R.I.S.K.

Risk Integrity Safety Knowledge, Inc.

PROJECT CASE STUDY

UPDATED - Dead-Legs and Corrosion Issues in a Process Hazard Analysis (PHA)

The Challenge

Identifying dead-legs and related corrosion issues is a challenge in the process industry. Pipeline corrosion has been a factor in several incidents involving releases and fires. A review of incident reports and citations shows that Process Hazard Analysis (PHA) revalidations often fail to address process hazards, including corrosion mechanisms and dead-legs.

To properly address these hazards, they must be accurately identified and documented in a PHA, along with recommended actions for preventive maintenance.

Client Description
Company Multiple Oil Refinery Sites
Project Locations Multiple US Locations
Industry Oil & Energy
Annual Revenues $20+ Billion
Employees 10,000+ employees
RISK, Inc. Solution PHA Facilitation

The Solution:

RISK facilitators use a systematic approach with the team for all PHAs and revalidations to identify and address corrosion and dead-leg concerns. We've introduced this approach at several sites, as well as incorporated it into PHA procedure updates.

Corrosion review:

- During preparation for the PHA or revalidation, the facilitator reviews known corrosion mechanisms associated with the unit in question. They review process safety information, including metallurgical or inspections reports, to identify potential corrosion issues to address with the team.
- If corrosion information is not included with the PSI, the facilitator seeks information from the metallurgy or inspections department or other site experts responsible for corrosion issues for that unit.
- During the PHA brain-storming sessions, the facilitator discusses corrosion concerns with the team. Additional team members from maintenance/metallurgy are brought into the sessions for this portion of the study to provide expertise. Discussions include potential accelerated corrosion during start up, shutdown or standby operations, excessive heating or cooling of a unit that may lead to increased corrosion including salt formation, mis-manifolding opportunities that may introduce material that could cause increased corrosion (particularly at plot limits), and identification of dead-legs that may see increased corrosion.
- The unit is reviewed to ensure both upstream and downstream effects have been thoroughly considered for all failure mechanisms. Corrosion of downstream equipment is considered upon loss of wash water or chemical inhibitors. Also, feedstock change and potential for corrosion is discussed within each relevant node.
- UPDATE: We include discussions of Corrosion Under Insulation (CUI) and Erosion. These issues have evolved over the more than ten years since we introduced this PHA approach. CUI has been featured in multiple Process Safety Beacons (June 2016, January 2014, February 2005).

Dead-leg Identification

- As P&IDs are reviewed, each line is thoroughly analyzed. To ensure that every line has been reviewed, they are highlighted prior to beginning each node. This helps identify for all team members what is being discussed. This also helps identify lines that are not part of normal operations.
- If a line is identified as not part of normal operations, or not in operation at all, it is flagged as a potential dead-leg. Further discussion follows to determine if it is a potential source of corrosion concerns in a leak-by scenario. MOCs may be reviewed to see if it was identified as being placed Out of Service (OOS). Inspectors are contacted to discuss need for or awareness of the potential hazard. Metallurgists are contacted to discuss potential for corrosion.
- If dead-legs are identified, a PHA recommendation is made to add that information to PSI, Inspections and/or Mechanical Integrity documentation.
- An additional recommendation may be made to ensure that a dead-leg management process be developed and maintained.
- UPDATE: We include discussions of intermittent use – is it used 1x/yr? 1x/month? We want the team to identify and consider the usage & how that relates to right sized inspections. Issues have evolved over the more than ten years since we introduced this PHA approach so we continually update.

It is especially important during project (MOC) PHAs and revalidations of systems that have experienced changes to uncover potential issues. Systematically approaching revalidations can uncover dead-legs created by a previous change and areas where required blanks may be missing. Project PHAs should include a specific review for tie-in points, dead-legs, demolition and corrosion issues.

The Result:

RISK, Inc. is committed to addressing this issue and has presented a comprehensive paper to help facilities improve their identification of potential dead-legs and corrosion issues during PHAs (see www.psmrisk.com or we can send you a copy). Take the time to review your PHAs and ensure they effectively identify dead-legs and corrosion issues. Establish a corporate standard to enhance the robustness of PHAs in identifying corrosion concerns and ultimately prevent incidents related to corrosion. Corrosion is often a hidden risk, you deserve to use all the tools available to be safe.

Link to paper: https://psmrisk.com/wp-content/uploads/2019/06/Corrosion-and-Dead-Legs-Paper-Journal-of-Loss-Prevention-2015.pdf [Note: this paper is being updated and will be republished in 2026]