

Aerosol Manufacturing System

Design and Safety Systems

Presented by Diversified CPC

Introduction

- Since the early 1970's, the chemicals available to the aerosol packager have been changing. As a result, more companies are converting their operations to process greater varieties of propellants and solvents. In most cases these new chemicals will be **FLAMMABLE**. Today we will discuss how to handle these flammable chemicals.

Topics of Discussion

- 1. Gas House
- 2. Tank Farm
- 3. Truck Unloading
- 4. Safety Systems

Regulations

- Gas House Safety
 - a. NFPA 58
 - b. NFPA 30B

NFPA 58

- Chapter 7
 - 1. House Construction
 - 2. Electrical Classification
 - 3. Ventilation (1 cfm/sf)
 - 4. Relief Panel (50:1)

NFPA 30B

- Chapter 2,3
- 1. Ventilation (1/2 cpm)
- 2. Relief Panel (30:1)
- 3. Fenwal Suppression System
- 4. Location
- 5. Electrical Classification
- 6. Venting

Propellants

HAP's Flammable	CO ₂ Non Flammable	HFC – 134 Non Flammable
DME Flammable Class C	N ₂ Non Flammable	HFC – 152 Flammable
	Air NA	

Gas House

- Flammable Propellants
 - 1. P-152
 - 2.DME (Dimethylether)
 - 3.HAP's (Hydrocarbon Aerosol Propellants)
- Characteristics: Flammable, Volatile, Heavier than air

HAP's

Propane A-108

Isobutane A-31

Normal Butane A-17

Blends A/AB – 18 to A/AB -107

Propellant Pressure

- Propane 110psig@ 70F
- 261psig@ 130F
- HFC-134 71psig@ 70F
- 199psig@130F
- HFC-152 63psig@70F
- 177psig@130F
- DME 63psig@70F
- 174psig@130F

Waterbath

Aerosol Pressure Testing DOT 173.1200(8)(E)

Each completed container filled for shipment must have been heated until the pressure in the container is equivalent to the equilibrium pressure of the content at 130 F without evidence of leakage, distortion, or other defect.

Safety Systems

- Gas House
 - 1. Ventilation
 - 2. Gas Detection
 - 3. Fenwal Suppression System
 - 4. Sprinklers
 - 5. Interlocks
 - 6. Isolation

Tank Farm System

- 1.Storage tanks
- 2.Pump
- 3.Relief valves
 - a. Vapor Relief
 - b. Hydrostatic Relief
- 4.Emergency valves

Truck Unloading

- 1. Propellant
 - a. Grounding
 - b. Disconnecting/Venting
 - c. Trouble Shooting
 - d. Loading To Maximum

Flammable Aerosol Systems Text

■ Gas House

- The Aerosol Gas House is the key element in the production of flammable aerosols. The proper design of this system requires certain key elements:
 - 1. Construction – the Gas House must be constructed of non flammable/combustible materials with a wall strength of 100 psf minimum. (Exception – the blowout panels /windows may be lexan or other synthetic material. NFPA 30B 3-4
 - 2.Ventilation – the Gas House must have ventilation that meets the requirements of NFPA 30B/NFPA 58. To this extent the air changes per minute must be 1 or greater for normal operation and 2 or greater for elevated levels of flammables, or meet the requirements of NFPA 30B 3-5.2. In addition the air pressure in the gas house must be negative in relation to its adjacent environment.
 - 3.Detection – The Gas House must be protected with a gas sensor system capable of detecting the quantity of flammable material in the gas house. This system must be integrated with a control system to meet the requirements of NFPA 30B 3-13.

- 4. Suppression - As required by NFPA 30b an effective suppression system must be incorporated into the gas house system. NFPA 30B 3-12
- 5. Interlocks must meet requirements of NFPA 30B 3-13.
- 6. Electrical systems in and around the gas house must be explosion proof or intrinsically safe. NFPA 30B 2-3
- 7. Venting in the gas house is not allowed. All venting must be piped to the outside and released in a safe manner.
- Venting may be accomplished by piping into the exhaust system. You should locate any gas sensors in the exhaust ducts to insure the vents are located after these.
- 8. Grounding - all systems should be grounded or bonded to a grounded surface.

- Note: To the best of my knowledge, no aerosol plant which was equipped with the required safety systems and has maintained these systems has suffered a damaging fire or explosion.

- Tank Farm
- Safety and Security

- 1.Fencing - prevent unauthorized entry
- 2.Barriers – protect system from damage from vehicular traffic
- 3.Gates – required in fenced enclosure (2)
NFPA 58 3.3.6

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■ Relief Valves

- **1. Storage Tank – NFPA 58 requires appropriate pressure relief valves . NFPA 58 2.4.7**

Relief Valves

- 1.Piping - hydrostatic relief valves are required in piping at all locations where gas/liquid can be trapped through the normal or emergency closing of valves.
- 2.Relief valves must be 400 psig minimum or if system design is greater than 350 psig, the valve must be rated at 110 to 125% of system design. NFPA 58 2.4.7

■ Point of Transfer

- **1.Truck Unloading – a point of transfer is any location where gas liquid/vapor can be expected to be released. These points of transfer are considered risk areas. During the unloading operation, persons for the plant and for the unloading vessel must be present. The area for 25 feet around the point of transfer is to be kept clear of anything which could serve to ignite the gas. This includes any vehicles except the unloading vehicle if it is equipped with protection for its exhaust and air intake.**
- **2.The piping at the point of transfer must be protected with a bulkhead, and appropriate safety valves. NFPA 58 3.2.19**

■ Emergency Valves

- **1. Emergency shutoff valves are required as follows:**
 - **A. Tank liquid valve NFPA 58**
 - **B. In piping between tank and gas house NFPA 30B**

■ Fire Protection

- **1. NFPA 58 places no specific requirements on the tank system except to require at least one fire extinguisher. However It is generally recommended that at least two fire extinguishers be provided in the tank farm. These should be located to allow a person to reach one from either inside or outside the fence during a fire event.**
- **2. It is a requirement of NFPA 58 that a fire safety analysis be performed on all new installations, and this analysis be kept on file at the facility.**

Gas House

Zone # 1

- Zone # 1 – Gas House
- Highly regulated / controlled.
- Authorized personnel only.
- Gas House can not run without all systems fully functional.
- Area around Gas House for 15 feet is restricted.
- Malfunction in Gas House will shut down entire operation.

Malfunction

- Gas Leak – detector reading 40%+
- Ventilation failure
- Detector failure
- Fenwal failure
- Doors open
- Solution – maintain systems properly

Ventilation



Gas Detector



Fenwal System



Storage Tank System

- The storage tank system is a highly regulated and restricted area. Only authorized persons are allowed into the area, and all activities must be performed by trained employees.

Storage Tank



Relief Valves



Storage Tank Components

- 1. Storage tanks/pumps
- 2. Piping
- 3. Unloading/bulkhead

Storage Tanks/Pumps

- Tank systems are designed to contain and transport flammable propellant to various locations in the plant. Containment is a critical aspect of these systems. As closed systems, the release of chemicals into the environment is prevented.

Storage Tanks/Pumps



Piping



Hydrostatic Relief



Unloading / Bulkhead

- The unloading of transports into the bulk storage system is regulated under NFPA 58. As such only trained persons should perform these duties. The points at the bulkhead and truck where connections are made is considered a point of transfer and commands the greatest attention.

Unloading Bulkhead

