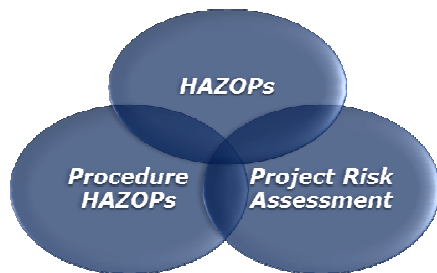
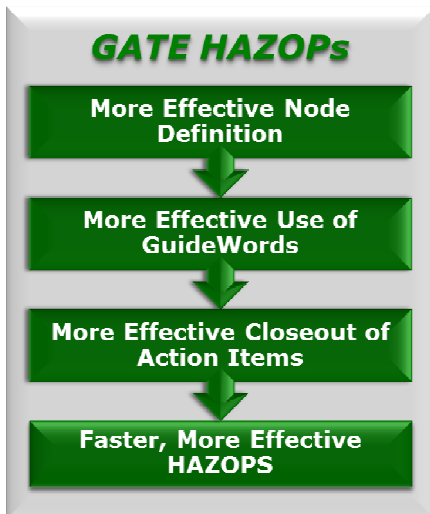


GATE KEEPER

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August, 2010
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A More Effective HAZOP Process

A group of subject matter experts gather together to evaluate a design; for a plugged-in engineer, nothing is more fun than that! Yet HAZOPs are boring and exhausting for most people. That's wrong! HAZOPs should be fun!

Picture yourself leaving a HAZOP exhausted, but hoping you can attend another one soon.

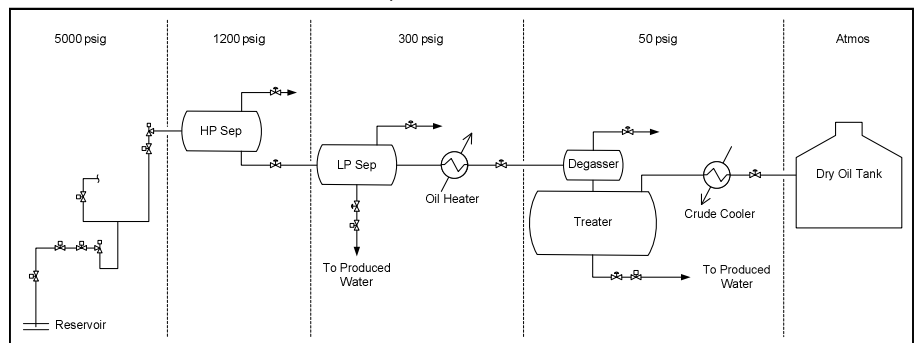
The Problems with HAZOPs

HAZOPs are not as effective as they should be. Duhon and Sutton (2010, SPE 120735) identified many reasons why we don't learn as much as we should from HAZOPs. These insights suggest a path towards a more effective HAZOP Process.

The GATE HAZOP Process – How it's Different

The GATE HAZOP process is different from the typical HAZOP process in several important ways including:

- Stream-based nodes vs. equipment-based nodes. More effective node definition streamlines the guideword-deviation conversations and decreases tendency to tunnel-vision.
- Stream-based nodes allow for discussion of operating procedures and even for simultaneously conducting a Procedure HAZOP.
- More effective ordering and application of guidewords avoids duplication of effort, saving time and minimizing tedium.
- Control room operator focus.
- More effective closeout of action items.
- More extensive and focused pre-work saves time in HAZOP sessions.

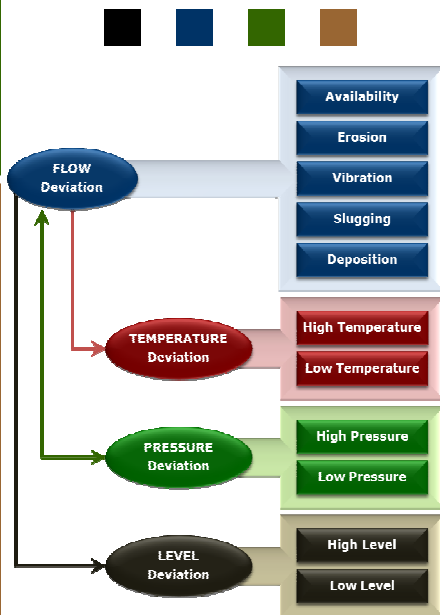


Example Stream-based Node

Stream-based Nodes

The typical HAZOP defines nodes based on equipment items; often one equipment item per node. The GATE HAZOP Process features stream-based nodes. A stream is followed from its inception to its logical conclusion. This is especially useful when considering FLOW deviations, because a FLOW disruption in any part of the stream affects all parts of the stream. These stream based nodes are much larger than typical equipment-based nodes and hence overcome the tendency of HAZOPs to create tunnel vision.

TEMPERATURE deviation discussions focus on the heat sources and sinks. A temperature change anywhere on the stream-based node potentially affects all equipment downstream of that point. For PRESSURE deviation discussions the node is divided at spec breaks. LEVEL deviations discussions focus on individual equipment items.



Effective Guideword Use

Pre-work

Effective and extensive pre-work can significantly decrease the HAZOP session time.

Reference:

Howard Duhon and Ian Sutton, 2010, "Why we don't learn what we should from HAZOPs", SPE-120735, SPE Projects, Facilities and Construction (EJournal), June, 2010

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More Effective Guideword Use

HAZOPs typically consider FLOW, PRESSURE, TEMPERATURE and LEVEL guidewords, but most pressure, temperature and level deviations are caused by flow deviations. Considering all four guidewords results in duplicated effort and tedium.

The GATE HAZOP uses FLOW deviations to educate the team about the behavior of the node. Most consequences are captured during the subsequent PRESSURE, TEMPERATURE and LEVEL deviation discussions. The only consequences captured during the FLOW discussion are those directly caused by flow, i.e. erosion, vibration, noise, etc.

Scenario Identification

FLOW disturbances propagate through the process, often in non-intuitive ways. It is instructive to mentally simulate the behavior of the entire node and perhaps other process systems outside the node.

HAZOPing Procedures

HAZOPs are supposed to evaluate operability, but that can't be done effectively without reviewing the operating procedures. But there is no point in a typical HAZOP at which the procedures can be effectively introduced. Stream-based nodes provide a natural bridge to the procedures. High level operating procedures can be, and should be, introduced during the stream-based node discussion. A Procedure HAZOP often provides more insight than the Process HAZOP.

Control Room Operator Focus

HAZOPs typically evaluate how a system should respond to a problematic event. We are also interested in how the control room operator should respond. Operator response is dependent on information. Questions such as "Does the control system give the control room operator adequate information to identify and respond to a problem?" and "How will the control room operator know this is happening?" need to be explicitly asked.

Yes, We Do Want to Solve the Problem

A HAZOP culture has developed in which we are supposed to identify the problems, but not solve them. But engineers want to solve problems. Stopping the discussion abruptly at the problem identification is unnatural, unsatisfying and results too often in ambiguous recommendations to "study" a problem. The HAZOP team contains subject matter experts who are rarely gathered together. It makes good sense to spend a bit of time solving the problem.

We suggest a middle ground. Where recommendations are made the team should identify possible solutions and perhaps debate the merits of one or more. Obviously the discussion has to be limited by the facilitator to keep the HAZOP on schedule.

Hazard Ratings per SIL Method

Hazard rating is challenging in HAZOPs. GATE recommends rating the hazards and protections per the SIL approach (IEC 61508). SIL rating can be easily and quickly applied during the HAZOP via a simplified SIL Targeting method. This approach makes risk judgment easier and simplifies judgments regarding the adequacy of closeout actions.

Action Item Closeout

The HAZOP isn't finished until the action items are closed out. Many forces conspire against effective closeout of action items, and so a structured approach should be applied to improve the closeout process.

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