IMPROVEMENT OF FIRE SAFETY MEASURES IN STEEL INDUSTRIES

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Abstract

This paper deals with reducing the likelihood of fire and spread of fire. Providing an adequate means to escape from fire which should be accessible and functional whenever needed. Providing an adequate means of detection and warning of fire. Providing a suitable means of fire fighting. Specifying the actions to be taken in the event of fire.

Keywords: Fire load calculation, Fire protection,

Stainless steel.

I. INTRODUCTION

Fire is the rapid oxidation of a material in the exothermic chemical process of combustion, which can releases heat energy, light energy, and various reaction products. And can slower oxidative processes like rusting or digestion are not included by this definition.

Fires start when a flammable and/or a combustible material, in combination with a adequate quantity of an

oxidizer such as oxygen gas or a different oxygen-rich compound (although non-oxygen oxidizers exist that can replace with oxygen), is exposed to a resource of heat or ambient temperature above the flash point for the fuel/oxidizer mix, and is able to maintain a rate of rapid oxidation that produces a chain reaction. This is normally called the fire tetrahedron.

The general fire causing sources of heat includes, sparks, welding spark, Incandescent light bulb, Arching, Chemical heat source, electrical spark, nuclear heat source.

FIRE TRIANGLE

In order for a fire to start or be sustained you need to have a Fuel, an oxidizer and an ignition source. If one of the three components is eliminated, then there will not be a fire (or explosion).

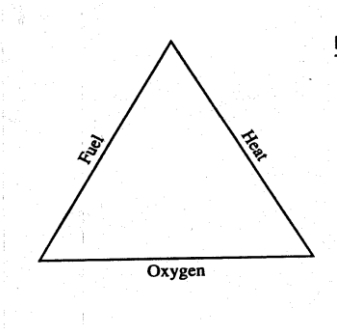


Figure 1 FIRE TRIANGLE

CLASSES OF FIRE

Class A

Class A Fires consist of ordinary combustibles such as solid materials like wood, paper, trash or whatever thing that leaves an ash. Water works most excellent to extinguish a Class A fire.

Class B

Class B Fires are the flammable or explosive liquids, which include oil, gasoline, and other comparable resources. Smothering effects which reduce the oxygen supply work best to extinguish Class B fires.

Class C

Class C Fires are Energized Electrical fire. Always de-energize the circuit then use a non-conductive extinguishing agent. Such as Carbon di oxide.

Class D

Class D Fires are flammable metal fires. Magnesium and Titanium are the most general types of metal fires. When a metal ignites do not use water in a challenge to extinguish it. Simply use Dry powder agents to smothering and heat absorption.

II. METHODS OF EXTINGUISHING FIRE

Fire extinction usually consists of removal limiting of one or more of three factors of fire triangle. However, a fourth way i.e. chemical interference has also been identified. This converts the "fire triangle" in to a "pyramid". The four ways to fight fire are

Table 1: Ways to Fight Fire

1.	Starvation	Elimination of fuel
2.	Smothering	Limitation of oxygen
3.	Cooling	Removal of temperature(heat)
4.	Chemical interference	Interrupt chain reaction

STARVATION:

The extinction of fire by starvation is brought about in the following three ways;

a) By removing combustible material from the neighbourhood of the fire such as the transfer of fuel burning oil tanks, cutting of branches around forest fire, closing the valve on the gas/fuel line etc.
b) By removing material on fire from the neighbourhood of combustible material for instance pulling apart a burning haystack or a thatched roof.
c) By sub-dividing the burning material to small sized isolated fires to break continuity.

SMOTHERING:

The general procedure in methods of this type is to prevent or impede the access of fresh air to the seat of fire and allow the combustion to reduce the oxygen content in the confined atmosphere until it extinguishes itself. This principle is ineffective in the cases where the burning material contain within itself the oxygen it requires for combustion in a chemically combined form such as celluloid.

COOLING:

If the rate at which heat is generated by combustion is less than the rate at which it is dissipated through various agencies the combustion cannot persist. In applying this principle of fire extinction the first step is to accelerate the speed with which heat is removed from the fire thus reducing the temperature of the burning mass and as a consequence the rate at which heat is produced.

CHEMICAL INTERFERENCE:

The combustion process actually takes place between free radicals and not between molecules as is usually depicted. Fire is an example of a free radical chain reaction.

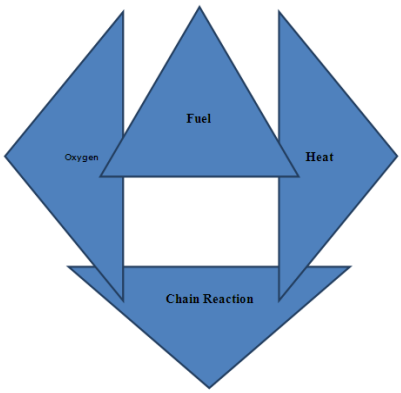
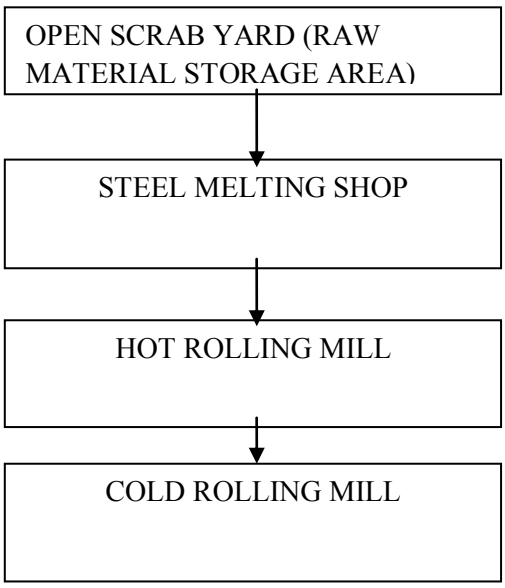


Figure 2 Tetrahedron (Pyramid)

PROCESS FLOW DIAGRAM OF STEEL INDUSTRY



METHODOLOGY

IDENTIFICATION OF FIRE PRONE AREAS

All the units in the plant are checked for materials which can catch fire .From that fire prone areas are identified.

CALCULATING THE FIRE LOAD

Determine the weight of combustible materials in the compartment for which you wish to calculate fire load. This value is represented by "W" and is measured in kilograms.

Determine the value of these materials in calories. This value is represented by "C" and is measured in kilojoules/kilogram.

Determine the area of the compartment. This value is represented by "A" and is measured in square meters.

Multiply M by C and can divide to the total by A to determine the fire load. The equation will be,

$$\text{Fire load} = (W \times C) / A$$

III. FINDINGS AND RECOMMENDATIONS

FIRE PRONE AREAS:

LOCAL SCRUB YARD

Reason: Fire may occur during gas cutting of raw material.

STEEL MELTING SHOP

Reason: Spillage of molten steel nearby workplace area .

HOT ROLLING MILL

Reason: Due to friction between coils and equipment fire may occur.

COLD ROLLING MILL

Reason: In the strip grinding mill due to,

a) over speed of coils.

b) Insufficient coolant oil.

c) Side track of coil.

COMPARISON OF FIRE LOAD WITH SUPPRESSION SYSTEM

Comparing the collected information's of the fire load in a unit and the amount of extinguishing material can be used in the suppression system.

Comparing the required amount of extinguishing material required for the amount of fire load in that unit can be calculated. If the amount of the extinguishing material doesn't meet the requirement to meet the fire load, then the amount of extinguishing material will be increased to meet the fire load required.

Fire load can be calculated in z-mill 1 of steel industry as follows:-

Weight of hydraulic oil in Kg (mass) X Calorific value of the material - Answer in Kj

For example 1 ton of hydraulic oil @ a calorific value of 10.5 x 10 to the power of 3 Kj/Kg

= 5 x10 to the power of 5 x 105 x 10 to the power of 2
=52500x10 to the power of 5 Kj

If you want to relate this to hydraulic oil equivalent the formula is:-

mass x calorific value divided by the calorific value of hydraulic oil, for example (with the calculation above):

52500x10 to the power of 5 divided by the A of Z-mill(7200 sq.m)

= 52500x10 to the power of 5 divided by 7200
= 7.29x10 to the power of 5 Kj per sq.m

After calculating the fire load it should be compared with water level. If fire load exceeded then a normal level necessary fire protective equipments should be provided. Some of the fire protective equipments are listed.

IV.CONCLUSION

The fire load should be equal to the amount of water level in the plant. So the water level required according to the fire load should be maintained. And to provide a necessary $C0_2$ suppression system at the place of fire hazardous area.

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