Why Bad Things Happen to Good People

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While we’ve made considerable progress in process safety, major and minor accidents are still happening in the process industries.
Why are accidents still occurring?

And why are bad things occurring to good people?
“Errare humanum est” - To err is human.
Human Error Distribution

- 80% Human Error
  - 20% Equipment Failure
  - 30% Individual Errors

- 70% Organizational Weakness (Latent Errors)

Individual errors can occur due to various reasons such as slips, mistakes, capture errors, misidentification, and various psycho-sociological reasons.
These classifications do not fully explain why apparently experienced, competent people make errors that lead to accidents.
Even the experienced can be wrong

How to Organize and Run a Failure Investigation (#05118G), Chapter 1, Figure 3, ASM International, 2005
Competence:

- Normal - Most of our experience
- Abnormal - A small portion of our experience
“Amateurs train to get it right, professionals train to never get it wrong.”

We cannot afford to get it wrong!

Master Sergeant Dave Estabrook
US Army
Invulnerability Vs. Vulnerability
These deviations from accepted safety practices many times appear to involve personal underestimation of risk and/or an overestimation of one’s ability to control the risk.
There is also a natural human failing for people to believe that bad things cannot happen to them. This may just be a natural extrapolation from past experience that nothing bad has happened so far or an inherent personality trait to overestimate our ability to control risk.
This can lead to a feeling of invulnerability.
Vulnerability

Vulnerability is the ability to see a potential near future that leads to a negative outcome.
Violations leads to accidents

Violations results from some derived benefit.
Mistakes of Perception
Situational awareness can be considered as the sum of the operator’s perception and comprehension of the process information and the ability to make projections of the system states (near future) on this basis.
Situational awareness is really how well our internal worldview or model reflects reality and our understanding of the situation.
Some Limitations

1. Attention Span and Capacity
2. Speed
3. Focus
4. Abstraction/Reality
Filters of Doom

1. Expectations
2. Preconceptions
3. Biases
4. Folklore
5. Legends
Situational Awareness

Memory
Working (Short) & Long Term

- Schema - Prototypical & Expected
  - Objects
  - Scenes
  - Order of Events

Human Variability

Group Dynamics

Mental Model (Worldview)

- Filters (biases, preconceptions, expectations, etc.)
- Interpretation
- Analysis
- Goals (internal, external)

External Cues (Sensory Input)

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Perception → Comprehension → Projection (Action)

Situational Awareness

Process Information Feedback

Potential Incident

External information, pressures, considerations

Process
In many accidents, it seems that the moon and the planets have lined up to cause an accident.

From a probability perspective, events and conditions would appear to multiply together to make it a low probability event, yet they still happen.
Randomness
&
Independence
Latent
&
Variability
A Series of Unfortunate Events

Unit Operating Limits
Normal Operating Limits
Operation

Potential for Operator or Group Error
Enabling Factors (Individual, Organizational and/or Group)

Average Operating state

Average Error Rate
Human Variability
Organizational Variability
Latent Weaknesses
Some Conclusions:

1. Not surprising, humans are complex and their involvement in accidents equally complex.

2. No one gets too old to learn a new way of being stupid.

3. We are not invulnerable!
Some Conclusions:

4. Reality does not always cooperate.

5. Violations results from some derived benefit.

6. Latent conditions and variability by superimposition lead to enabling conditions just waiting for events to line up to cause accidents.
Got a Risk Reduction Strategy?

The End

ANY QUESTIONS?

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