BP OIL – TOLEDO REFINERY

Document Type: Procedure	**Refinery Wide**	**Procedure No.:** SAF 103
Effective Date: September 18, 2014	Guidance on Preparations for Breaking Containment	**Rev. No.:** 3
Owner: Brent Schacht	**Auth. By: D. C. Durnwald** (signature on file)	**Page** 1 of 8

SCOPE	This procedure describes ways to prepare equipment prior to breaking containment.
HEALTH **Special PPE & Special Hazards**	Any energy source that may cause unexpected movement of equipment or release of hazardous energy during maintenance.
SAFETY	Appropriate personal protective equipment needed to protect against exposures.
REFERENCE DOCUMENTS	SAF 037 Control of Hazardous Energy (Lock Out/Tag Out) Procedure SAF 102 Developing Isolation Plans Toledo Control of Work Policy Toledo Isolation Policy
SPECIAL MATERIALS & EQUIPMENT	N/A
QUALITY	Annual Auditing of Program
ENVIRONMENTAL	The internal pressure of vessels must be less than 5 psig when they are opened to the atmosphere. A form to document this must be completed and returned to the Environmental Team. Before draining of a process stream or vessel that could pose problems to the Waste Water Treatment Unit, you must notify OM&S Truck 4 or the Refinery Coordinator to proper actions are taken to prevent an upset of the WWTU operation.

OVERVIEW

Before performing equipment preparation work, including the draining to sewer, venting to the flare system, and flushing of vessels or pipe work notify affected personnel.

All equipment preparation work, including the draining and flushing of vessels or pipe work shall be included in the Isolation Plan. The Isolation Plan shall include a P&ID or drawing and the procedure steps to follow.

1.0 Potential Hazards	1.1 Some examples of potential hazards to be considered when preparing plant and equipment for breaking containment are: • Accidental spillage and freezing effects of liquid nitrogen. • Accidental spillage during draining/flushing (environmental impact). • Blockage of vents and/or drains. • Chemical reactions between cleaning materials and a tank or its fittings (e.g. acidic cleaning fluid attacking a blanking spade installed for isolation). • Design capacity of any flaring, venting or draining systems. • Disposal of pipeline fluids, contaminated water, etc. • Explosions and fires caused by the sudden mixing of water with hot oil, either during steam cleaning or by the admission of hot oil into systems which have been steamed or flushed with water but not thoroughly drained and dried. • Formation of an explosive atmosphere due to vapor or gas release. • Gaskets containing asbestos which shall be handled and disposed of in accordance with site procedures. • Hydrostatic load on pipe work and vessels. • Ignition sources including simultaneous operations (SIMOPs) in the area and electrical storms. • Incompatible chemicals e.g. acid and water. • Leakage or collapse of a tank or its supports caused by reaction with cleaning materials, excessive weight of wash solutions, or by creating vacuum conditions. • Possible asphyxiation through personnel exposure to nitrogen or other asphyxiant. • Potential dead-legs. • Protection of reception facilities from over-pressurization or overfilling. • Pyrophoric scale may be formed in systems that contain H2S. If these systems are subsequently opened up and the scale is exposed to air, there is a danger that the scale could smolder or ignite. Pyrophoric scale in equipment shall be rendered harmless by constant thorough wetting until it is either removed or the system is again closed up. • Scale which has been removed shall be similarly wetted until safe disposal. • Static electricity as an ignition source or cause of electric shock during steam cleaning or high-pressure water jetting if equipment is not earth bonded. • Vacuum effects within vessels/equipment during draining. • Valve freezing or embrittlement effects on steel pipe work due to auto-refrigeration. • Volatile vapors released from a liquid.

2.0 Depressurizing and Draining of Process Systems	2.1 For this purpose process systems may be divided into: • Pressurized vessels and pipelines/pipe work • Atmospheric tanks and vessels 2.2 For pressurized vessels and pipelines/pipe work The precautions for de-pressurization and draining of pressurized hydrocarbon and chemical containment systems should include the following: a) The system should be adequately isolated from fluid pressure and inventory for the purpose of emptying. b) The appropriate Material Safety Data Sheet should be available and reviewed. c) Online Relief Valves (RV's) shall be isolated only after provision of an alternative means of pressure relief and completion of a Level 2 Task Risk Assessment (L2TRA) or an approved risk assessed operations procedure. The L2TRA will follow approvals defined on the Task Risk Category Table. Operations procedures are approved by the Area Superintendent. d) The pressure within the system shall be relieved in a safe manner and the system drained. Negligible residual pressure should be confirmed within the system before containment is broken. e) Systems containing gas should be depressurized to a closed system or a vent/flare header designed to accept such gas. If possible, venting to flare is preferred. f) Gas systems shall be depressurized to the atmosphere only after communication with operations and environmental. This will ensure proper control and safety techniques are in place and any calculated emissions are available for reporting requirements. Persons working downwind of any drainage/venting operation should be warned by the Area Authority or Isolating Authority and, if instructed, vacate the area. All Hot Work should cease within the affected area. g) Where suitable facilities exist, liquid residues should be drained to a closed system. Where this is not possible, an estimate should be made of the quantity of liquid remaining in the system. Where local legislation allows, sufficient containment facilities should then be provided for at least this quantity. Liquid may then be drained by carefully opening a drain or flange at a low point in the system. Precautions should also be taken to prevent the spread of any accidental spillage. h) The existence of possible 'dead-legs' in the system must be borne in mind. Such traps may have to be flushed with water to remove residual liquids if there are no flanges or connections. i) Any oil contaminated/soaked lagging material should be removed from hot equipment to prevent subsequent ignition. 2.3 When emptying atmospheric tanks and vessels in preparation for changing their contents, carrying out inspections, repairs or modifications, or prior to dismantling, the following guidelines should be observed: • Follow site procedures for the task or, if none are in place, a risk assessed procedure should be developed. These procedures

	should as a minimum cover the following: a) Prior to emptying any tank/vessel, reference should be made to the as-built engineering drawings. These drawings show in detail the internals of the tank/vessel and will aid development of a suitable method to be adopted for draining and isolation, e.g. a bottom off take of a vessel viewed from the outside may lead to an assumption that the off take is flush whereas the drawing may show that the off take is raised internally. b) Storage tanks and vessels should be emptied initially using the normal off-take lines, until suction is lost. The contents should be transferred to another suitable tank or to a mobile tank, where appropriate. c) When emptying and draining, care shall be taken to avoid pulling a vacuum. This may occur if the atmospheric or vacuum vents are blocked, or by excessive emptying rates through large diameter lines. The procedure for vessel preparation shall take this into account. d) Once suction is lost through the normal off take it may be necessary to remove residual liquid contents using either a portable pump operating through an open manhole (or using the tank water drain valve) or possibly by water-flotation, taking appropriate precautions against spillage. The procedure for vessel preparation should take this into account. e) The hazards of using a portable pump in an area likely to be contaminated with flammable vapor shall be taken into account. Appropriately sited, air-powered pumps should be used where possible. f) Residual liquids and sludge shall be disposed of in the correct manner, in compliance with the requirements of local legislation and site procedures.
3.0 Cleaning and Gas-freeing Methods	3.1 After de-pressurization and draining, residual hydrocarbon liquids, vapors and gases should normally be removed before further work can proceed. Various media can be used for this purpose and the most suitable should be chosen by the Area Authority and/or Isolating Authority. 3.2 **Water Flushing** • Water may be used for flushing or to float out light substances from vessels. It is ideal for the removal of water-soluble materials and is reasonably effective at displacing (rather than removing) hydrocarbons. Water does not easily remove sludge or oils trapped in complex pipe work or vessel internal structures. • Before pipe work, a tank or a vessel is flooded with water; it shall be confirmed by the relevant discipline Technical Authority that its support structure is capable of sustaining the weight. This is particularly important for large diameter systems that normally contain gases or low specific gravity liquids e.g. flare systems. In addition, adequate run-down and draining facilities shall be provided, as large volumes of water are usually necessary for such operations.

- To avoid a build-up of a static charge, water shall be added from the base of the tank or vessel. If a hosepipe is used, the velocity shall to be kept low until the end is submerged, and the nozzle becomes electrically earthed. Flooding with water shall not be relied upon to remove all petroleum vapor, liquid or solid residues.
- It is possible to carry out hot work on the external surface of a water-flooded tank or vessel without further removal of internal hydrocarbon residue, providing the work is below the water level and a Level 2 Risk Assessment has been completed.
- Water used for displacing and removing liquid hydrocarbons will be heavily contaminated after use. It shall be disposed of in the correct manner, in compliance with the requirements of local legislation and site procedures.
- Water shall be totally removed from hot oil vessels to prevent the hazards of steam being generated during re-commissioning.
- In winter the risk of freezing may result in blockages or equipment fractures, therefore removal of residual water should be taken into account.
- Water may increase corrosion risks, especially where the plant contains halogenated compounds.

3.3 **Nitrogen**

- Refer to SAF 086 Use of Nitrogen for specific information regarding nitrogen usage.
- Nitrogen may be used to displace hydrocarbon gas and vapor.
- Vaporized, heated nitrogen under pressure can be effective for purging liquid containing systems.
- Particular care should be taken with systems which may contain pyrophoric scale from high-sulfur bearing hydrocarbons. If such scale is subsequently exposed to the air, it may rapidly burst into flame. Water sprays may be used to prevent this by keeping the scale constantly wetted.
- A quantity of inert gas at least double the volume of the vessel being purged is likely to be necessary to ensure adequate dispersal of hydrocarbon gases. Introduction of inert gas at reasonably high velocity is also helpful in ensuring good mixing. Purge with inert gas until the concentration of flammable vapor is that required for the task to take place.
- Normal flammable vapor monitoring devices do not work accurately in atmospheres which are deficient in oxygen; therefore it is necessary to use specialized equipment to determine the effectiveness of an inert gas purge.
- Following the displacement of hydrocarbon vapor with inert gas, the vessel or tank may be purged with air to displace the inert gas in its

turn. This shall always be done in cases where confined space entry is planned (except for inert entry), regardless of any intended use of PPE.

3.4 **Steam**

- Steam is useful when heat is needed to aid the purging (e.g. with high boiling point substances) or to scour the surface of a vessel or pipe work. Two methods of steaming may be employed - open or closed steaming:
- **Open steaming** is when the tank or vessel and its associated system is fully open to the atmosphere.
- **Closed steaming** is used for closed vessels and their associated equipment. During this operation, the temperature is raised allowing volatile liquids to vaporize and disperse into the bulk of the steam. The heavy constituents can flow more freely and be drained off with the condensed steam from the base of the system
- For all but the largest vessels and tanks, sufficient steam should be available to raise the external surface temperature to at least 95°C. Steaming should be continued until the condensate flowing from the vessel is substantially free of hydrocarbons.
- Steaming may be used to clean process vessels, pipe work, small storage tanks and medium sized insulated tanks. In large tanks, the rate of condensation of steam is such that adequate purging is not possible. It is essential that, following a period of closed steaming, there is adequate provision to prevent damage from a vacuum being drawn by condensation of steam.
- Steaming should be done from a mid or low point to the top of the equipment until steam appears from the high point bleed.
- After steaming, the equipment may be cooled with copious quantities of water; this also gives an additional wash to help remove residual hydrocarbons.
- Where residual material is left on the tank or vessel surface after prolonged steaming, such residual material may still evolve vapor on application of heat, e.g. burning or welding. In such cases, cold cutting may be employed or the internal surface kept thoroughly wet during the heating operation.
- All temporary steam hoses used shall be electrically bonded and earthed because static electricity can be produced.
- Steam condensate shall be totally removed from hot oil vessels to prevent the hazards of steam being generated during re-commissioning.
- In winter, freezing of steam condensate may cause blockages or equipment fractures.

3.5 **Air**

- Air may be used to purge non-flammable gases. It is unlikely to effectively remove all liquid from long pipe work systems. A final air purge may be required on equipment or vessels to ensure no asphyxiation hazard at the job site.

3.6 **Caustic Neutralization**

- Preparation of sulfuric acid lines for maintenance may require caustic neutralization followed by a water wash.
- The engineering department shall be consulted during the planning phase before the decision is made to use caustic neutralization. Engineering can help determine if caustic is appropriate, and can specify the type and amount of caustic to be used.

WARNING
Caustic in carbon steel piping can crack welds unless they are stress relieved.

- Purge acid material to safe location.
- Maintenance will need to be in Acid suits while opening acid lines.
- Drain all free acid from the equipment and piping.
- Fill pipe with neutralizing solution to rapidly raise the pH to above 7 and circulate if possible. If there is sludge in the line, the neutralization solution should flow until sludge is dissolved.
- Drain the neutralization solution, constantly checking the pH to ensure it is above 7. If pH is below 7 at any point in the draining, repeat step 2.
- Rinse with water until pH leaving the pipe is the same as the pH of the rinse water.
- Nitrogen can be used at this time to dry the piping if necessary.

Revision History

Revision history

The following information documents at least the last 3 changes to this document, with all the changes listed for the last 6 months.

Date	Revised By	Changes
9/9/14	Brent Schacht	Owner of Procedure changed from Matt Grimes **to** Brent Schacht
9/9/14	Brent Schacht	Administrative change in verbiage from Level 2 Risk Assessment (L2RA) **to** Level 2 Task Risk Assessment (L2TRA). This change was necessary for consistency with eCoW terminology. MOC# 2014707-001

THIS IS THE LAST PAGE