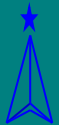


ACHIEVING THE TECHNICAL LIMIT

Excellence In Operating Discipline

Five essential elements



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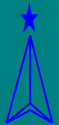
Step 1. Writing Effective Operating Procedures

- Why are they needed?
- Who says we have to have them?
- Why must we use “Error Proofing”
- What's in it for me?



Answers

- They are needed to guarantee a minimum level of safety and as an aid to standardizing on quality and volume of production.
- An average man with a pencil and paper can do better than a genius without one
- We are all making errors – our task is to recognize when we are most vulnerable and to erect barriers against them



Answer

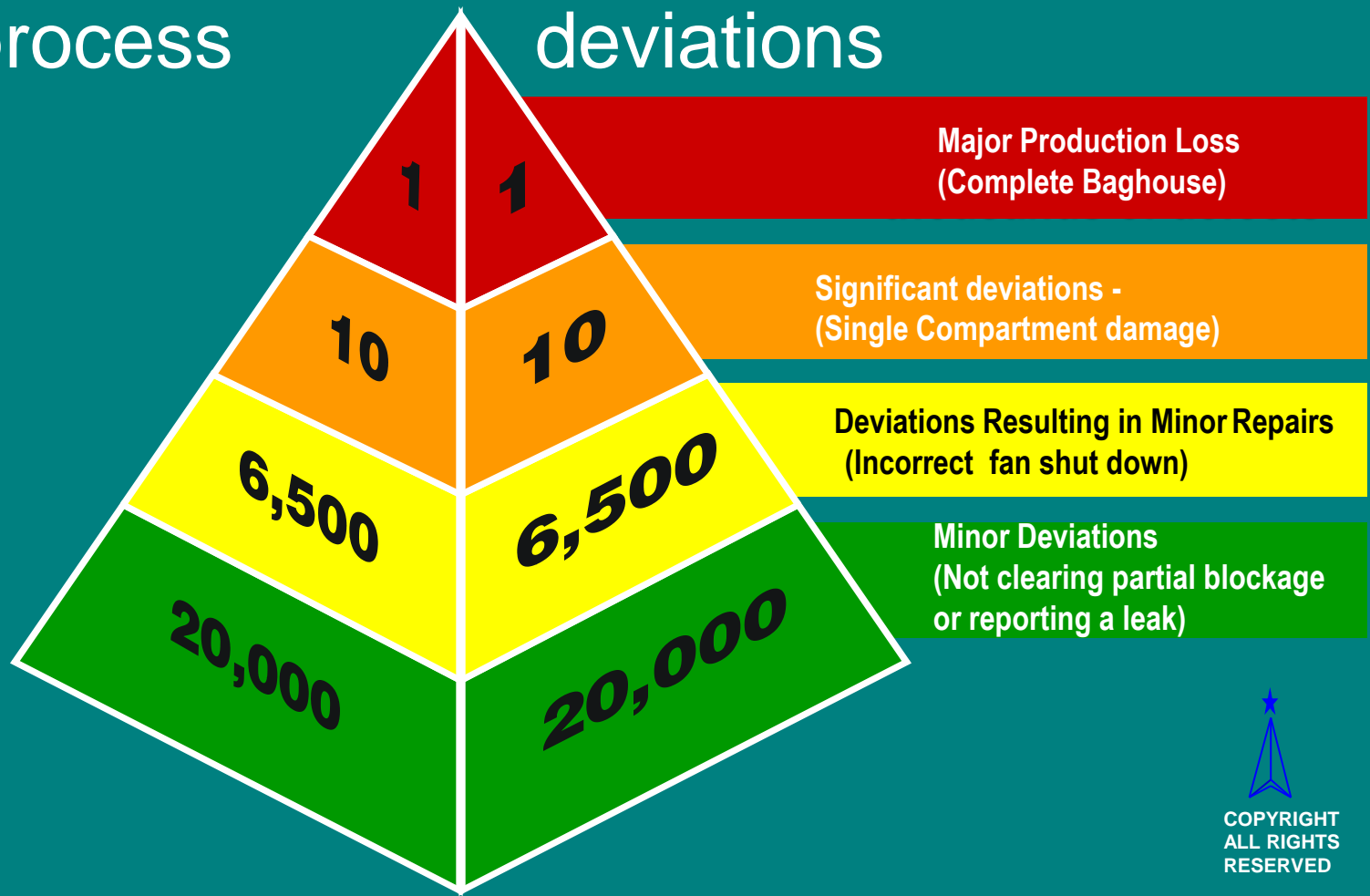
We have to have accurate procedures

1. Because OSHA & the EPA says we have to have them.
2. ISO and the Chemistry Councils “Responsible Care” requires them
3. It is “Recognized and Accepted Safe Work Practice” to have them.



How the inaccuracies stack up

- Variations from operating specification #'s of process deviations



The Modified Bathtub Curve

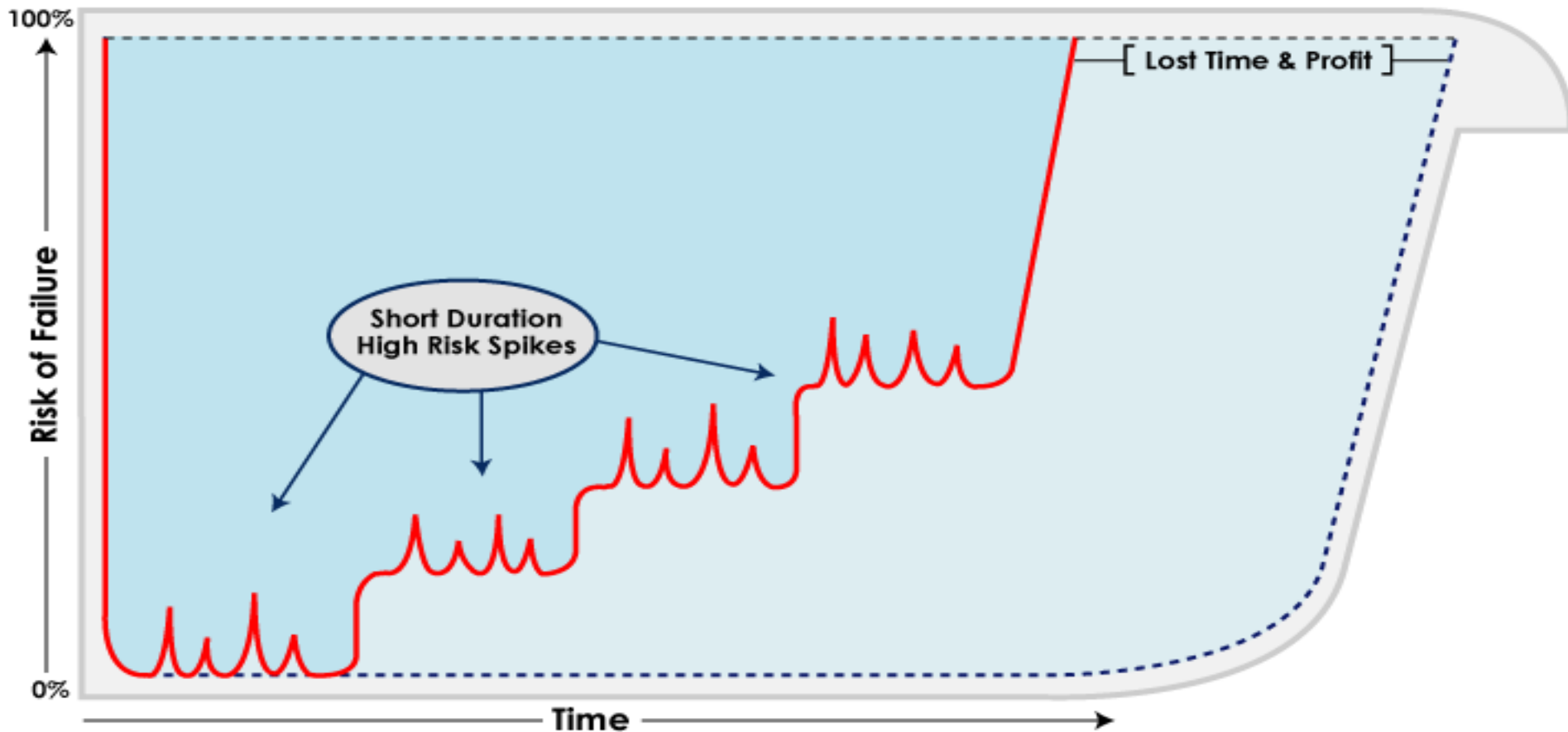


Fig. 4 - Reality - Steps and Spikes in the Bathtub

Answers

Research by DuPont showed the five sources of defects –

Maintenance materials	- 18%
Maintenance workmanship	- 7%
Raw materials	- 5%
Equipment & Process Design	- 25%
Operational Discipline	- 45%

If we can improve operating discipline by 50% we will reduce the total error count by 23%. If we were at 60% OEE and we can get to 90% OEE we would save \$50

M / yr

23% of \$50 M/ yr = \$ 8 - 10 M / yr



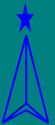
You benefit by -

- Having a safer work place
- Having a more controlled place to work in
- By eliminating deviation bugs we can improve quality and volume ensuring your plant's long term economic viability



Steps and Spike Elimination

- Understanding, training in, and following SOP's will reduce the number and size of damaging steps
- Using individually assigned checklists while stopping, starting or during emergency situations will limit errors and the size of spikes



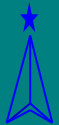
A Changed Basis

- We need procedures which will improve our safety performance – limits and consequences of deviation
- The procedures should use numbers assuming that the plant will be operated at its design or “best demonstrated” rate



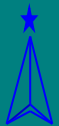
Gathering Information

- It's a multidisciplinary task – “a team” with knowledge of error proofing methods
- P&ID's
- Old procedures
- Other similar plants procedures
- Safety reviews
- Corporate standards
- Operators, Engineers, Chemists experience
- Watching experienced operators perform the task



Team Composition

Person	Role and Function
Team Leader	Set meeting schedule & resources
Shift Foremen	Equipment & operating experience
Panel Operator	Equipment & operating experience
Outside Ops	Equipment & operating experience
Process Eng	Process technology, Alarm Mgt Strategy
Controls Eng	Process Control Strategy



Choosing a Format

- The format must be concise and easily referenced
- It must conform to industry best practice
- Make the best use of white space
- Have a numbering system to track changes
- It must specify one format for all – Layout, section title, font and size etc



Format Options

- Narrative – Written as a story
- Flat & Outline formats - Step by Step in chronological order (with or without warnings & cautions)
- Playscript – Suitable for multiple individuals
- Work sheet – Extended checklist with notes



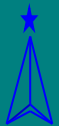
Format Options

- Flow charts
- T – Bar format. Main steps on left details on right (with additional information and cautions)



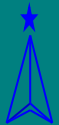
Basic rules for writing procedures

1. Write each step as a command
2. Require “One Action” per step
3. Be consistent with the level of detail and format
4. Steps in sequence need numbers. Steps without sequence use bullets
5. Use simple words
6. Be as specific and exact as possible



Basic rules for writing procedures

7. Only use abbreviations and acronyms that everyone understands
8. Does not require calculations or the use of tables if any other means is available
9. Should use graphics if they improve comprehension or reduce the size of the document
10. All documents referred to must be readily available
11. Every alarm must require an action by an operator





Interstate Highway

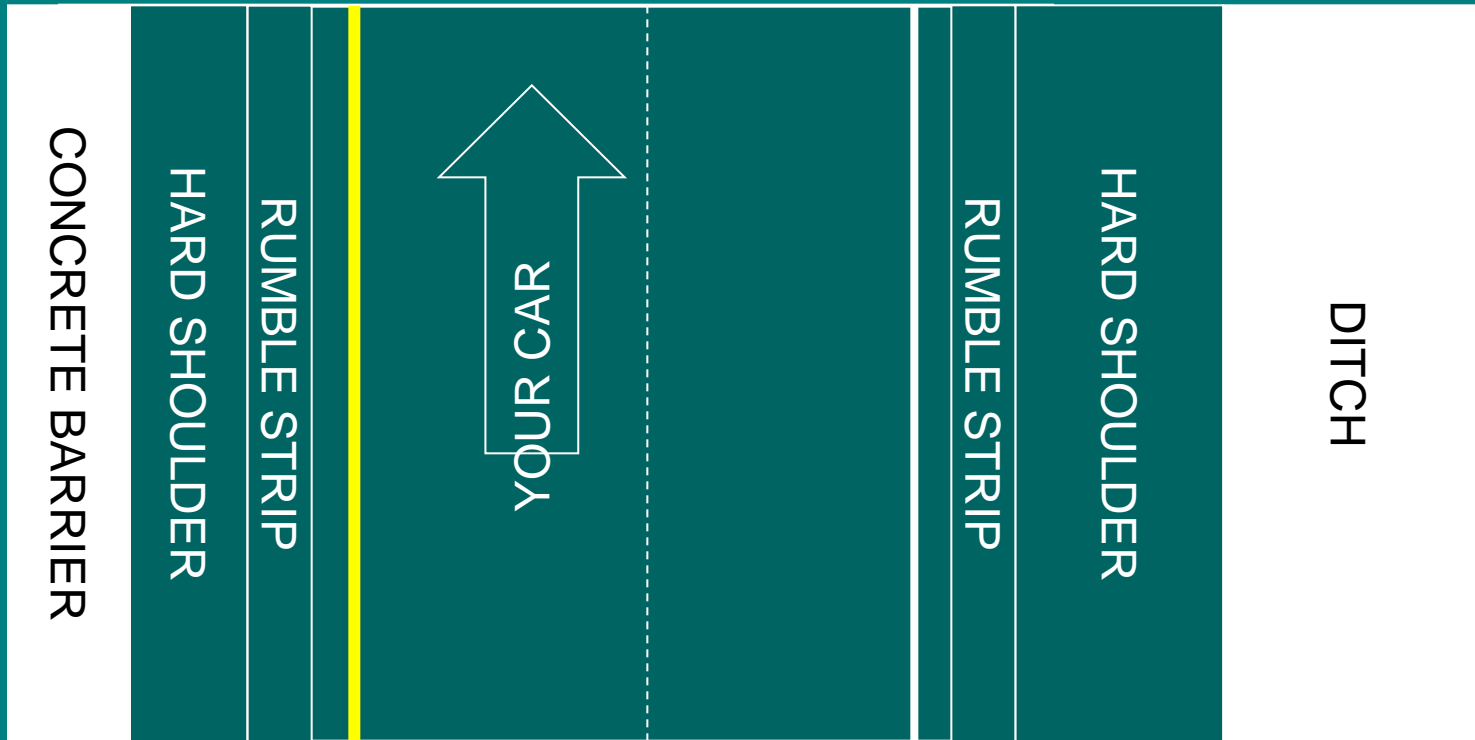
OPERATIONAL LIMITS ON THE INTERSTATE

 Information (Soft limits) = Broken Lines

 Warning (Medium limits) = Solid Lines

 DO
Hard limits = Rumble strips

 DO NOT
Hard Shoulders = Final Margin - Critical



STANDARD OPERATING PROCEDURE – NARRATIVE FORMAT

Drive from Aceville to Kingsville

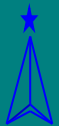
When you need to get from Aceville take the interstate highway rather than the back roads which are slower and more dangerous. The XYZ chemical plant is on the north side of the interstate on highway 67. It takes about 3 hours to get there. There are a few things you need to know about the interstate highway regarding safety. Normally there will be a concrete wall on your left hand side with a hard shoulder inside that and a set of grooves cut into the road called a rumble strip to warn you when you are getting close. Inside that by a couple of feet is a solid yellow or white line to tell you are getting close to the rumble strip. Up the middle of the road is a dashed line separating the road into two lanes. It is safest to pick one side or the other and stay in it.

It is best to fill up the vehicle with gas before starting out at the Shell Station on the left hand side of the road just before you get to junction number 230 on the freeway. They serve good coffee and doughnuts all day. Because you are only allowed three hours to make the trip and there are frequent wrecks and road repairs it is worthwhile to listen to your CB radio for warnings of congestion and make plans to follow diversions or take a short cut around the mess.

When you get on at mile marker 230 you will also notice a solid white line on your right hand side just in front of another rumble strip. This is there to warn you about getting close to the slow lane hard shoulder which is the space before you get off the road into the ditch.

When you are getting off the interstate at junction 466 the road surface is full of holes and is extensively damaged. The ramp involves a sharp turn and unless you are careful to keep your speed below 45 mph you are likely to turn your vehicle over. Having gotten off, turn left under the freeway and travel north looking for signs to XYZ chemicals






HOW MUCH OF THIS WILL YOU REMEMBER AFTER 20 MINUTES ?



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The “T” bar format

SOP – 165 Unit SO 1 Start Up

STEPS	DETAILS
1. Open water charge valve and add 100 gallons of water	 The water valve number V-132 , turn one full turn clockwise to ensure that it is fully closed after charging WATER
2. Open acid valve and add 5 gallons of 30% acid over 5 minutes	 The acid valve is a quarter turn ball valve it must be fully open (when the handle is in-line with the pipe)  <div data-bbox="1190 672 1895 858">CONSEQUENCES OF DEVIATION IF: An overcharge occurs THEN: temperature control can be lost</div>
3. Charge 80 lbs of catalyst through man way	 <div data-bbox="1093 901 1904 1065">DO: Check labeling on every bag. The floor operator in acid dilution is the only person allowed to charge catalyst.</div>
4. Start Agitator	 <div data-bbox="1093 1158 1904 1400">DO NOT: Delay starting the agitator it must be started within one minute of charging catalyst Consequence: The vessel outlet will be plugged and an uncontrolled reaction could occur</div>






Operating Limits

- Quantative Limits – Pressure, temperature, flow, composition
- Qualative Limits – Enough / Adequate knowledge, details, training, organization and control



The “T” bar format

SOP – Drive from Aceville to Kingsville

STEPS	DETAILS
1. Get on interstate highway at junction 230 traveling east	 A full service gas station if needed is on your left before just before the junction
2. Drive east to maintain schedule until you need to rest	 If traveling below 60 mph stay in the right hand lane with the dashed line on your left and the solid white line on your right
3. Maintain maximum speed that safe limits allow	 <p>DEVIATION IF: You cross the rumble strip in an attempt to pass on either hard shoulder THEN: You risk a major wreck</p>
4. Exit at mile 466 North on Hwy 67 and follow signs to XYZ Chemicals.	 Listen to CB and local radio for points of congestion and be prepared to take alternate routes
	 <p>DO NOT: Exceed speed limit there is a real risk of overturning the vehicle. The road surface is bad in the turn. Speeds above 45 mph are dangerous</p>

Step 2. Extensive use of “Checklists”

- If airline pilots and doctors use them to help guarantee air travel safety, and good surgery why not use the technique to improve complex tasks in operating discipline?
- Individual Emergency Action Checklists



Checklists - Verification

- For experienced operators only
- The steps in T-bar summarized with boxes for check off and signature at bottom
- A checklist is a procedure for ensuring that a procedure gets done

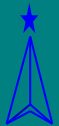


Checklists

1. Open water charge valve and add 100 gallons of water
2. Open acid valve and add 5 gallons of 30% acid over 5 minutes
3. Charge 80 lbs of catalyst through man way
4. Start Agitator

✓

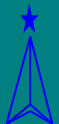
Signed.....



Operating Limits

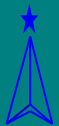
- In addition to those in the body of the procedure compile a table

Process stream #.....	Normal operating value or ranges	Limit Values	Consequences of exceeding limits	Trouble shooting guidelines	Response steps



Step 3. Process Deviation Reporting

- By counting and analyzing near misses we have improved our safety performance
- By counting and analyzing our “Process Deviations” and the “Bear Traps” that cause them we will improve our operating performance
- Who can write a suggestion for removing a bear trap?
- What type of deviations do we have to report ?



Step 4. Training Reviews

- After several months several common deviations will be repeated which will be addressed by
- Revising the procedure, some design change or by providing additional training
- The training will be based on the patterns of deviation rather than just reviewing procedures

