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Popcorn Polymer Accumulation, Pipe Rupture, Explosions, and Fires at TPC Group Chemical Plant Butadiene Unit

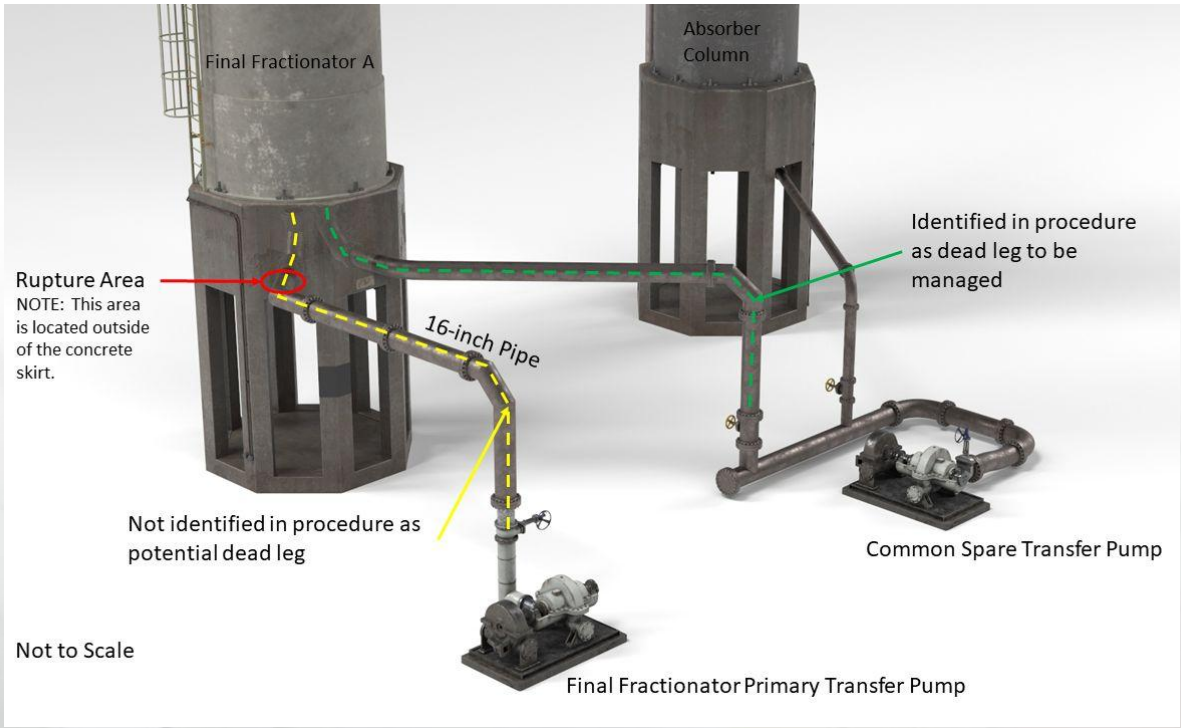
Incident Overview

Safety Issues

- Dead Leg Identification and Control
- Process Hazard Analysis Action Item Implementation
- Control and Prevention of Popcorn Polymer
- Remotely Operated Emergency Isolation Valves

Safety Issue 1: Dead Leg Identification and Control

- No TPC safety evaluation when dead leg procedure could not be followed
- No effective safety management system
- TPC procedures did not identify all temporary dead legs
- ACC Butadiene Product Stewardship Guidance Manual has gaps



Safety Issue 2: Process Hazard Analysis Action Item Implementation

- TPC 2016 PHA recommendation to ensure flushing of out of service equipment
- Implementation of this recommendation could have helped prevent the incident
- This 2016 PHA recommendation was never implemented
- Dead leg conditions leading to the incident were not mitigated

Safety Issue 3: Control and Prevention of Popcorn Polymer

- Increase in popcorn polymer formation in TPC unit before incident
- TPC did not have policies to shut down and clean butadiene unit after experiencing high levels of popcorn polymer
- Additional guidance needed in ACC's Butadiene Product Stewardship Guidance Manual

Exemplar photo of popcorn polymer (not from TPC facility)

Safety Issue 4: Remotely Operated Emergency Isolation Valves

- TPC process not equipped with remotely operated emergency isolation valves
- TPC incident demonstrates consequences that can occur when portions of a chemical facility cannot be remotely isolated

Recommendations

TPC Group

- Develop and implement a program to identify and control, or eliminate, dead legs
- Passivate equipment in high-purity butadiene service
- Incorporate the recording of any paper-based process performance information into TPC's electronic records management system

American Chemistry Council (ACC)

- Revise Butadiene Product Stewardship Guidance Manual to include guidance on identifying and controlling or eliminating dead legs in high-purity butadiene service
- Revise Butadiene Product Stewardship Guidance Manual to provide guidance on a methodology to identify what should be considered excessive or dangerous amounts of popcorn polymer, and mitigation strategies.

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