

SCOPE

- I 1.1 This practice covers classification of areas where combustible dusts are handled, processed, or stored.
- I 1.2 This practice is intended for application to:
 - a. Petroleum refining and chemical facilities involving combustible dusts.
 - b. Coal and similar facilities, excepting those which are associated with underground mines and those associated with surface mines covered by regulations of the authorities having jurisdiction.
- I 1.3 An asterisk (*) indicates that additional information is required. If a job is contracted, the additional information is furnished in the Job Specification.

SUMMARY OF ADDITIONAL REQUIREMENTS

- I 2.1 Table 1 lists the standards (including recommended practice) which shall be used with this practice:

TABLE 1

STANDARDS	
ANSI / NFPA Standards	
70	National Electric Code (NEC)
496	Purged and Pressurized Enclosures for Electrical Equipment
499	Recommended Practice for Classification of Combustible Dusts and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas
API Recommended Practice	
RP500	Classification of Locations for Electrical Installations at Petroleum Facilities
IEC Standard	
1241	Electrical Apparatus for Use in the Presence of Combustible Dust
Other Regional and National Standards	
Appropriate Regional or National Standard applicable to the specific plant location.	

- I 2.2 Where compliance with any code or standard specified by an authority having jurisdiction is mandatory, the prescribed regulations shall be met. In locations that do not have regulations covering surface mines, this practice shall apply.

DOCUMENTATION

- S 3.1 Area classification drawings shall be prepared by the contractor as follows:
 - a. The classification and extent of each area shall be shown with major structures and equipment indicated. Drawings shall indicate dust fallout density pattern including prevailing wind effects.
 - b. All equipment which is considered a source of combustible dust shall be shown on the drawings. Each source shall be identified by equipment number, combustible dusts handled, and the atmosphere group according to the standard(s) to which electrical equipment is to be purchased
 - c. Where equipment is considered a source of both combustible dust and flammable liquid, gas or vapor (e.g., coal dust and methane), both materials and atmosphere groups shall be identified.

DEFINITIONS

- I 4.1 For purposes of classified area extent per Figures 1-9, the dusts handled or processed are assumed to have specific particle densities greater than 40 lb/ft³ (670.42 kg/m³). Dusts of lower specific density may require extending the classified area. Refer to NFPA 499 Par. 3-5.4.

IP 16-1-2	Area Classification and Related Electrical Design for Combustible Dust	
Page 2 of 7		
Rev. 0 March 1998		

- I 4.2 **Dusts** shall be **considered combustible** for electrical classification purposes if either of the following criteria are met:

- a. **Ignition Sensitivity Index (ISI) ≥ 0.2** , defined as:

$$ISI^{(1)} = \frac{T_c \times E \times C \text{ [for dust equivalent to standard Pittsburgh coal dust]}^{(2)}}{T_c \times E \times C \text{ [for dust being classified]}^{(3)}}$$

where: T_c = cloud ignition temperature, °F (°C)
 E = minimum ignition energy (J)
 C = minimum concentration for explosion, oz/ft³ (kg/m³)

- b. **Explosion Severity Index (ESI) ≥ 0.5** , defined as

$$ESI^{(1)} = \frac{P_{\max} \times P \text{ [for dust being classified]}^{(3)}}{P_{\max} \times P \text{ [for dust equivalent to standard Pittsburgh coal dust]}^{(2)}}$$

where: $P_{\max}$ = maximum explosion pressure, psig (kPa)
 P = maximum rate of pressure rise, psi/s (kPa/s)

Notes:

- (1) The **Ignition Sensitivity Index** and the **Explosion Severity Index** are empirical expressions which permit evaluation of explosiveness by numerical ratings that are consistent with research observations and practical experience (refer to **NFPA 497, A-1-3**, and for cloud ignition energy values in particular, to NMAC 353-3).
- (2) Pittsburgh seam coal dust, used as the standard dust by U.S. Bureau of Mines in tests with its apparatus design and procedures, has the following characteristic values:

T_c = 1130°F (610°C)
 E = 0.060 J
 C = 0.055 oz/ft³ (0.055 kg/m³)
 $P_{\max}$ = 83 psig (572 kPa)
 P = 2300 psi/sec (15,858 kPa/s)

If other standard dusts, apparatus or test procedures are used to determine comparable indices of explosion severity and ignition sensitivity, appropriate relationships of the characteristic values to the standard Pittsburgh seam coal values, reflecting the test apparatus and procedures used, shall be determined.

- * (3) Values for the dust being classified will be specified.

- I 4.3 **Unclassified locations** are as follows:

- a. Locations completely outside Division 1 or Division 2 locations.
- b. Locations where dust layers are present but do not obscure the surface underneath.
- c. Enclosed spaces for which dust collection and removal equipment or dust suppression equipment, or both, prevent the conditions characteristic of Division 1 or 2.
- d. **Locations with dusts** having an **Ignition Sensitivity Index < 0.2** and an **Explosion Severity Index < 0.5** .

In such locations, and within the classified area limits of Figures 1 - 9, electrical equipment shall be suitable for other specified characteristics of the dust which can affect equipment operability and safety. [For example: (1) Conductive dusts, (2) Layer ignition temperature of the dust less than the exposed surface temperature of the equipment].

AREA CLASSIFICATION

- S 5.1 Equipment and facilities shall be classified per the following and the additional requirements of this practice:

EQUIPMENT OR FACILITY		AREA CLASSIFICATION REQUIREMENT PER:(1)
a.	Coal Handling Facilities:	
1.	Conveyors	Figures 1 through 4
2.	Reclaim tunnels and reclaim hoppers	Class II Division 1
3.	Transfer towers with diverter gates and trippers, surge bins, and conveyor transfer points, granulators	Figures 5, 6, 8, 9
4.	Crusher houses with diverter gates and trippers, surge bins, sampling systems, and granulators	Figures 5, 6
5.	Silos, bins, bunkers	Figures 8, 9
6.	Radial stackers, reclaimers, ship and barge loaders and unloaders	Figure 7
7.	Boiler plant with conveyors, trippers, gravimetric feeders, pulverizers	Figures 5, 6, 8, 9
b.	Other Solid Handling Facilities:	
1.	Enclosed and non-ventilated conveyor	Figure 1
2.	Outdoor semi-enclosed conveyor	Figure 2
3.	Outdoor open conveyor	Figure 3
4.	Sealed Conveyor	Figure 4
5.	Indoor fully enclosed equipment, such as: Screw and drag conveyors; pulverizers; material loading, transfer and drive stations; mixers; dust collectors; pneumatic conveying systems	Figure 5
6.	Indoor open or semi-enclosed equipment, such as: Pulverizers; open bins; hoppers; mixers; material transfer, loading and drive stations; dust collectors; trippers and dischargers; rail car unloading	Figure 6
7.	Outdoor open equipment, such as: Trippers and dischargers; hoppers; material transfer, loading and drive stations; spouts or scoops; hoists or booms	Figure 7
8.	Silo, bin, or bunker with closed discharge	Figure 8
9.	Outdoor or indoor silo, bin, or bunker with discharge to open bin or conveyor	Figure 9

Note: Classifications specified in the table or by reference to the figures do not reflect provision of dust collection and removal equipment, or dust suppression systems.

- S 5.2 Where the **extent of the areas classified** for combustible dust and flammable liquid, gas, or vapor **overlap**, the equipment applied shall be **suitable for both classifications**.

ELECTRICAL DESIGN FOR CLASSIFIED AREAS

- S 6.1 Electrical equipment selection and installation shall be in accordance with **ANSI/NFPA 70 Article 502** (or the appropriate article of the applicable regional or national standard) where combustible dust is the material requiring classification; or with **ANSI/NFPA 70 Articles 501 and 502** (or, the appropriate articles of the applicable regional or national standard) where combustible dust and flammable liquid, gas or vapor are the materials requiring classification.

METHANE MONITORING SYSTEMS

- S 6.2 Where a **coal handling facility** may release sufficient methane to cause a **concentration of 0.5 volume % in air**, continuous **methane monitoring systems** shall be provided for the following:
- For tunnels below stockpiles and surge piles.
 - For enclosed areas above or below silos or enclosed structures above silos.
 - For enclosed coal storage areas or other confined spaces involving coal storage, preparation, and reclaiming.