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seveso common INSPECTION series criteria

Avoiding Ignition Sources

Publication of Common Inspection Criteria is intended to share knowledge about technical measures and enforcement practices related to major hazard control and implementation of the Seveso Directive. The criteria were developed by Seveso inspectors to aid the dissemination of good enforcement and risk management practices for the control of major industrial hazards in Europe and elsewhere. CIC #14 highlights the main elements of an effective inspection of an operator's controls for avoiding ignition sources. This document is not intended as a technical standard nor as a summary or replacement of any existing standards on the matter.

The EU ATEX Directives

The inspection criteria for avoiding ignition sources are closely linked with the two so-called **EU "ATEX" Directives** aimed to protect workers from explosive atmospheres (ATmosphere EXplosive = ATEX). A potentially explosive atmosphere exists when a mixture of air gases, vapours, mists, or dusts combine in a way that can ignite under certain operating conditions. These Directives are:

- Directive 99/92/EC (**the "ATEX Workplace Directive**"), establishes minimum requirements for improving the health and safety protection of workers potentially at risk from explosive atmospheres.
- Directive 2014/34/EU **(the "ATEX Equipment Directive")** concerning equipment and protective systems (so-called "ATEX Equipment") intended for use in potentially explosive atmospheres. The Directive defines the essential health and safety requirements and conformity assessment procedures, to be applied before products are placed on the EU market.

DEFINITION AND SCOPE

This bulletin deals with measures to avoid ignition sources outside process equipment. Ignition of internal explosive atmosphere inside process equipment is not within the scope.

Avoiding ignition sources is just one aspect of avoiding fires and explosion. First and foremost, the release of flammable substance should be avoided and if any release should occur, the quantities liberated should be kept as small as possible. There are also control measures that support these strategies, e.g., safety instrumented systems, pressure relief systems, maintenance of primary containment systems and emergency isolation systems. These supporting measures are the subject of Common Inspection Criteria bulletins #1, 6, 8, and 9, respectively.

OBJECTIVE AND FOCUS OF THE INSPECTION

The inspection should verify that the operator has sufficient measures in place to avoid ignition sources that could trigger a fire or explosion. At minimum, the inspection should evaluate the following elements:

- Classification into zones
- Equipment used in hazardous zones
- Working and mobile equipment in hazardous zones
- Avoid ignition in non-ATEX zones (in case of a major release)

Each of these elements is addressed in the sections that follow.

Joint Research Centre

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CLASSIFICATION INTO ZONES

The employer shall classify places where explosive atmospheres may occur into zones (Article 7 of the EU ATEX Workplace Directive).

Zone categories

These zones are defined as places in which an explosive atmosphere consisting of a mixture with air of flammable substances in the form of gas, vapour or mist, as follows:

- is present continuously or for long periods or frequently (Zone 0)
- is likely to occur in normal operation occasionally (Zone 1)
- is not likely to occur in normal operation[1] but, if it does occur, will persist for a short period only (Zone 2).

A similar definition exists for explosive atmospheres in the form of a cloud of combustible dust in air, the zones being designated as Zone 20, Zone 21 and Zone 22. *(See Table 1.)*

The zones should be represented graphically on plans of the installation, allowing the identification of the type and extent of all the zones.

Location and identification of the source of a potential ATEX release

The classification into zones should be based on an identification and location of the sources of release. For each source of release, the grade of release should be determined:

- continuous if the release is to occur frequently or for long periods
- primary if the release to occur periodically or occasionally during normal operation
- secondary if the release is not expected to occur in normal operation and if it does occur, is likely to do so only infrequently and for short periods

Table 1 ATEX zones for gas and dust

Flammable material	Present continuously	Present Intermittently	Present abnormally
Gas/Vapour	Zone 0	Zone 1	Zone 2
Combustible dust	Zone 20	Zone 21	Zone 22

Documentation of ATEX zones

Each zone, with its defining characteristics, should be documented in an explosion protection document (EPD). This documentation should include at minimum:

- Information on the type of ventilation (natural or artificial), its degree (e.g., low, medium, high) and availability (e.g., good, fair, poor) for all areas with sources of release
- A table listing all sources of release (the rows of the table) and for each release source, the conditions (the columns of the table), including grade of release, that support the zone classification and the area to which the zone classification applies
- A reference to a corresponding drawing of the classification area with the calculations used to define the area.
- All flammable substances in the installation along with their relevant properties, including flash point, auto ignition temperature, lower and upper explosion limit, minimum ignition energy.

In such a way, the basis of every ATEX zone classification is documented and justified.

The classification into zones, and its documentation in the EPD, should be completed before an installation or a modification (giving rise to new zones or modifying existing zones) is permitted to operate.

[1] Note*: "Normal operation" refers to the situation in which installations are used as intended within their design parameters. Major releases of flammable substances, resulting from the failure of primary containment systems, are not considered as "normal operation". Therefore, the explosive atmospheres formed from these releases are not classified as a Zone 2 (and, for even greater reason, not as a Zone 1 or 0).*

Marking of places with possible explosive atmospheres

Where necessary, places where explosive atmospheres may occur in such quantities as to endanger the health and safety of workers shall be marked with signs at their points of entry.

Warning signs should be used, possibly in combination with marking on the floor (e.g., yellow-black hatching).

The following elements should also be considered:

- Hot surfaces in hazardous areas operating at temperatures above the auto-ignition temperature of the flammable substances involved, should be shielded from the environment (e.g., insulation, double-walled).
- Pumps in hazardous areas should be protected against dry running, that is operating without adequate lubrication, as this may result in temperatures exceeding the auto-ignition temperature of the flammable substances involved.
- Pumps and compressors should be included in a maintenance program to avoid high temperatures as a result of lack of lubrication or vibrations. If necessary, they should be equipped with vibration monitoring.
- Where there is a risk of electrostatic charging, the necessary electrical earthing and bonding should be implemented. These risks are particularly relevant in drum filling operations.

Table 2 Equipment categories for ATEX zones (EU ATEX Directive)

Equipment group		Equipment category		ATEX zone	Equipment Protection Level
II	The equipment is intended for use in explosive atmospheres (in non-mining applications) for gas/vapour/mist hazards	1G	Protection level is very high and can be used safely when explosive atmospheres exist continuously, for long periods or frequently	Zone 0, 1, 2	Ga
		2G	Protection level is high and can be used safely when explosive atmospheres exist occasionally during normal operations	Zone 1, 2	Gb
		3G	It can be safely used when explosive atmospheres are not likely to be present during normal operations or only exist for a short period if they do occur	Zone 2	Gc
III	The equipment is intended to be used in explosive atmospheres (in non-mining applications) for dust hazards	1D	Protection level is very high and can be used safely when explosive atmospheres exist continuously, for long periods or frequently	Zone 20, 21, 22	Da
		2D	Protection level is high and can be used safely when explosive atmospheres exist occasionally during normal operations	Zone 21, 22	Db
		3D	It can be safely used when explosive atmospheres are not likely to be present during normal operations or only exist for a short period if they do occur	Zone 22	Dc

EQUIPMENT USED IN HAZARDOUS ZONES

The ATEX Equipment Directive establishes the explosion-proof criteria and standards suitable for equipment in each ATEX zone. *(See Table 2.)* Whenever equipment is installed in a hazardous zone, the operator should be able to present the necessary certificates that the equipment is suited and corresponds to the ATEX Equipment Directive. This is not only the case for electrical equipment, but for mechanical equipment as well, such as pumps and compressors, rotating mixers, etc.

Electrical installations should be inspected periodically to ensure they meet the requirements needed for installations in hazardous areas.

Maintenance and repair of ATEX equipment

When working on ATEX equipment, proper protocols should be followed to ensure that the equipment maintains its ATEX properties. Therefore, maintenance and repair of ATEX equipment should only be performed by personnel with specific training for this work.

WORKING AND MOBILE EQUIPMENT IN HAZARDOUS ZONES

Regardless of the operation, tools and equipment, brought into the area, clothing and personal protective equipment, and working procedures must be compatible with ATEX protocols.

Permit-to-work required in hazardous zones

All work in hazardous areas should be subject to a work permit system. In case ignition sources cannot be avoided during work (e.g., cutting, welding, etc.) or non-ATEX equipment is used, permanent gas detection should be in operation while the work is ongoing. The detection system should be programmed to trigger an audible alarm well below the lower explosion limit.

Bringing in equipment to hazardous zones

In particular, the operator should ensure that non-explosion proof equipment (mobile phones, radios, carrying lamps, etc.) into hazardous areas. This rule also applies to clothing such that, when carrying out work in hazardous areas, non-static working clothing (including shoes and gloves) should be worn.

All equipment brought into the area should be explosion-proof, including forklifts. Explosion-proof forklifts should be equipped with non-sparking forks. Notably, hydrogen and acetylene have a very low ignition energy. Work on systems containing these gases should be performed with non-sparking tools.

Explosion proof working equipment, including forklifts, should be regularly inspected for any defect that might compromise their explosion-proof properties.

AVOIDING IGNITION OUTSIDE ATEX ZONES (IN CASE OF A MAJOR RELEASE)

On many hazardous sites, there is also the possibility that an explosive atmosphere can be created outside an ATEX zone as the result of a major unplanned release of flammable substances. For example, such an incident may occur when there is a particular large release that spreads to a non-ATEX area adjacent to an ATEX zone.

A hazard assessment should determine the likelihood of such an event. Such a scenario should normally have a relatively low probability, but if it is still considered realistic in the hazard assessment, the operator should also consider measures for avoiding ignition sources.

Possible control measures could include:

- Using equipment suitable for Zone 2 in areas not classified as Zone 2 but where explosive atmosphere could occur as a result of a major accidental release.
- Gas detection and alarms that require specific actions from personnel on site to stop the spread or mitigate the effects of a release. In terms of avoiding ignition sources, the following actions can be considered: stopping traffic, stopping any activities involving ignition sources, shutting down certain machinery, and other potential triggering activities.
- Water curtains to prevent migration of explosive clouds toward areas with permanent ignition sources (hot furnaces, flares, combustion engines, etc.)

The risk assessment should help to define which control measures are most appropriate for the scenario in question.

About the bulletin

This bulletin is a product of the EU Technical Working Group on Seveso Inspections. For more information related to this bulletin and other similar products, visit https://minerva.jrc.ec.europa.eu/en/shorturl/minerva/publications

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