Procedure

LPG Flaring Procedure

August 2017 Copyright © 2017

Emergency Response Assistance Canada (ERAC) is a not-for-profit emergency preparedness and response organization. Experts in designing emergency response assistance plans (ERAPs), ERAC is instrumental in assisting hundreds of oil and gas and transportation organizations. From coast to coast ERAC provides highly trained and skilled responders, equipment and industry best practices for road or rail incidents involving flammable gases and liquids. ERAC is a subsidiary of the Canadian Propane Association (CPA).

Disclaimer: The information contained in this course was obtained from sources believed to be reliable and is based on technical information currently available. The material contained herein was prepared by Emergency Response Assistance Canada.

Contact:

Emergency Response Assistance Canada

Assistance d'intervention d'urgence du Canada

1100, 744 – 4th Ave S.W. Calgary, Alberta T2P 3T4

Telephone: (587) 349-5880 Fax: (403) 543-6099 Web: www.erac.org

Document Control Information:

LPG Flaring Procedure			
Originated By:	Lee Nelson, Technical Advisor	Reviewed By:	Patrick Knight, Safety and Quality Manager
Approved By:	Don Merriam, Operations Manager	Version:	V1.0 2017-07-25
Distribution:	Operations Manual/Procedures	Revision Date:	2020-07-25

Table of Contents

1 Introduction

This procedure provides the information necessary for Emergency Response Assistance Canada (ERAC) responders to safely flare LPG products as contained within the LPG Plan.

Prerequisites to any LPG flaring operation include but are not limited to

- hazard analysis,
- container assessment,
- site assessment, and
- site safety.

This procedure covers all anticipated flaring operations and should be reviewed by all ERAC LPG responders at the awareness level to ensure they are competent and knowledgeable on the procedures and considerations. ERAC Remedial Measures Advisors (RMAs) and Response Team Leaders (RTLs) must be able to describe, and be able to competently conduct and manage all aspects of LPG flaring described in this procedure.

2 Background Information

Flaring operations may be conducted at any point at an LPG incident. Flaring may occur to lower or stabilize pressure in a damaged MOC, to lower the pressure in a receiving MOC, to lower the pressure in an MOC at the conclusion of a transfer, or to destroy liquid product.

2.1 Overview

Flaring activities will involve significant amounts of radiant heat and an open flame. Response teams need to carefully select flaring locations and manage combustible materials around the operation. The area can be watered down or scraped clear of combustible materials. Fire extinguishers need to be located in easily accessible locations.

2.1.1 Vapour Flaring with a Flare Stack

The ideal scenario for vapour flaring is utilizing a vertical flare stack. The stack allows the by-products of combustion and heat to discharge above the responders in a location upwind or crosswind from the MOC. Vapour flaring is conducted for several reasons. Pressure control is achieved by forcing the liquid in the MOC to boil and cool. The discharge of flammable vapour is safely managed by burning it at the flare stack. In this scenario there is no need to pad the container with nitrogen as the intent is to lower the pressure. Vapour flaring may also be conducted to empty the container of flammable vapours. In this scenario, the liquid will have already been removed to the maximum extent possible. Flaring may be aided by the injection of an inert gas or water to displace the flammable vapour inside the tank.

2.1.2 Vapour Flaring with a Minimal Flare

In some situations (typically a rail incident) where multiple MOCs need to be flared at the same time and multiple flare stacks are not available a “minimal flare” may be considered. This flaring set up will accomplish all the same results that a flare stack can. Minimal flaring is not remote from the MOC and personnel and equipment are exposed to more heat and the by-products of

combustion. A minimal flare is constructed of pipe nipples and elbows directly plumbed into the railcars vapour valve.

2.1.3 Liquid Flaring with Pots

Liquid flaring is used to destroy product when a transfer is not an option. This could be a result of site conditions, MOC condition, product degradation or contamination. When liquid flaring plumb liquid to the evaporator coil on the flare pot taking advantage of the 270/1 expansion ratio of the LPG. Flare pots are ideal in situations where dark smoke is not acceptable or in an urban setting where building a pit or containment is not an option. The flare pot will empty a container of liquid faster than a vapour flare and slower than liquid flaring to a pit.

2.1.4 Liquid Flaring with a Flare Stack

Liquid can also be flared using a vapour flare stack if site conditions are favourable. In this case, the flare stack is fastened to a pipe vice parallel or at a slightly uphill angle to the ground. Liquid flow from the MOC is restricted at the tank valve so the LPG has time to vapourize inside the hoses prior to reaching the flare stack. If the flow rate is too high, liquid will be discharged from the flare stack and droplets of burning LPG will fall to the ground. Response teams must be mindful of combustible material in the line of fire and adjacent to the stack when using this method. Site control is critical as the flame is at ground level.

2.1.5 Liquid Flaring into a Pit

Flaring to a pit allows the response team to pipe liquid LPG to a containment pit without restriction through 2” transfer hoses and piping.

Pit construction and site selection must be performed carefully. The containment should be approximately 10m x 20m with berms that are 2m tall.

Note: the ground in the pit will be sterilized by the heat of the flaring and if used for agricultural purposes it will need to be removed and replaced.

LPG should be routed into the pit and directed downward through 2” black pipe. The LPG must discharge down the long axis of the pit.

2.1.6 Butane Flaring

Caution needs to be taken when attempting to vapour flare butane. The boiling point of butane is around 0°C. When butane vapour exits the MOC and is subjected to ambient conditions at or below freezing it will condense to liquid and will exit the stack as burning droplets of liquid. This phenomenon is predictable and steps must be taken to manage the issues. Hot nitrogen can be injected into the tank to heat the vapour, the tank can be externally heated, the hose from the vapour valve to the flare stack can be heat traced and insulated.

Pressure can be added to the MOC to push the butane to the flare stack, pot or pit. This can be accomplished with nitrogen, CO2, or propane vapour from another MOC (e.g., a BBQ tank).

2.1.7 Vent and Burn

Note: Specialized contractors will conduct vent and burn operations. The information here is provided for awareness.

Vent and burn is a procedure used to decrease the pressure in a damaged MOC and then remove the liquid. The procedure is used when the regular valves and fittings are no longer accessible or serviceable. Vent and burn is a tactic with limited applicability inside urban areas

due to the inability to control flow rates once initiated. Vent and burns use explosive shape charges to penetrate the highest portion of the vapour space and the lowest portion of the liquid space while the response team is in a safe location. **The explosives company should use time delay programmable blasting caps**. Similar to a liquid flare, a containment needs to be built around the MOC. This containment berm should be built 10m or more from the MOC with walls 2m tall.

Explosive charge placement is key in this operation, and the response team will need to work closely with the explosive contractor to get placement right. One charge needs to be placed in the highest portion of the vapour space based on current tank orientation. The charge should be placed to avoid tank welds and heat affected zones and areas of the tank that are double thickness (mounting pads). The vapour charge should be accompanied by a separate ignition source or incendiary device. Similarly, the liquid charge needs to be carefully placed in the lowest possible portion of the liquid space. The charge needs to be clear of heat affected zones and clear of mounting pads, and head shields (e.g., areas of greater thickness). Once charges are placed and secured the initiation wires for the blasting caps will need to be run. The explosive company needs to route the wires in such a way as to avoid burning any initiation wire with existing fires and ignition sources that will be placed in the containment pit.

Once preparations are complete, the ignition sources need to be ignited and placed in the pit, and on top of the MOC. It is critical to understand how long your ignition sources will burn once they are lit. The explosives need to be detonated before the ignition sources burn out. Once the shape charges are initiated the vapour release will create a flare, and reduce the tank pressure. Five to seven seconds after the vapour charge detonates the liquid charge will detonate and allow liquid LPG to drain from the MOC into the burn pit.

3 Procedure

3.1 Vapour Flaring with a Flare Stack

1) Determine what valves are appropriate for flaring.
2) Position fire extinguishers at key locations.
3) Position flare stack upwind or crosswind from the MOC.
4) Install stub out and snappy joe.
5) Plumb hose or pipe to the flare stack.
6) Protect the final 20 feet of hose/pipe from heat (cover with soil or thermal blankets)
7) Pressure check system at 1.5X the MOC gauged pressure.
8) Light pilot light on flare stack.
9) Partially open the supply valve until the flare stack lights.
10) Open the valve as much as possible being mindful of heat production and its effects and closely monitor the operation.
11) Flare until goal is reached.
12) Shut down flare and purge line with nitrogen.

3.2 Vapour Flaring with Minimal Equipment (Rail Car)

1) Connect 18” stub-out into vapour valve.
2) Connect snappy joe to stub-out.
3) Connect 90 degree elbow to the snappy joe.
4) Connect a 10’ section of pipe oriented vertically.
5) Assemble ignition source/pilot light assembly.
6) Secure vertical section of pipe with wire or cable.
7) Light pilot.
8) Partially open the vapour valve until the flare pipe ignites.
9) Open the valve as much as possible being mindful of heat production and its effect on the tank car and responder access to the vapour valve.
10) Flare until goal is reached.

3.3 Liquid Flaring with Pots

1) Determine what valves are appropriate for liquid flaring.
2) Position fire extinguishers at key locations.
3) Position flare pot upwind or crosswind from the MOC.
4) Install stub-out and snappy joe.
5) Plumb hose to the flare pot.
6) Pressure check system at 1.5X the MOC gauged pressure.
7) Position team member with an ignition source upwind from the flare pot.
8) Partially open valve until the flare pot lights.
9) Open the valve as much as possible being mindful of heat production and its effects. If liquid droplets are noticed reduce flow until only vapour is discharging from the flare pot.
10) Flare until goal is reached.
11) Shut down flare and purge line with nitrogen.

    NOTE: Flare pot must be connected to 20’ of **hard** pipe with unions (not ACME fittings) before connecting to hoses.

    Annual pressure check of the liquid flare pot is required (see below).

    Pressure checks are conducted on liquid flare pots to ensure the evaporator coil and threaded connections are leak free and serviceable.

    1) Remove burner nozzle using a 1.5” socket and install ½” npt nipple/ball valve combination.
    2) Cap the inlet to the evaporator coil.
    3) Apply 100psi to the liquid flare pot evaporator coil.
    4) Check all threaded and welded connections with leak detection fluid.
    5) Turn off pressure supply, release pressure from the flare pot.
    6) Reinstall the burner nozzle.

3.4 Liquid Flaring into a Pit

1. Determine what valve(s) are appropriate for liquid flaring.
2. Position fire extinguishers at key locations.
3. Build containment berm or pit upwind or crosswind from the MOC. Install a section of 2” black pipe through the wall of the berm (the flare stack may also be used) for each liquid connection on the damaged MOC through the wall of the berm. Each pipe should be equipped with a block valve outside of the berm to allow for a pressure check and to control flow.
4. Install stub-out and snappy joe into each liquid valve to be used.
5. Plumb hose(s)/pipe(s) to the flare pit piping. The flare pit piping should be at least 20 ft long and connected with unions and not ACME fittings.
6. Pressure check system at 1.5X the MOC gauged pressure.
7. Place multiple ignition sources in multiple locations in the burn pit (road flares).
8. Partially open valve until the pit flare ignites.
9. Open the valve as much as possible being mindful of heat production and its effects. Closely monitor the operation. Flow rate must match the capacity of the burn pit to contain all the LPG.
10. Add pressure to the MOC if flow rate needs to be increased (see Section 2.1.6).
11. Flare until goal is reached.
12. Shut down flare and purge line with nitrogen.