



The Human Reliability Company

Better Knowledge of Safe Operating Limits to Improve Human Reliability

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Agenda

- Information Challenges
- Relevant Standards
- Documentation Sources
- Technology
- Tracking & Reporting

We Have All Seen Diagrams Like These...

They come from the domain of probabilistic risk assessment, layer or protection analysis, and Safety Instrumented Function (SIF) and Safety Integrity Level (SIL) assessment

50 ANSII/ISA-84.00.01-2004 Part 1 (IEC 61511-1 Mod)

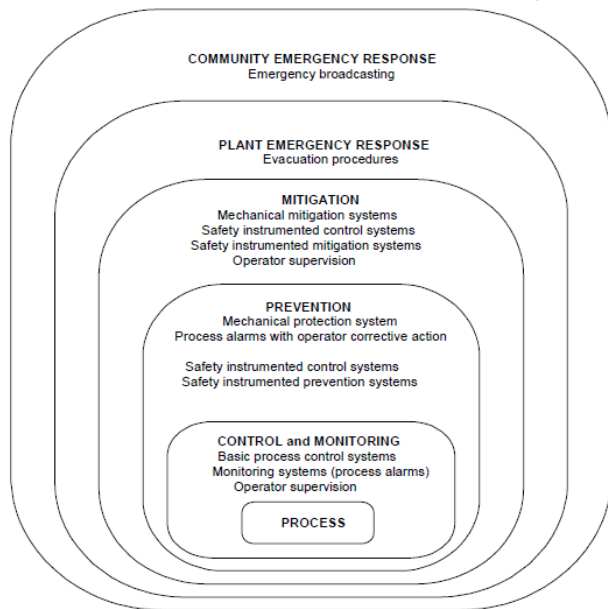


Figure 9 – Typical risk reduction methods found in process plants

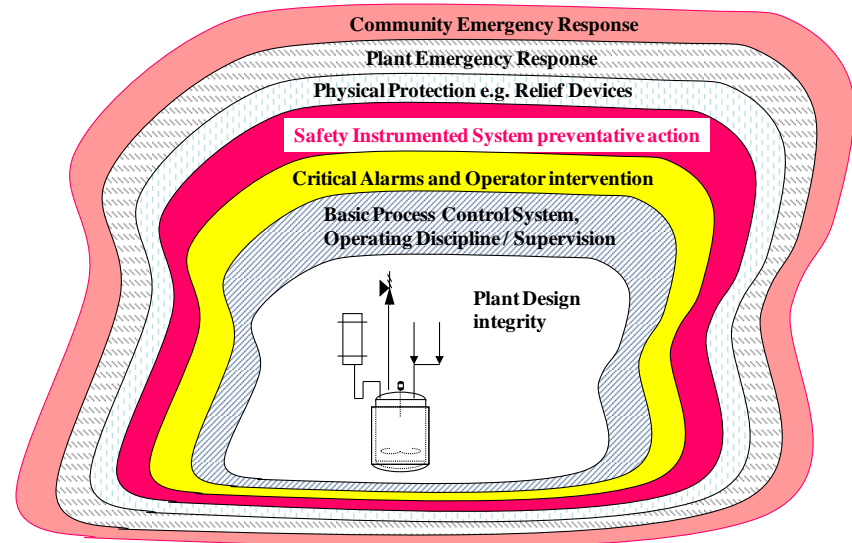
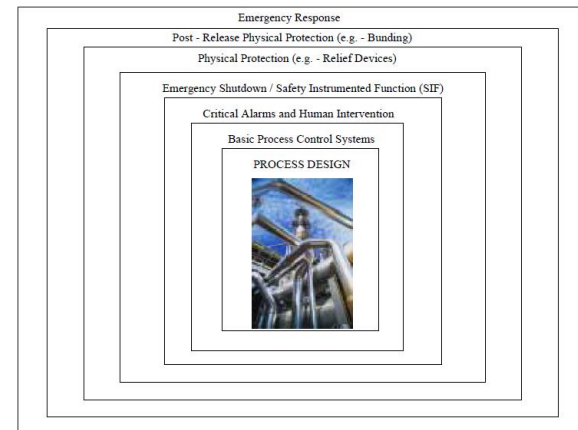


Figure 1.1 Lines of Defence



The relationship between initiating events, LODs or LOPs, releases and consequences is shown in Figure 1.2.

Challenges



- Operators manage thousands of process variables
- Process variables have limits associated with them
- Many of these limits are parameters entered by humans
- Process design limits are generally not known by process operators
- Operators are often unaware of environmental limits
- Information about limits resides in multiple locations

Full Visibility to Limits is Essential to Safe Operations

Information Required for Safe Operations

- Process Operators need immediate access to process design limitations to safely operate the plant
 - Desired Operating Zone (Optimal)
 - Safe Operating Zone (Normal)
 - Abnormal Operating Zone (Alarm settings)
 - Shut Down Limits (Plant Trips)
 - Emergency Procedures (Major Impact)

- Typical Operator manages thousands of limits
 - Pressures
 - Flows
 - Environmental
 - Quality
 - Etc.



Operations Issues

- Limit Values Change with Time
 - Process Optimization Settings
 - Catalyst degeneration
 - Alarm set points
 - Equipment fouling & de-rating
 - Etc.
- Current settings often invalid
 - Alarm setting above process trip point
- No Single reference source for the operator
 - Usually rely upon memory
 - No time to look up values during upset conditions

Human Reliability

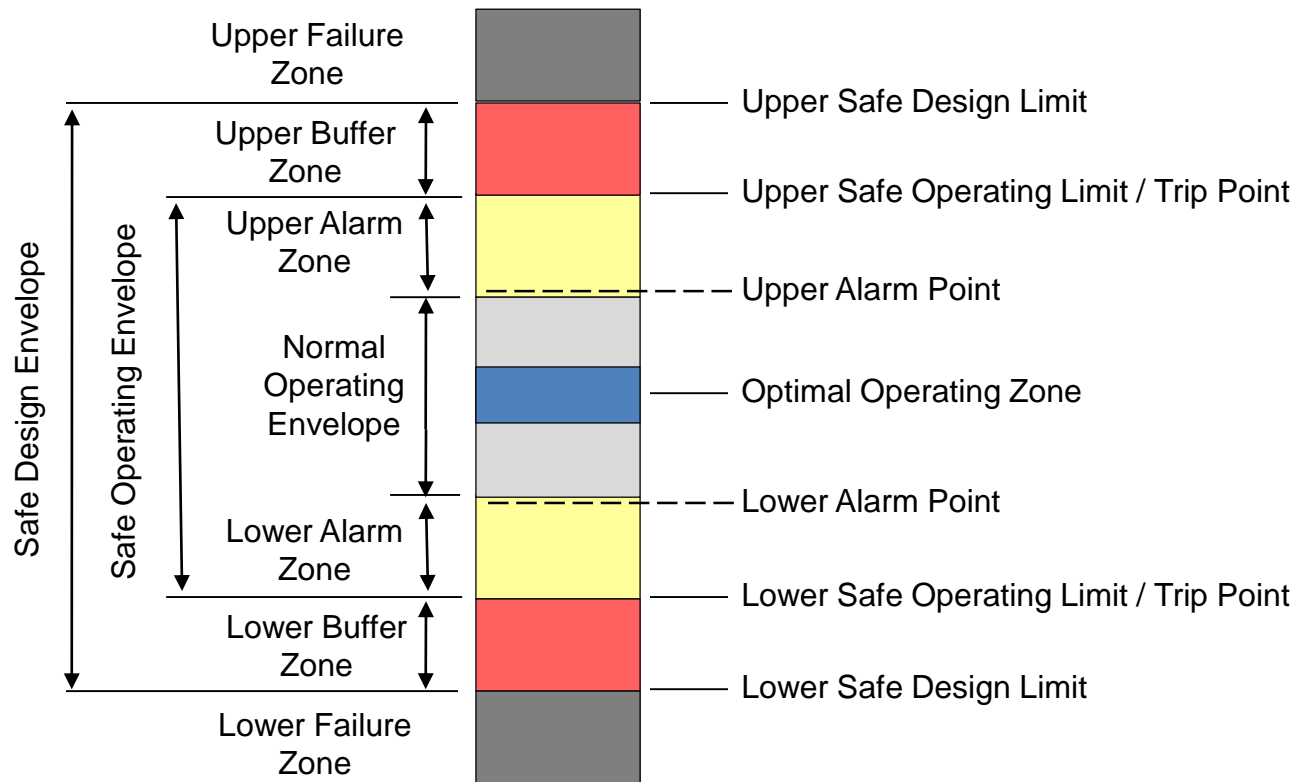
Human Reliability is the science of minimizing human error in service of greater safety, compliance, and ultimately profitability.

Effective Boundary Management

- Common repository for design, operating, environmental, and other limit data
- Hierarchy structure to ensure that relationships between limits are not violated
- High performance HMI to provide limit information to personnel in context and in real time
- Reporting system to track adherence to boundary limits

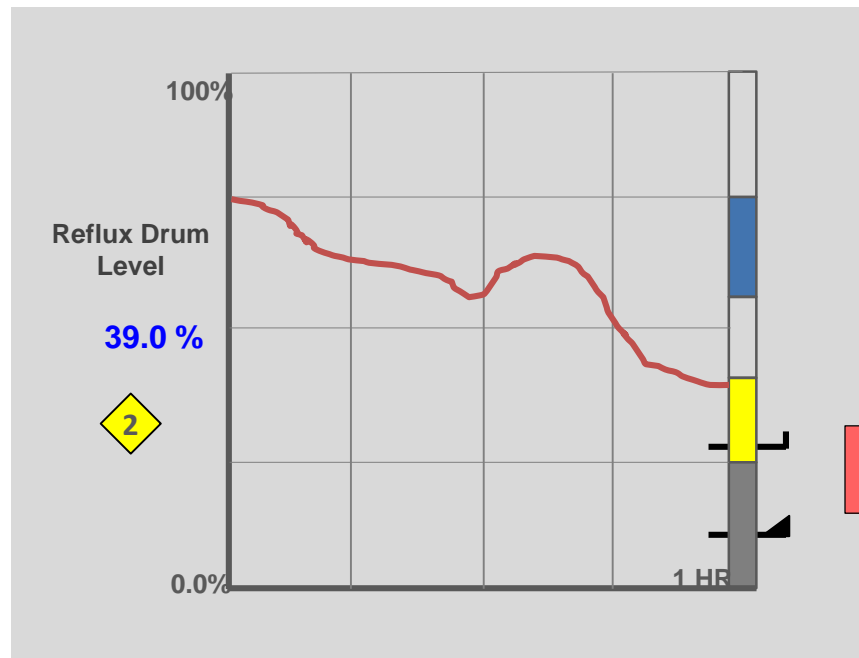
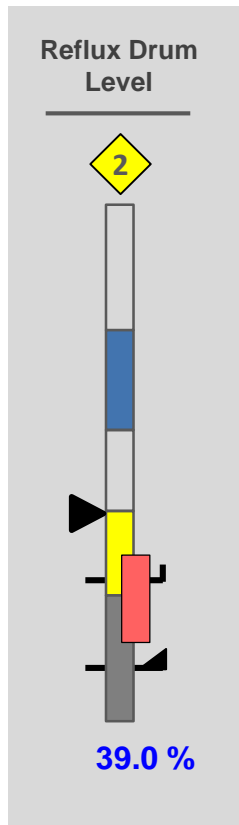
Hierarchy Structure

Ensure that relationships between limits are not violated.



High Performance HMI

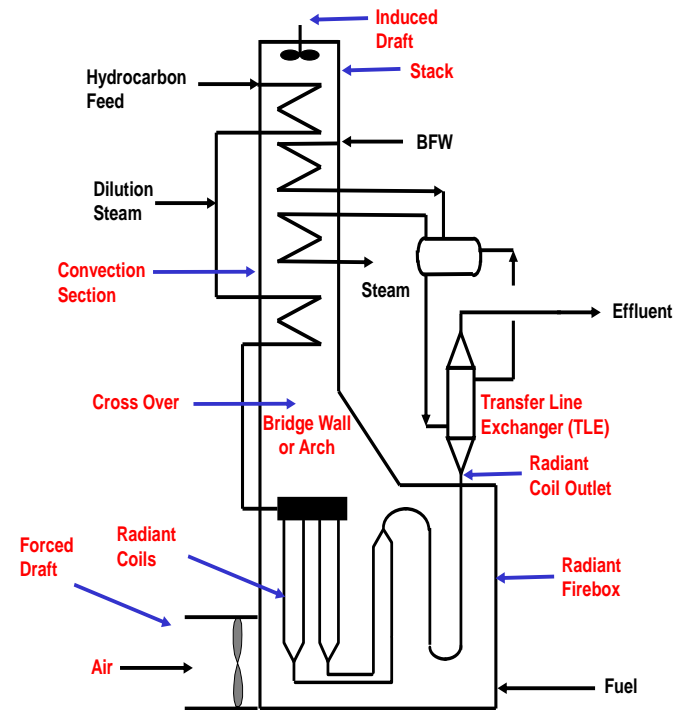
Provide limit information to personnel in context and in real time.



Case Study: Olefins Pyrolysis Furnace

Multiple safety, environmental, and economic constraints

- Interrelated
- Must be continuously monitored
- Typically vary depending upon the type of hydrocarbon feed, the constraint set frequently changes

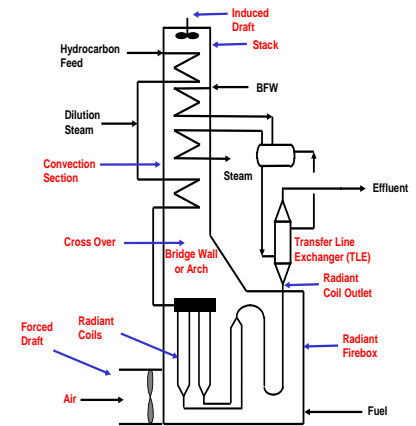


Operators always have the correct set of consistent constraints active for the current operating condition. Additionally, the engineering basis for all constraints is easily accessible thereby contextualizing the basis for all constraints.

Case Study: Olefins Pyrolysis Furnace

Key Process Variable / Boundary Table:

Process Variable	HH Safety	High Alarm	High Opt	High Ctl	Low Ctl	Low Opt	Low Alarm	LL Safety
Combustion Side:								
Excess O ₂		X	X	X	X	X	X	X
Stack NO _x		X	X	X	X	X	X	
Tube metal temperatures	X	X	X	X	X			
Firebox Pressure	X	X	X	X	X			
Fuel Gas Pressure	X	X	X	X	X	X	X	X
Fuel Gas Flow		X	X	X	X	X	X	
Process Side:								
Coil Outlet Temperatures		X	X	X	X	X	X	
Coil feed flow rates		X	X	X	X	X	X	X
Coil dilution steam flows		X	X	X	X	X	X	
Coil steam/HC ratios			X	X	X	X		
Furnace Effluent Analysis			X	X	X	X		



Summary

- All relevant limit data should be aggregated in one place
- All limits set within defined hierarchy
- Operators continually vigilant about operating limits
- Management aware of limit excursions
- Improved Human Reliability

About PAS

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- Provider of *Human Reliability Software™* for *safe production*
- Serving Power, Oil & Gas, and Processing industries globally
- Global Locations (Europe, Middle East, Asia, Australia)

Technology

- Integrity Automation Asset Management Software
- PlantState Suite Operations Decision Support System

Business Strategy

- Innovative technologies inspired by domain expertise
- Strategic customer relationships
- Mission critical software solutions
- 20% annual R&D Reinvestment

Thought Leadership & Strategic Partnerships

- Alarm Management and HP HMI Handbooks
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