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Target Audience
FOD inspectors inspecting food premises
Specialist Group Inspectors (Engineering & Process Safety)

HAZARDOUS AREA CLASSIFICATION FOR DUST HANDLING PLANT IN THE FOOD INDUSTRY

This SIM introduces the requirement for hazardous area classification under the Dangerous Substances and Explosive Atmospheres Regulations 2002 (DSEAR). The SIM summarises the explosion risks from dusts in the food industry and gives examples of where hazardous dust clouds and dust layers are likely to form. It also introduces the concept of zoning (hazardous area classification) and gives examples in Table 1 of typical classifications for areas in dust handling plant. Further information is contained in **OC 284/7 Dangerous Substances and Explosive Atmospheres Regulations 2002 SI 2002/2776**.

BACKGROUND

1 Many products are handled in the food industry as fine powders, and most are capable of causing dust explosions if the conditions are right. Typical examples include: flour (from all types of grain), modified starches (as used in soups and custard powder), sugar including glucose, milk powder and tea. Generally, all powders except inorganic minerals should be assumed to be explosible, unless testing shows this not to be the case.

2 The Dangerous Substances and Explosive Atmospheres Regulations 2002 (DSEAR) came into force on 9 December 2002. These update all earlier legislation on use and storage of flammable materials, and bring to the dust handling industries procedures and terminology that have long been widely used where flammable gases and liquids are handled. In particular, the regulations require those who operate dust handling plants, to assess where dust clouds do or could form, and so create an explosion risk.

ASSESSMENT

3 Assuming that fine dusts are present in the process, the aim of this stage of risk assessment, which is termed hazardous area classification, is to identify those parts of the plant where clouds or layers may form, either in normal operation or as a result of some unintended or infrequent event. Once the

hazardous areas are identified, they form the basis for setting the controls over ignition sources. Possible ignition sources include fixed and movable electrical equipment, portable tools that create hot surfaces and sparks (eg grinders, power saws), tools with open flames (eg welding, brazing sets), equipment that has high surface temperatures in normal operation (eg ovens, space heaters).

4 The risks depend on the probability that a dust cloud or layer will be present. Where a dust cloud is expected for long periods of time, the area is described as zone 20. Where it occurs regularly in normal operation, but not constantly the area is described as zone 21. Where a cloud is only likely to occur rarely, but is still possible the area is described as zone 22. More precise definitions of the zones are contained in the Regulations, but the aim of this document is to provide very simple guidance on deciding what zone applies where.

5 Layers and clouds of dust are found at many places inside the process equipment. Commonly the equipment is a container for the dusty product itself. The inside will generally be zone 20 or 21, depending on the amount of time that a dust cloud is present. For instance, the inside of a cyclone may contain a dust cloud all the time the plant is running, but a silo will only contain a cloud while it is being filled, and for a few minutes after.

6 Dust clouds may also be formed when dust escapes, for instance at bag tipping points, when filter elements are replaced, from ill-fitting connections on transfer lines, from inspection hatches and when taking samples.

7 Dust layers may form even when there is no release big enough to form a visible cloud, and the finest dust will spread widely around a building on thermal air currents. Occasionally dust layers may be lifted into clouds, by the rapid movement of air, through an open door or window, or from a fan or airline within the plant. In this way, a layer may cause an explosion, even though the dust as a layer is hard to ignite.

8 Dust clouds dense enough to explode are too thick to see through, and are not likely to form in a workroom except very locally. Handling techniques and dust collection systems should be designed to prevent dust escaping in this quantity. If dust releases are being controlled for occupational hygiene reasons, and it has been shown that personal protective equipment is not needed to prevent people breathing in the dust, the extent of any zone 21 area will be minimal, or non-existent. A small zone 21 may exist however, if extraction equipment is ineffective, by powder transfer points on open conveyor systems, or where sacks or larger containers are filled. Direct observation of the process may be best way of setting the extent of the zone.

9 To assess the extent of zone 22, it is necessary first to determine where dust regularly collects, and secondly to assess where dust could be released as a result of some fault in the plant, or for short periods during normal operation. Simple examples might be: overfilling of a weigh hopper, tearing of a sack or FIBC during handling, failure of an explosion vent panel, perished seals on any part of the plant, or manual transfer of product into a different

container. Events which would lead to a release of less than 10 kg of dust at one time will normally be insignificant.

10 When assessing where dust regularly collects, particular attention should be paid to ledges, beams and light fittings at high level. Where dust can be dislodged from high up ledges within rooms to make a large cloud, the whole room should be classified zone 22. Some dusts absorb water and cannot be easily raised back into a cloud after they have settled as a layer, in which case the area need not be considered zone 22

11 Fine dust can travel a long way around a building on convection currents, so to avoid the need for very extensive zoning (and reduce the routine cleaning work), internal doors should be close fitting and self-closing, even if these are not needed for other reasons.

EQUIPMENT LOCATED OUTDOORS

12 Not much process equipment in the food industry is located in the open air, but sometimes filters or large bins are outside of any building. Unless the plant is sited where it is very sheltered from the wind, it is usually impossible to envisage a dense dust cloud of any size lasting more than a few moments. Dust layers are likely to be blown away, or quickly pick up moisture until they can no longer be lifted into a cloud and become an explosion risk.

13 Dust zones in the open air should then be minimal or non-existent, but equipment that could become submerged in dust at for instance a tanker discharge point may need to be considered more carefully.

ZONES FOR TYPICAL DUST HANDLING PLANT

14 Suggested zones for typical dust handling plant used in the food industry is given below:

Table 1

Description	Comments	Suggested zone
Inside dry blender, conveying system, cyclone, grinding plant	Providing the dust is fine enough	Zone 20
Inside silos, hoppers, other equipment filled intermittently	Filling last more than 6 hours/day Filling takes less than 6 hours/day	Zone 20 Zone 21
Dirty side of filters, heavy dust burden on inlet stream	Dust clouds will be present during each regeneration cycle	Zone 20 if filter regenerates frequently Zone 21 if filter regenerates infrequently
Dirty side of filter with light dust burden, e.g.		Zone 21

downstream of a cyclone		
Clean side of filter	Allows for the case of displaced/torn filter element	Zone 22
Around places where dust is regularly released	Local exhaust ventilation will normally be needed. Visual inspection of operation needed.	Small area of zone 21 if dense dust clouds visible, should rarely extend more than 1m from the source. Otherwise zone 22.
Conveying plant running at pressures below atmospheric	No leaks likely	No need to classify unless there are other sources of release
Conveying plant running above atmospheric pressure	Small leaks are common, unless maintenance standards are very high	Likely to create dust layers and an area of zone 22
Work rooms	Visual inspection needed, look at high level.	Any regular deposits, zone 22 whole room
Offices, control rooms, and other rooms adjacent to classified rooms, containing no source of dust release	Internal self-closing doors should reduce the spread of dust	Unclassified if permanently clean, and door is kept closed. Zone 22 otherwise.
Locations close to hot surfaces	eg space heater or water boiler	Need to ensure tight controls prevent dust releases

ACTION REQUIRED

15 No special visits or actions are required by this SIM. The guidance is for information. Further information on interpretation and enforcement of the DSEAR is contained in **OC 284/7 Dangerous Substances and Explosive Atmospheres Regulations 2002 SI 2002/2776**.

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