Best Practice for Disconnecting Process Pipelines

Scope

While there is no per se OSHA requirement for safely disconnecting process pipelines, there are safe work practices that apply. The reason for this best practice is based on both safety and process safety risks associated with this activity. Two actual incidents are described below in the "Case Study" section.

Key Points

- Develop a policy and permit for disconnecting process pipelines.
- The permit shall drive a hazard assessment that considers the material last in the pipeline prior to cleaning or flushing and whether or not the pipeline was observed depressurized and drained. Based on this hazard assessment, determine the appropriate approval needed to proceed.
- Personal protective equipment for the initial disconnection of the pipeline shall be the same as what is required for the last chemical in the pipeline in an open system. The "last chemical" in the pipeline in this context is the chemical prior to flushing or cleaning.

Case Studies

Incident No. 1. Maintenance Employees Exposed to Caustic Soda – While disconnecting a caustic soda pipeline that had been flushed with water that was already correctly locked out for another purpose, two maintenance employees and a passer-by were injured when caustic soda was unexpectedly released from the pipeline when the line was disconnected. *Lessons Learned: Although the isolated line was locked out for another purpose, the change in scope required a re-evaluation of the work to be done and may require additional steps such as evaluating what valves are locked, and flushing and draining requirements for the new work. A pipeline locked out for some other purpose may not be safe for a change in scope and must be re-evaluated.*

Incident No. 2. Fire at a Tall Oil Refinery – A significant fire occurred in a tall oil refinery when a blind flange was removed from a closed and properly locked out gate valve on a drain line connected to the bottom of a distillation column.

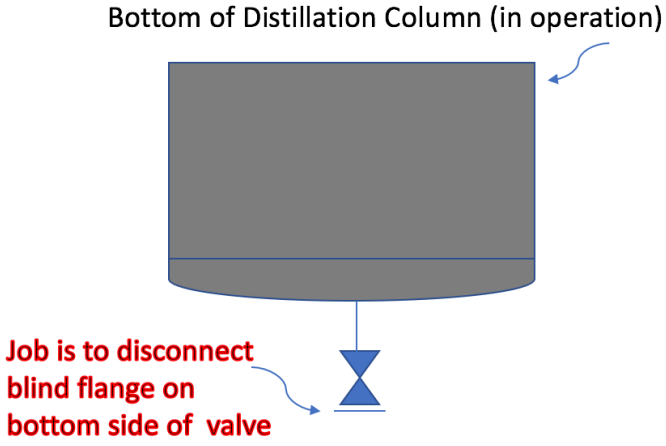

Figure 1 – Schematic of Incident No. 2

When the blind flange was removed, the contents of the column which were over 500^{o} F were released and autoignighted. Fortunately, there were no injuries. The "closed" gate valve was found to have a small piece of metal lodged on the seating surface preventing full closure, in spite of the valve stem giving the impression that the valve was fully closed. *Lessons learned: 1) A valve that looks or feels closed may not be. 2) With no way to confirm the disconnection point was flushed and drained, there should have been a process hazard analysis that asked the question, what if the valve leaks through? 3) Unless the risk could have been reduced to an acceptable level, work should have been scheduled for when the refinery column was shut down.*

Develop a Policy and Permit

Clearly define for your facility what a "process pipeline" is that will be covered in a facility-specific safe work practice. Consider chemicals covered under OSHA's Process Safety Management and EPA's Risk Management Program regulations, corrosives, chemicals operating above their flash or autoignition points, molten rosin/resins, pressure hazards (steam, compressed air). Consider logical exceptions for which there are procedures developed, such as opening a manway to add chemicals, opening filter housings to change/clean baskets, changing pressure gauges, connecting/disconnecting to railcars and tankwagons. Also consider minimum pipe diameters, e.g. is tubing included in your policy or not?

Develop a Permit

The permit should define the following and are discussed below.

- General Information
    - Identify the specific system, location, purpose, and the last chemical what was in the pipeline prior to any flushing or cleaning.
- Steps Taken to Prepare the Line

- Lock out the piping system following your lock, tag, test procedure. Consider the work to be performed; a standard isolation procedure may or may not be sufficient for the specific line disconnection to be done. For example, if the standard lockout procedure doesn't have a vent and drain included in the locked-out piping system, could the lockout be extended to include additional piping that does have a vent and drain?

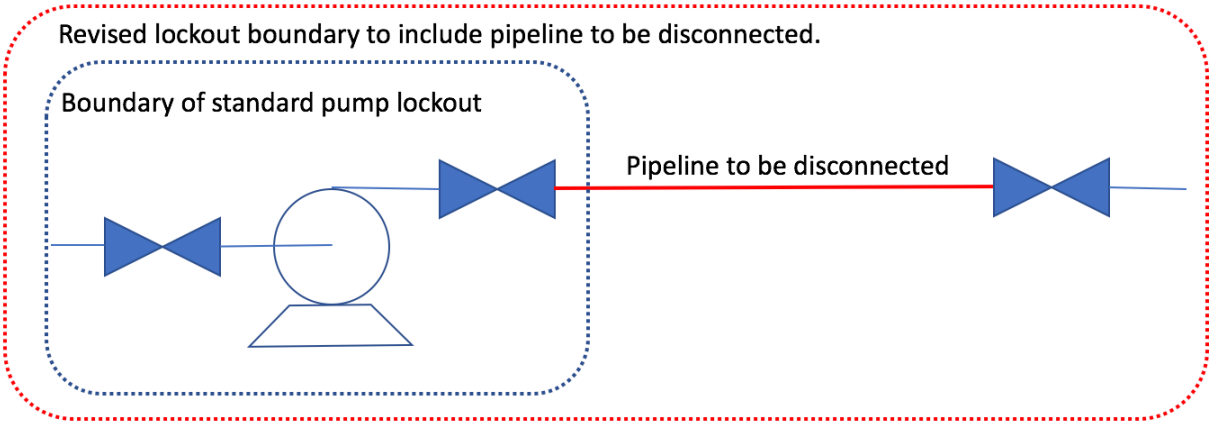

Figure 2 – Extension of a Standard Lockout Boundary

- Flush, clean, or blow the line, if possible.
- Drain the line and verify the line is drained by observing (seeing or hearing) material coming out of the drain. Do not depend on a pressure gauge, pressure transmitter, level gauge for this purpose. Beware of the "finger on the straw" phenomenon" that prevents complete drainage of the line. Open a high point vent when possible to prevent this phenomenon.
- Ensure vents and drain valves that are opened on the locked-out system are put back in their correct positions prior to startup. One way to do this is to document these on the isolation procedure.

- Hazard Assessment. Address the following:
  - What was the last chemical in the line before cleaning, flushing? Consider categorizing your chemicals into hazard categories, such as low, medium, and high.
  - Was the line cleaned, flushed, or blown?
  - Was the line observed drained and the drain point at a lower elevation than the disconnecting point?
  - Based on the answers to the above questions, perform the hazard assessment. It may be helpful to develop a matrix to assess the risk, looking at both chemical hazard and whether the line was confirmed drained, purged, and depressurized. See the sample permit approval matrix which follows.

	Hazard of Chemical		
	High	**Medium**	**Low**
Pipeline NOT verified depressurized and drained.	Hazard Assessment and Highest Approval Level (2 Managers)	High Approval Level	Medium Approval Level
Pipeline verified depressurized and drained.	High Approval Level	Medium Approval Level	Lowest Approval Level

Figure 3 – SAMPLE Permit Approval Matrix

- For line disconnections where no drain is present and this is the only valve isolating a high-risk chemical, determine if an additional valve(s) can be locked out. See Figure 4.

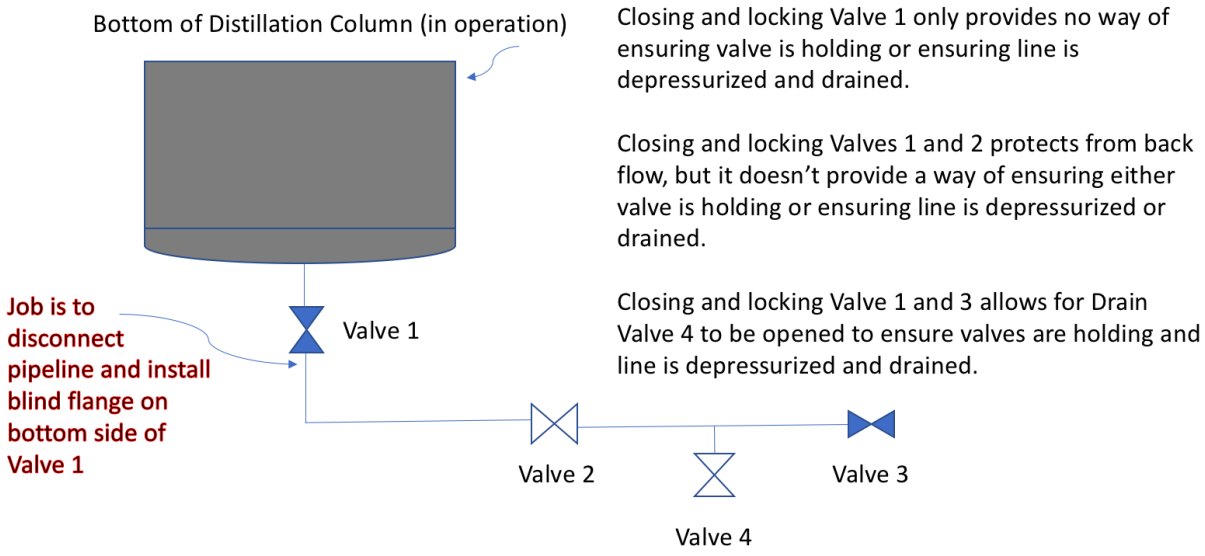

Figure 4 – Revised Lockout Boundary to Include Method of Draining Pipeline

- Based on the assessed risk, determine the level of approval needed and additional mitigation steps that may be needed.
- In some cases, the risk may be high enough to conduct a detailed process hazards analysis, and/or require that more than one manager reviews and approves the work and sign the permit.

- Personal Protective Equipment and Other Requirements for the Individuals Making the Line Disconnection
    - Identify on the permit the personal protective equipment required for the initial line disconnection for the mechanics and any individuals within 15 feet (minimum) of the line disconnection and all exposed elevations below the line disconnection. It is recommended to use full personal protective equipment required by your facility for an "open system" (potential direct exposure to the chemical.)
    - Mechanics shall disconnect the line taking precautions to avoid line of fire to the extent practical.
    - After the "initial" line disconnection, personal protective equipment can be reduced per the facility's policy for working around the chemical in a closed system.
- Approvals
    - Document approvals for this line disconnection based on the hazard assessment.

Review Your Incident History

Make sure that your written policy and permit address the root causes of past incidents involving disconnecting process lines.

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