuse VOC emissions that are released while loading operations;

— other applications.

This NTA lays down the requirements the IR camera shall meet and the method to be followed to enable reliable statements to be made.

Annex D of the NTA contains examples of inspection forms for recording OGI measurements on storage tanks. In addition to the obligatory emission calculations (e.g. E-PRTR (European Pollutant Release and Transfer Register) or environmental annual reports) a measurement protocol based on the *Handboek emissiefactoren* [Emission Factors Handbook] [4] can be used for the measurements on storage tanks.

If OGI is used for monitoring emissions from tanks pursuant to legislation and regulations, the measurement protocol to be used will have to be coordinated with the authorities.

Using the IR camera as a measuring instrument for the LDAR programme is not in keeping with the Dutch *Meetprotocol voor lekverliezen* [Measurement protocol for leakage losses] [3] and the authorities will have to authorize this as part of their permit activities. This NTA does not include a measurement protocol for conducting LDAR measurements based on OGI

5.2 Requirements an IR camera shall meet for use for OGI

An IR camera that is used for OGI shall at least meet the following requirements:

— the presence of a specified filter,

— the IR camera shall be designed for detecting gases,

— a detector that has cooled down to the right operating temperature,

— it shall be possible to make gases visible in real time,

— 'thermal sensitivity' of at least 25 mK,

— detection limits for common gases like methane and propane shall have been studied and documented, and

— the possibility to record images.

Annual calibration of the IR camera by its supplier is not strictly necessary for gas detection.

Annual calibration of the IR camera by the supplier is only necessary if the IR camera is also used to measure temperature.

For the measurements to be conducted properly and the images to be interpreted correctly, the measurement engineer shall have knowledge of infra-red thermography as well as of the installations on which the measurements are carried out. The engineer shall have at least taken a basic training course in infra-red thermography and shall be able to prove this.

NOTE Various training courses on infra-red thermography are available, such as level 1, 2 and 3 training courses or a more specific gas detection course.

8 Practical aspects of conducting the measurements

Start the measurements after:

— determining the measurement plan,

— making the preparations, and

— carrying out the test procedure for the use of the IR camera (see annex A).

The basic principle is that an IR recording will be made only if an emission is detected.

Only make IR recordings of all emission sources if laid down specifically in the measurement protocol.

Before accessing the measurement zone, first do a quick safety scan from an ample distance for very large and potentially hazardous leaks. If there are no such leaks, continue with the following steps.

— Perform an accurate and systematic round of measurements on the basis of the measuring plan, while preventing exposure to released VOC emissions as much as possible.

— Record a continuously emitting source for at least 10 s (per recording mode and filming position).

— Record a fluctuating emission source for at least 10 s or for as much longer as is necessary to make its fluctuating character visible (per recording mode and filming position).

— If possible, film around the emitting source.

— Make a visual recording (non-IR) of the emission source. The visual recording of the source shall also make the surroundings of the source visible, so that the reason for the leak becomes as clear as possible.

NOTE A visual recording of the emitting source may be a photo or a film lasting at least 5 s.

Record the following for every recording (in writing or by a sound recording):

— time of the recording,

— file name of the recording,

— name of the emitting source, and

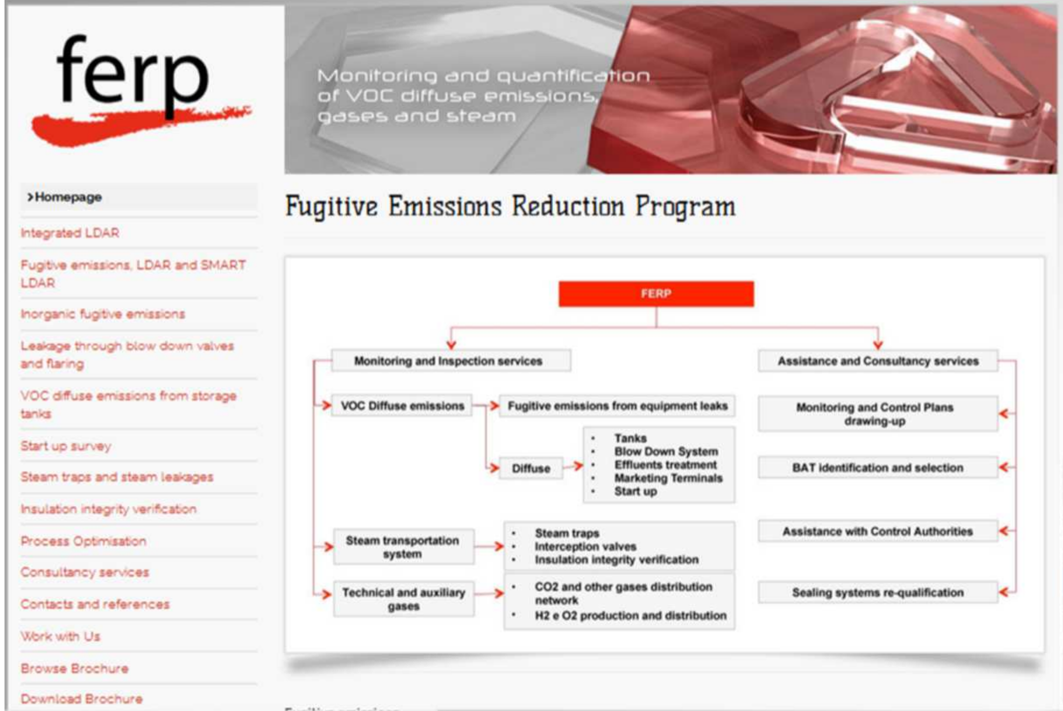
— other specifics.

Base your choice of sensitivity settings for the IR camera on what is being measured and the measurement strategy.

Maintain a distance from the source of emission that:

— is practical and safe,

Grazie per la vostra attenzione !



Potete rivolgere le vostre domande a questo indirizzo:

FERP-LDAR@CARRARA.IT