

**SPE-120735**  
**Why We Don't Learn**  
**What We Should From**  
**HAZOPs**

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# Basis

SPE-110211; Duhon, Elias

## **Why It's Difficult to Learn Lessons**

Insights from Decision Theory and  
Cognitive Science

2007, SPE Annual Convention, Anaheim

2008, Projects, Facilities and Construction, September

# Learning Limit Causes

- 1) *Anchoring, Commitment, Sensemaking*
- 2) *Structural Secrecy*
- 3) *Alternative-focused Thinking*
- 4) *Conflicting Objectives*
- 5) *Unactionable Plans, Groupthink, In-Group Favoritism*
- 6) *Systems Effects*
- 7) *Lack of Motivation to Change*
- 8) *Limits to Learning from Failure*
- 9) *Stress and Expertise (Naturalistic Decision Making):*

# Rqrd for Effective HAZOP

- *Mature and Competent Design*
- *Effective HAZOP Session (find majority of design problems)*
- *Effective Closeout of Action Items*

## **Why do we have to start with a competent design?**

- *Probability*
- *Tedium*
- *Closeout Issues*

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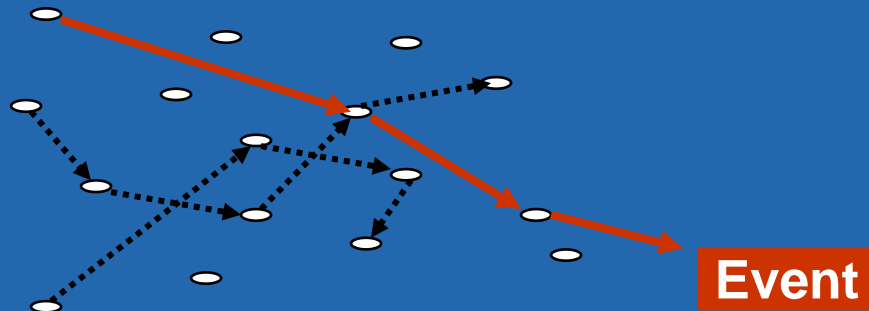
# Anchoring / Sensemaking

**Anchoring:** *Once you have put a design down on paper you will 'anchor' on that design and resist change.*

**Sensemaking** *is the study of how we use our existing beliefs to make sense of new data.*

- Sensemaking simplifies history
- Usually limited by inadequacy of our mental model rather than by lack of data.
- Driven by plausibility rather than accuracy

# Properties of Sensemaking



Predictable  
paths prior  
to event

History is complicated. Many possible outcomes could have been predicted before an event.

But after the fact, decisions and data that were ambiguous at the time, can seem to lead inevitably to the results experienced.

**Limited by Inadequate Models**  
rather than **Lack of Data**

**Driven by Plausibility rather than Accuracy**

# Anchoring / Sensemaking

## Impact on Achieving a Competent Design

- When flaws are identified the design team may argue them away rather than fixing them
- Minimal data required to support a plausible design
- Design culture now treats HAZOPs as part of the design effort.

## Impact on HAZOP Session

- Tendency to accept familiar designs
- HAZOP team has limited data and will fill in the rest of the story

## Impact on Action Item Close-out

- Recommendations will be resisted if the design team is firmly anchored on the design

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# Structural Secrecy

Complex projects have multiple subject matter experts on many teams with many companies.

Experts collect data and evaluate it. Then they communicate inferences and opinions to others. Often these opinions are biased and self-serving.

- ***No one knows the whole story.***
- ***Few people consider the big picture.***
- ***The structure of the organization guarantees that people will be shielded from some important information.***

# Structural Secrecy

## Structural Secrecy between Design Teams

- Design flaws result from inadequate sharing of information between design teams.
- HAZOPs may not identify these flaws if the HAZOP team doesn't have the right people or if the info available to the team is inadequate. The subsea design is usually HAZOPed separately from the topsides design, etc.
- Party responsible for closing a HAZOP recommendation may work in isolation

# Structural Secrecy

## Secrecy Across Project Phases

- Engineers design for steady state operation and are frequently unaware of commissioning and operability issues.
- HAZOPs identify potential upset conditions, but often cannot anticipate startup, shutdown or commissioning requirements unless they are made explicit.

## HAZOP Tunnel Vision – Secrecy across Nodes

- The HAZOP considers one node at a time. Interaction between systems can be missed.

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# Unactionable Plans, Group Behavior

## I. When nothing important is at stake people:

- *try to be fair,*
- *seek valid and accurate data,*
- *value input from other stakeholders.*

## II. But if something is very important or potentially embarrassing you are likely to:

- *try to win,*
- *cherry-pick data that supports your position,*
- *take unilateral action*

***The more important the issue, the worse we behave.  
Team membership increases this behavior.***

# Limits to Learning from Failure

- *We learn from successes; not failures.*
- *Simply identifying a problem is not learning.*
- *We are defensive about our errors – we tend to “learn” the least embarrassing lesson:*
  - *Claim Success or Bad Luck if possible*
  - *Else claim Skill-based Error (flawed action)*
  - *Else claim Knowledge-based Error (flawed plan)*
  - *Else claim Judgment-based Error*
  - *If necessary admit Belief-based Error*

**The more important the error, the more difficult it is to learn valid lessons from it.**

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# Stress and Expertise

## Analytical Decision Making

- ***Identify your objectives***
- ***Identify some alternative solutions***
- ***Evaluate the alternatives, elect the best***
- ***Implement the selected alternative***

## Naturalistic Decision Making

- ***Evaluate the situation (identify objectives)***
- ***Identify a possible solution***
- ***Will it work?***
- ***If yes, implement it***

# Stress and Expertise

**Design engineers use naturalistic decision methods because time is short.**

**HAZOP teams use naturalistic decision methods because time is short.**

**Engineers closing out HAZOP action items use naturalistic decision methods because time is short.**

# Recommendations

- Confirm that the design is adequate.
- Prepare adequately for the HAZOP
- Use a qualified facilitator.
- Pay attention to the interface between teams.
- Document HAZOP recommendations well.
- Consider scenarios.
- Consider operating procedures.
- Ask “How would an operator know?”
- Make HAZOPs faster and more effective via effective guide word selection.
- Address ‘HAZOP as part of the design’ issue.

# Confirm Adequate Design

Conduct design review prior to HAZOP – use structured process and/or SMEs.

Ensure that actions items from previous HAZOPs have been closed out.

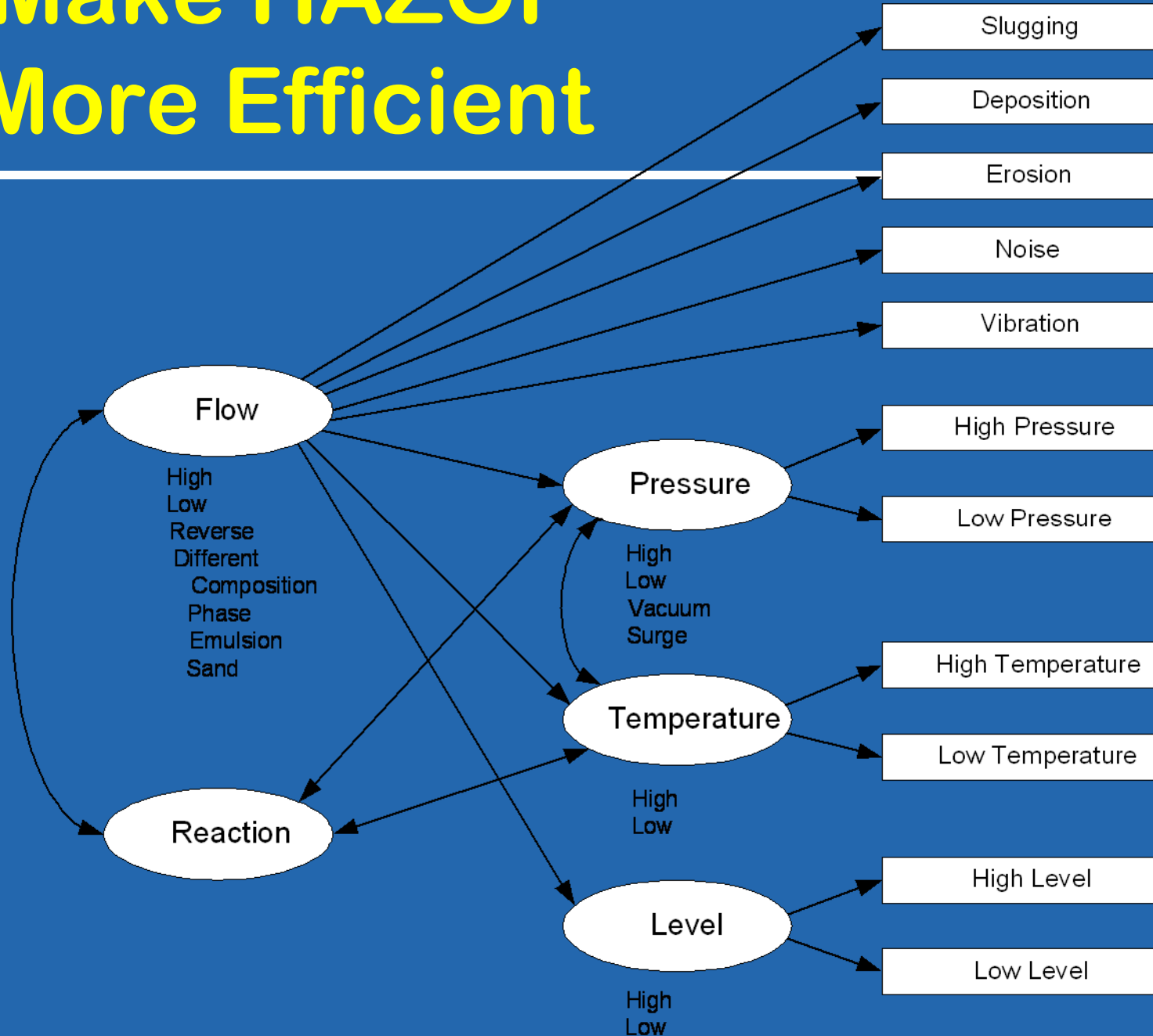
Reject the design and stop the HAZOP if there are too many design problems.

# “Would an operator know?”

We expect the operators to diagnose problems and intervene. Operators can intervene effectively only if the control systems gives them adequate information. For identified problems ask “How would an operator know that this is happening?”

Consider advanced means of providing information to operators.

# Make HAZOP More Efficient



# Conclusion

**We don't learn what we should from HAZOPs for many reasons including:**

- **Social and cognitive limits to learning**
- **Sloppy HAZOP implementation**

HAZOPs are our last and best line of defense for catching design errors and omissions. A significant improvement in HAZOP implementation could provide a step change in the safety performance of process designs.

**We should do a better job.**

THANK YOU!

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