Flare Safety Overview

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Flare Safety Overview

1. Introduction
2. Titan Group Flare System
3. Westlake Two Flare System
4. Westlake One Flare System
5. Incident
6. Conclusions

Introduction

1. The Flare is a major part of the pressure relieving system for hydrocarbon processing plants. For most plants it is the last line of defence against potential hazards.

2. Flare design should include thermal radiation limits, explosion hazards, liquid carryover, noise, temperature limits, and ground level concentrations of combustion products.

Introduction

3. In Hydrocarbon Service there has been several flare line ruptures, therefore it is something each Ethylene Plant should review, particularly at every revamp or expansion.

4. Unfortunately, one of these incidents was the flare line rupture of Westlake One in January 2002.

Introduction

5. Many flare system designs exist and some have design advantages.

4. The purpose of this Flare Safety Review is to stress the need for each producer to review their flare system and to stress Titan's Commitment to make this Region a safe place to operate an Olefin plant.

Titan Group Flare System

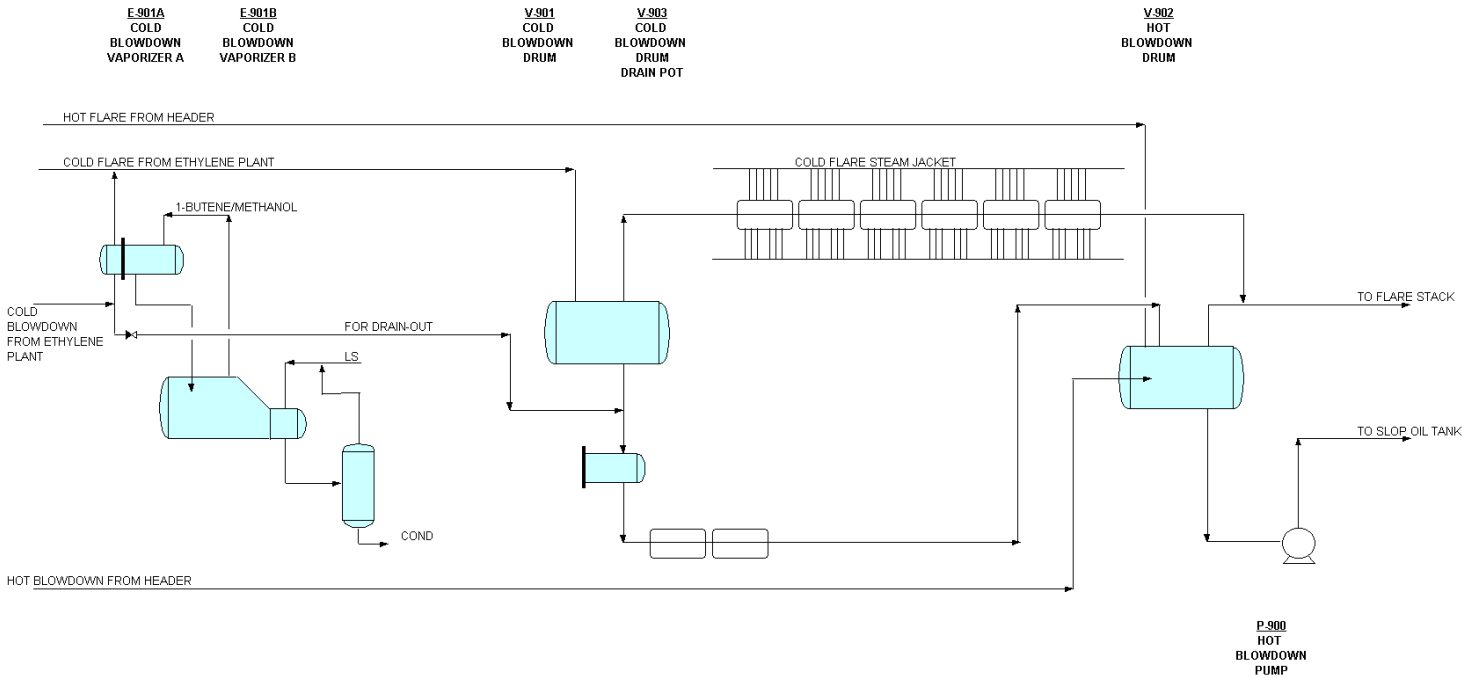
1. Consist of a three-part Flare System

   A. Warm Gases / Liquids with KO Drum - Named Hot Blow Down

   B. Cold Gases - Named Cold Flare Line

   C. Cold Liquids With Vaporization System - Named Cold Blow Down

TITAN PETROCHEMICALS (M) SDN BHD
COLD AND HOT BLOWDOWN SYSTEM



Titan Group Flare System

A. Warm Gases / Liquids with KO Drum - Named Hot Blow Down

1. Carbon Steel System with liquid collection system for recycle

2. Gasses are routed directly to Flare

Titan Group Flare System

B. Cold Gases - Named Cold Flare Line

1. Stainless Steel system until one hundred and fifty feet after steam jacket heating system.

2. Gases are routed to flare through steam jacket system.

Titan Group Flare System

C. Cold Liquids With Vaporization System - Named Cold Blow Down

1. Stainless Steel system until one hundred and fifty feet after steam jacket heating system.

2. Liquids are vaporized in a heat exchanger with 1-Butene or methanol as heating medium.

Titan Group Flare System

Advantages

1. Large Steam Jacketed Heating System.

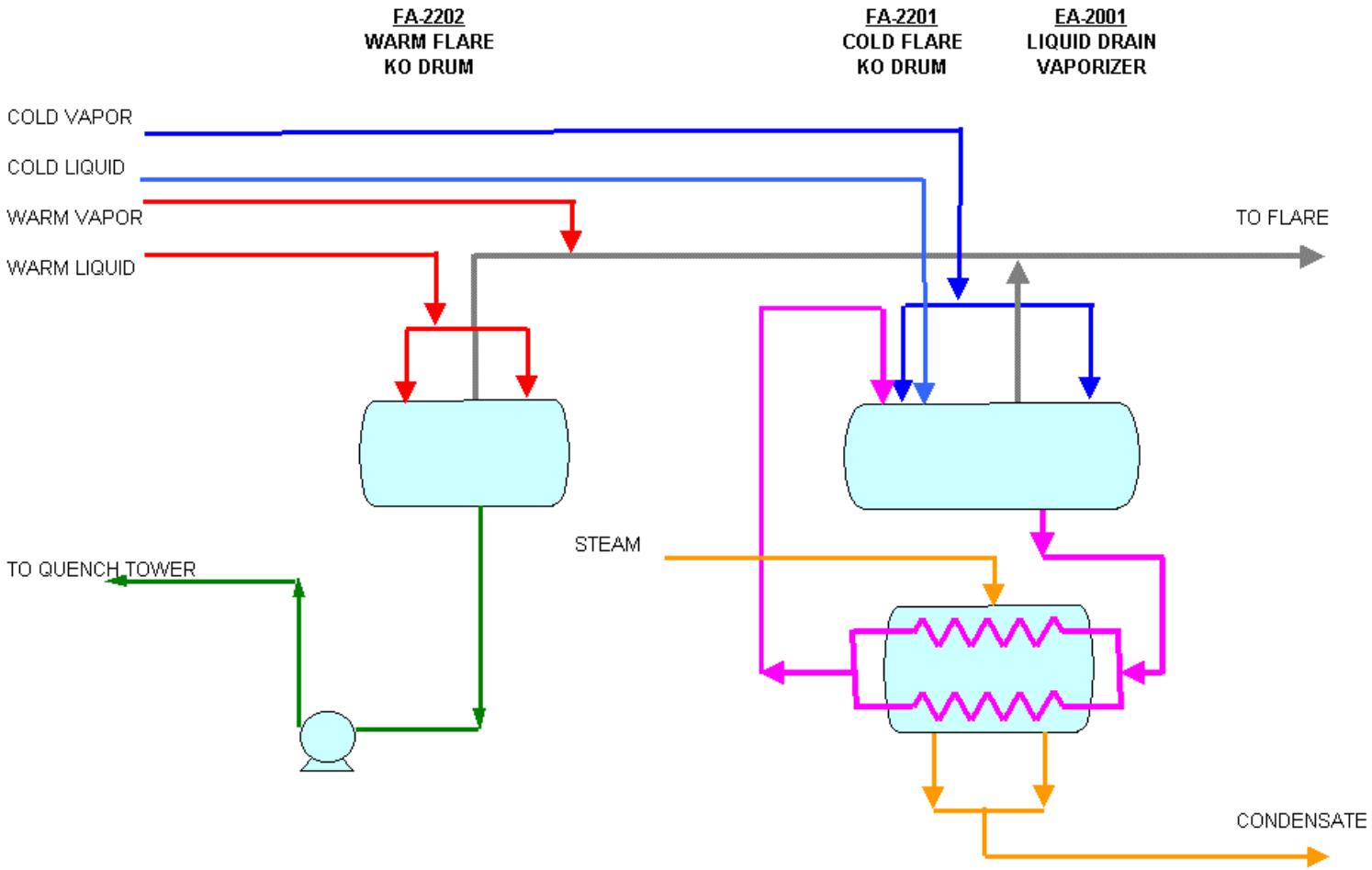
2. Heating Medium allows low temperatures.

Westlake 2 Flare System

1. Consist of a three-part Flare System

   A. Warm Gases / Liquids with KO Drum - Named Wet Or Warm Flare System
   B. Warm Gases - Named Hot Flare System
   C. Cold Gases / Liquids With Vaporization System - Named Dry or Cold Flare System

WESTLAKE PETROCHEMICALS CORP, LAKE CHARLES
COLD AND HOT BLOWDOWN SYSTEM



Westlake 2 Flare System

A. Warm Gases / Liquids with KO Drum - Named Wet Or Warm Flare System

1. Carbon Steel System with liquid collection system for recycle

2. Gases are routed directly to Flare

Westlake 2 Flare System

B. Warm Gases - Named Hot Flare System

1. Carbon Steel system routed to flare.

Westlake 2 Flare System

C. Cold Gases / Liquids With Vaporization System - Named

Dry or Cold Flare System

1. Stainless Steel system until 300 feet after vaporizer.

2. Liquids are vaporized in a heat exchanger with steam as heating medium utilizing thermosyphon.

Westlake 2 Flare System

Advantages

1. Allow temperature control of flare line by use of warm flare gasses.

2. Both Cold vapor and liquid have the potential to be heated.

Westlake 1 Flare System

1. Consist of a three-part Flare System

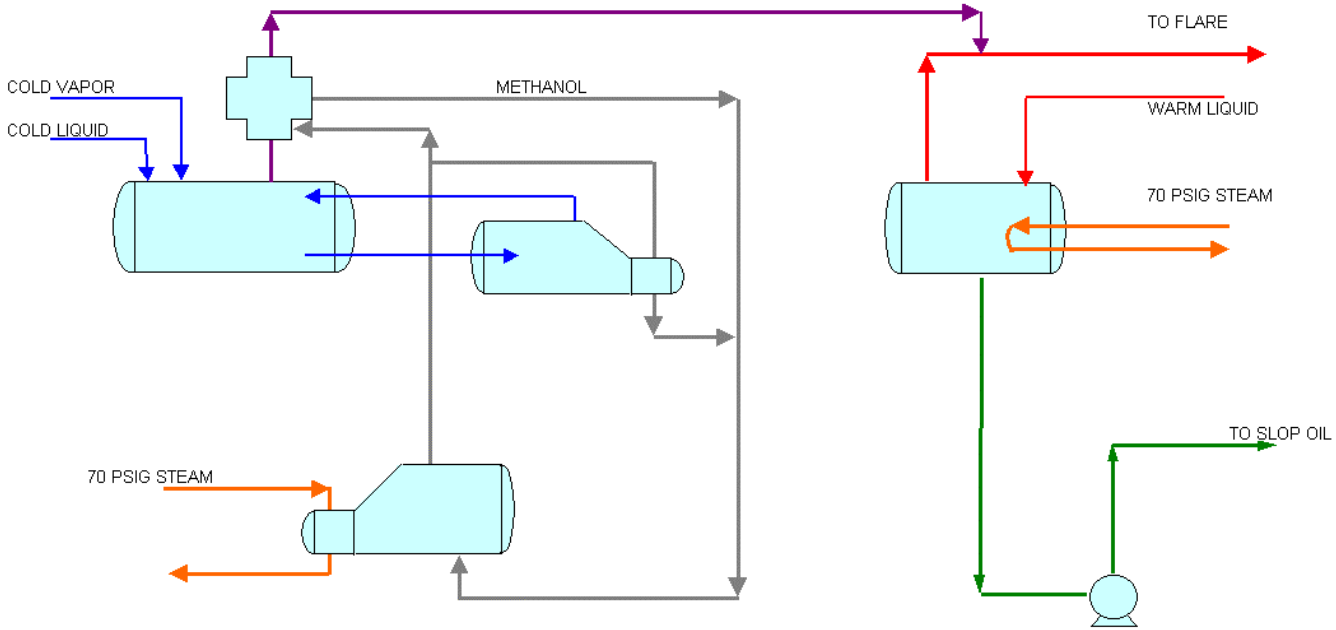
   A. Warm Gases / Liquids with KO Drum - Named Warm Flare Header System

   B. Cold Gases - Named Cold Vapor Header Flare System

   C. Cold Gases / Liquids With Vaporization System - Named Cold Liquid Header Flare System

WESTLAKE PETROCHEMICALS CORP, LAKE CHARLES
COLD AND HOT BLOWDOWN SYSTEM

5401F	5102C	5100C	5101C	5402F
COLD FLARE DRUM	COLD FLARE SUPERHEATER	METHANOL VAPORIZER	COLD FLARE VAPORIZER	WARM FLARE DRUM



Westlake 1 Flare System

A. Warm Gases / Liquids with KO Drum - Named Wet Or Warm Flare System

1. Carbon Steel System with liquid collection system for recycle

2. Gases are routed directly to Flare

3. Contains internal steam vaporizer

Westlake 1 Flare System

B. Cold Gases - Named Cold Vapor Header

1. Stainless Steel system until one hundred feet after super heater.

2. Gases are routed to flare through super heater system.

Westlake 1 Flare System

C. Cold Gases / Liquids With Vaporization System - Named Cold Liquid Header

1. Stainless Steel system until one hundred feet after super heater.

2. Liquids are vaporized in a heat exchanger with methanol / propanol as heating medium.

Westlake 1 Flare System

Advantages

1. Has Cold Header Superheater
2. Both Cold vapor and liquid have the potential to be heated.
3. Has Warm Flare Heating Coil
4. Heating Medium allows low temperatures.

Flare System

Potential Disadvantages

1. Some Heating Mediums cannot tolerate low temperatures.

2. Cold Liquid Vaporizers can be fouled with heavy oil, for example PRC Seal Oil.

3. Cold Header Superheater can be fouled with heavy oil.

Flare System

Potential Disadvantages

4. Some Cold Vapor streams are not heated.

5. Some Hot drums have no vaporization.

6. Some systems do not allow heating of cold stream by hot streams

Incident

1. The Westlake Distribution System is designed such that the Ethylene Product is either routed to the pipeline or to the flare. There is no off test storage.

2. On Friday, 4 January 2002 the Ethylene Product went off test on Acetylene.

Incident

3. The Ethylene Product was Flared.

4. The Cold Flare Vaporizer may not have been functional due to heavy oil found in the Cold Flare System. This oil may have come from the PRC Seal Oil System.

5. Post investigation found the oil also fouling the super heater.

Incident

6. It was noted that the flare temperature was exceeding the metal temperature limits and Unit Feed Rate was reduced to allow the temperature to increase.

7. At 7:38 AM a heavy rain storm passed through the plant area.

Incident

8. The combination of the thermal shock of the warm rain and the weight of the rain on the ice jacket may have caused the 30 inch pipe to fail.

9. The Vapor Cloud was ignited by an unknown source.

Incident

10. Damage was recorded to the equipment but no personnel injuries resulted.

11. Unit was decommissioned and fire extinguished on 12 January 18:50.

Conclusions

1. Flares are an Ethylene Plants last line of safety defence, but they are not an ironclad defense. They must be properly monitored and maintained.

2. Each Olefin Plant has the potential to have a major explosion and damage resulting from a flare line rupture.

Conclusions

3. Flare designs are similar, but modifications can be made to increase flare safety systems.

4. The objective of this paper is not to compare which flare system is better, but to underline Titan's commitment to make this region a safe place to operate an Olefin plant.

Thank You

Q&A