Latest Development in Inherently Safer Technology

Presentation to P2SAC Spring 2017 Conference

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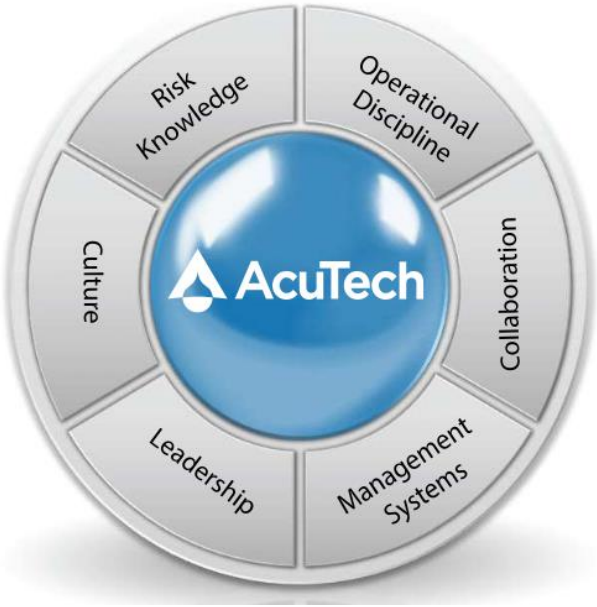
Who We Are

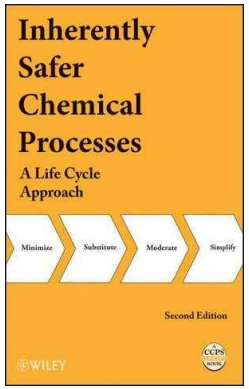
Since 1994, AcuTech has been the global leader providing management and technical consulting services, a world-class training institute and a new enterprise risk management software for improving risk, safety, environmental, and security performance specific to the oil and gas, petrochemical and chemical industries.

Process Safety and Risk Management

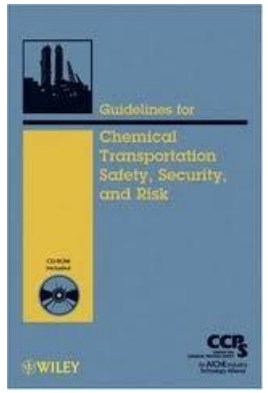
- Safety Management Systems (SMS)
- Process Safety Culture Improvement
- Management Systems Auditing
- Risk and Hazards Analysis
- Health & Safety Programs
- Process Hazards Analysis/Safety Instrumented Systems
- Barrier Analysis
- Facility Siting
- Human Factors
- Regulatory compliance
- Quantitative Risk Analysis (QRA)
- Consequence Modeling
- Inherent Safety
- Mechanical Integrity



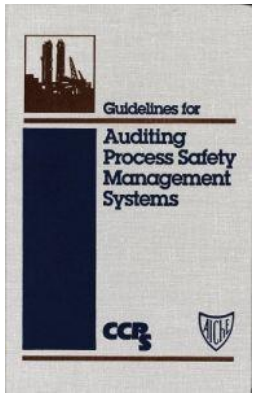
IST (2009)



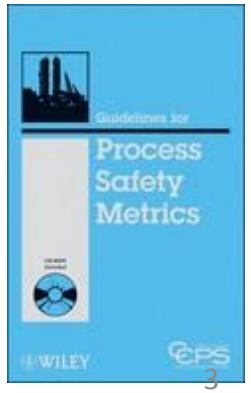
Transport (2008)



Auditing (2010)



Metrics (2009)



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Outline

- Background and Implementation of Inherent Safety
- Inherent Safety Regulatory Requirements
- Importance of Inherent Safety in the Process Safety Strategy
- Practical Application of Inherent Safety
- Challenges and Future Needs
- Discussion/ Questions

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Background of Inherent Safety

- The history of inherent safety as a documented strategy for loss prevention is rather recent, but the concept is very old.
  - On December 14, 1977, Trevor Kletz presented “What you don’t have, can’t leak,” the first clear and concise discussion of the concept of inherently safer chemical processes and plants.

- A chemical manufacturing process is inherently safer if it reduces or eliminates the hazards associated with materials and operations used in the process, and this reduction of elimination is permanent and inseparable.

- Called “Inherent Safety,” Inherently Safer Technology,” or “Inherently Safer Design”

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Chemical Hazard

- An inherent physical or chemical characteristic that has the potential for causing harm to people, the environment, property, and/ or operations/business.

- Hazards are intrinsic to a material, or its conditions of use.

- Examples
  - Chlorine - toxic by inhalation
  - Gasoline – fire/ thermal radiation
  - Flammable vapor – vapor cloud explosion
  - High pressure system - potential energy due to pressure, high temperature

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Inherent Safety Design Strategies

Strategy	Examples
Minimize	Use smaller quantities; eliminate unnecessary equipment; reduce size of equipment or volumes processed.
Substitute	Replace material with a less hazardous substance.
Moderate	Use less hazardous conditions, a less hazardous form of material or facilities which minimize the impact of a release.
Simplify	Design facilities which eliminate unnecessary complexity and make operating errors less likely.

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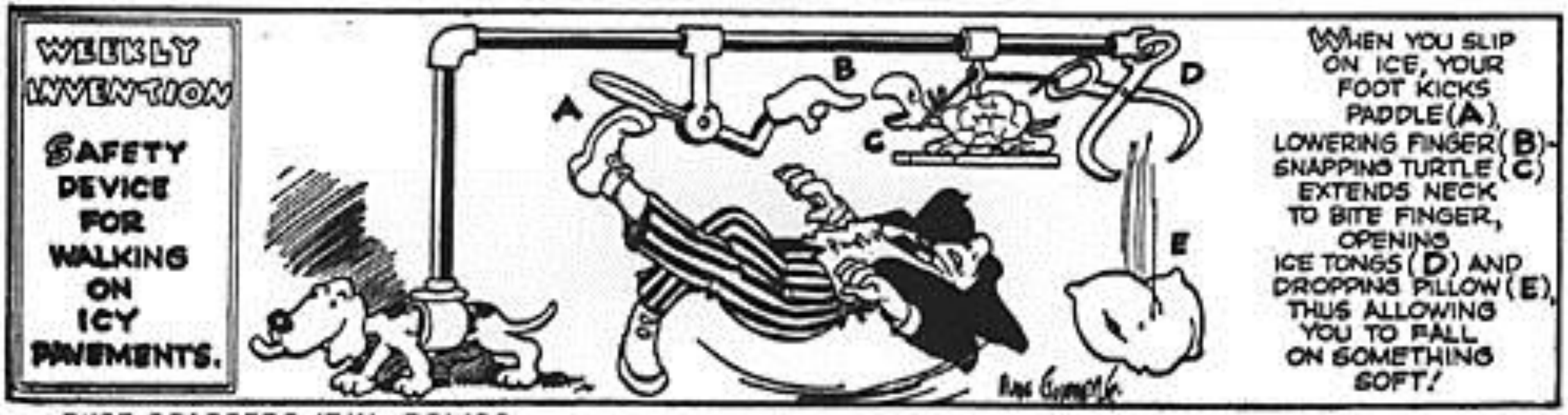
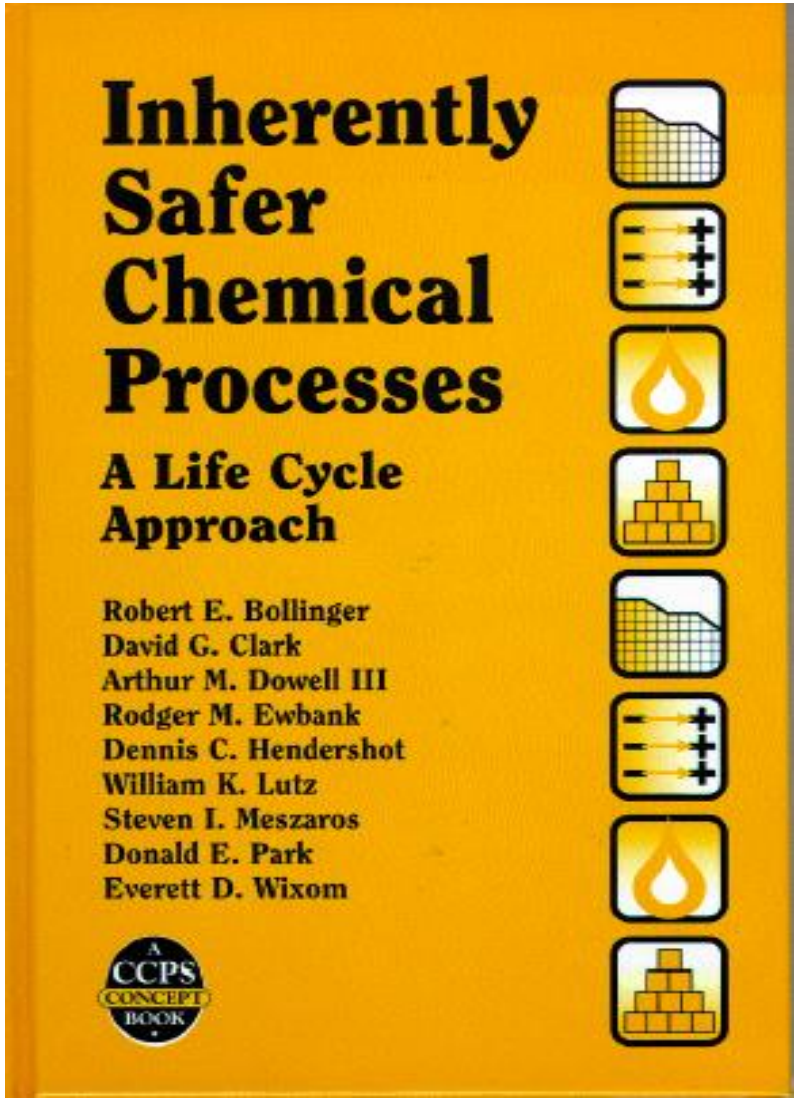
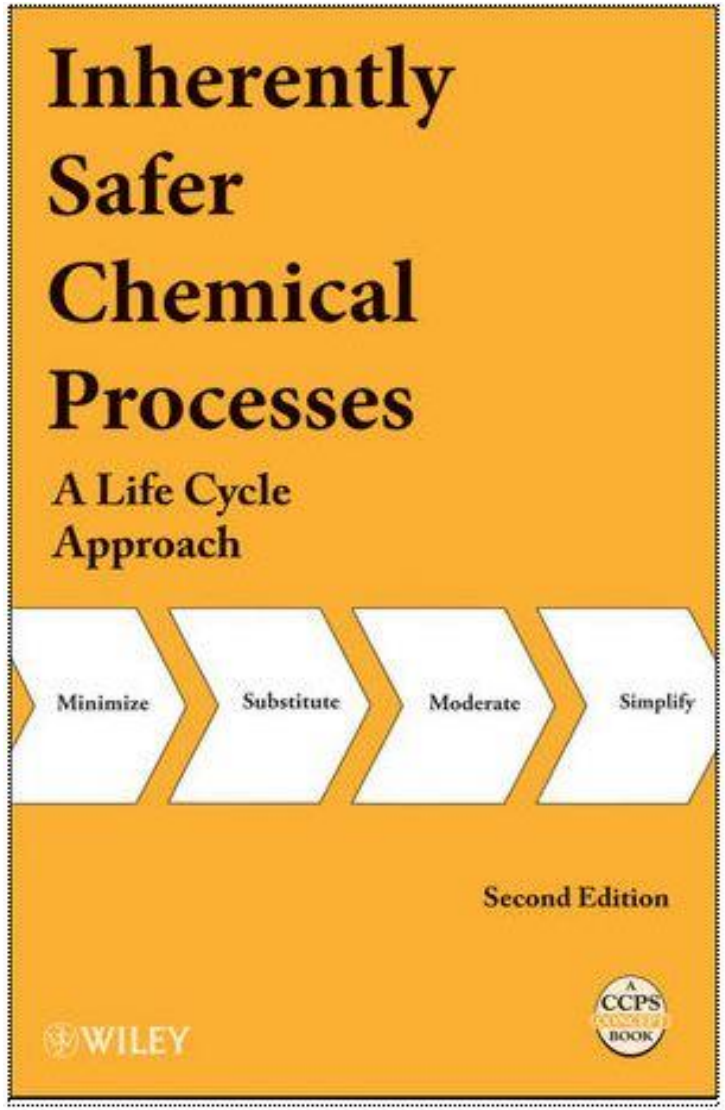
Not so Inherently Safe



RUBE GOLDBERG (TM) RGI 100

Inherent Safety Resources



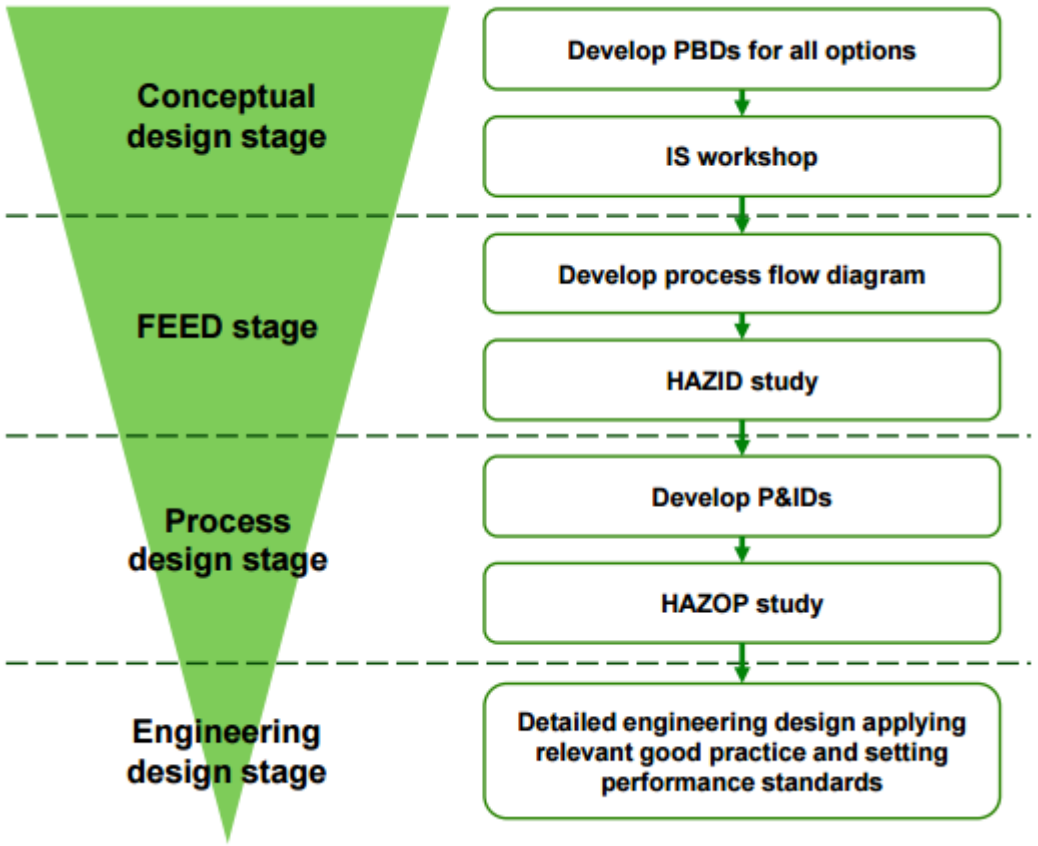


Implementation of Inherent Safety

- While Inherent Safety concepts for the chemical industry have been around for nearly 40 years, they are still rarely employed to their full potential.

- Misconceptions
  - Only for new facilities
  - Once missed in the process design only traditional means of risk management can be applied

- Inherent Safety Regulations



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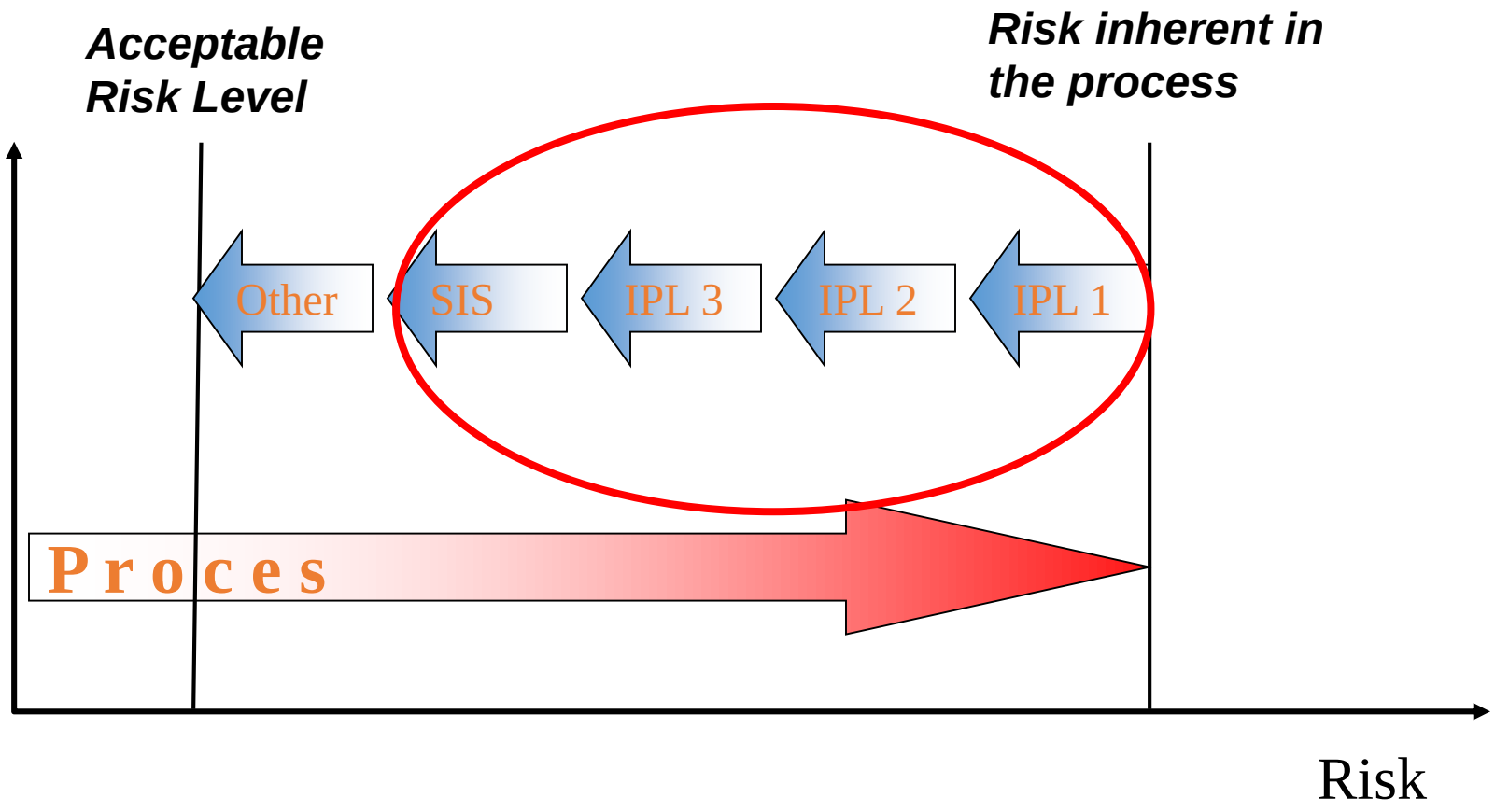
Inherent Safety Regulations

- Contra Costa County – Industrial Safety Ordinance
  - When PHAs action items are considered, an inherently safer system needs to be implemented
  - If not implemented, need to justify why not
  - An annual report to the County clarifies what was done, and audited periodically for compliance
- City of Richmond, CA (follows CCC ISO)
- New Jersey - Toxic Catastrophe Prevention Act (TPCA)
  - Requirements for performing the IST review and preparing and submitting the IST review report, which occurs every 5 years or whenever a risk assessment is performed.
- EPA RMP Rule Amendments (delayed until Feb. 19, 2019)
  - Program 3 processes would be required to conduct a Safer Technology Alternatives Analysis (STAA) for each process as part of their process hazards analysis (PHA), which occurs every 5 years.
- DHS Chemical Facility Anti-Terrorism Standards
  - Inherent Safety concepts can reduce Tiering and security and program requirements

Traditional Risk Management

- Typical risk management practices focus on managing the inherent risk of the process:
  - Capital Projects
  - MOC
  - PHAs
  - PSSR

- Applying IST allows options to lower the inherent risk, and reduce/ eliminate need for additional levels of risk mitigation



Preferred Integration of Inherent Safety

MOC

All changes are evaluated and hazards identified and focus on eliminating or reducing hazards through IST

PHA

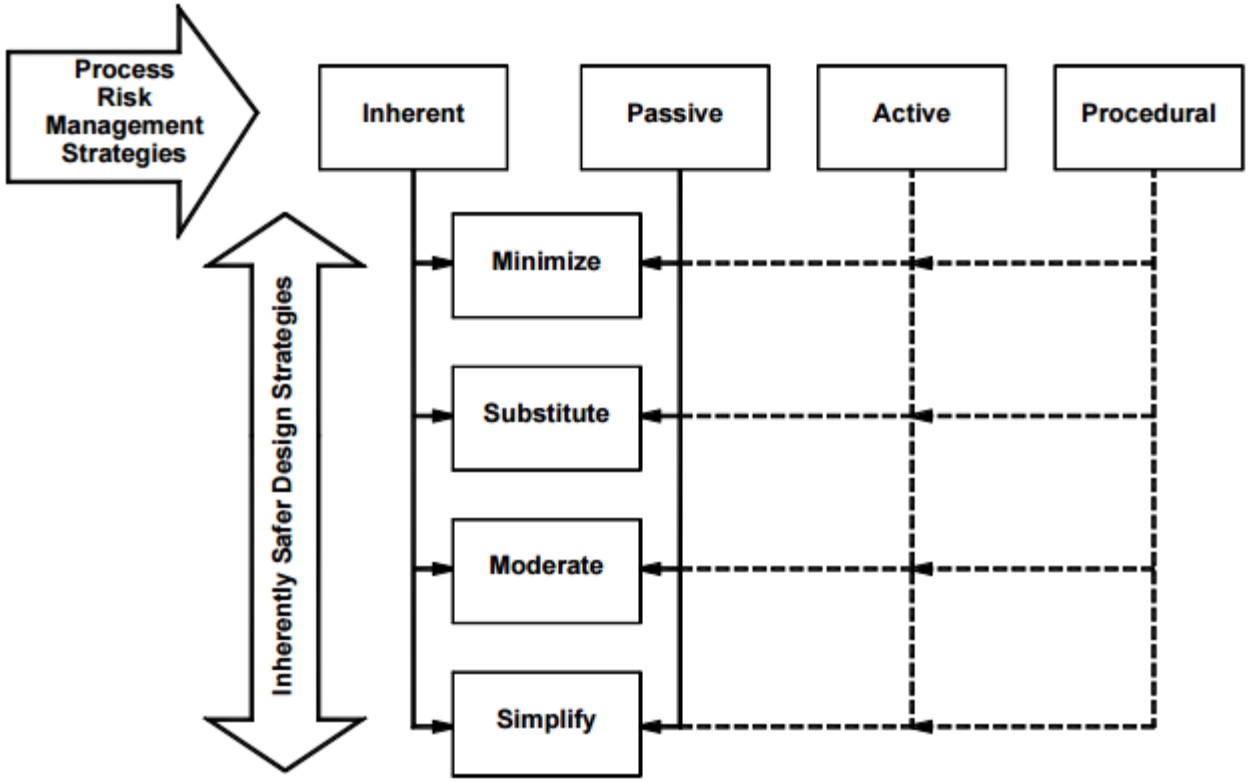
Risk-based evaluation throughout the lifecycle of the process seeking IST opportunities

Operational Readiness Review

All changes are evaluated for readiness to initiate operations and consideration of IST as is possible

Process Safety Management Strategy

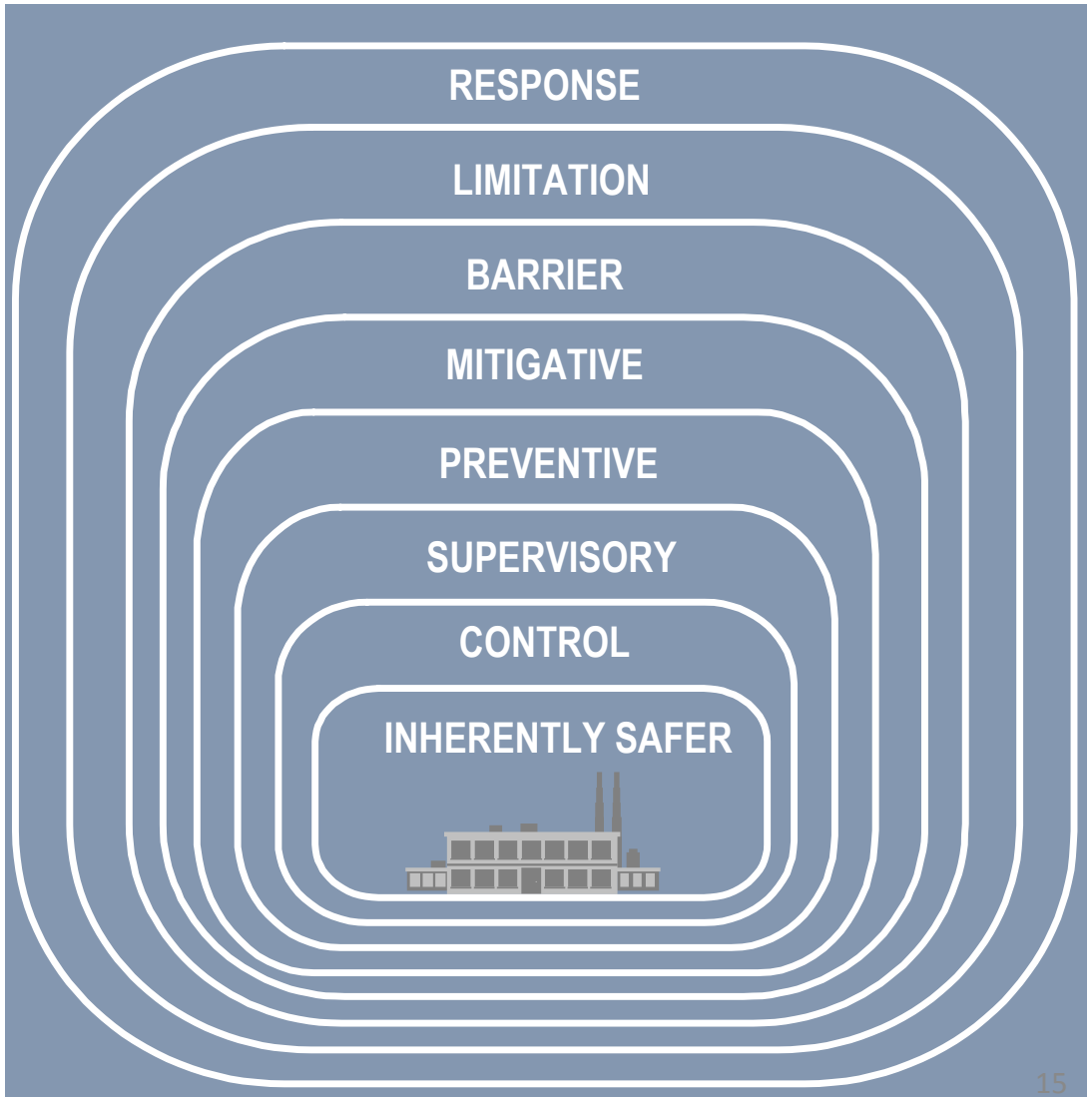
- Inherent
  - Eliminate or modify the hazard and/or risk by employing one of four strategies of substitution, minimization, moderation, simplification.
- Passive
  - Minimize the hazard by process and equipment design features which reduce either the frequency or consequences of the hazard without the active functioning of any device.
- Active
  - Using controls, safety interlocks, and emergency shutdown systems to detect and correct process deviations.
- Procedural
  - Using operating procedures, administrative checks, and emergency response to prevent incidents, or to minimize the effect of an incident.



Layers of Protection

- There is a place and need for ALL of these strategies in a complete process safety management program

- IST is just one component



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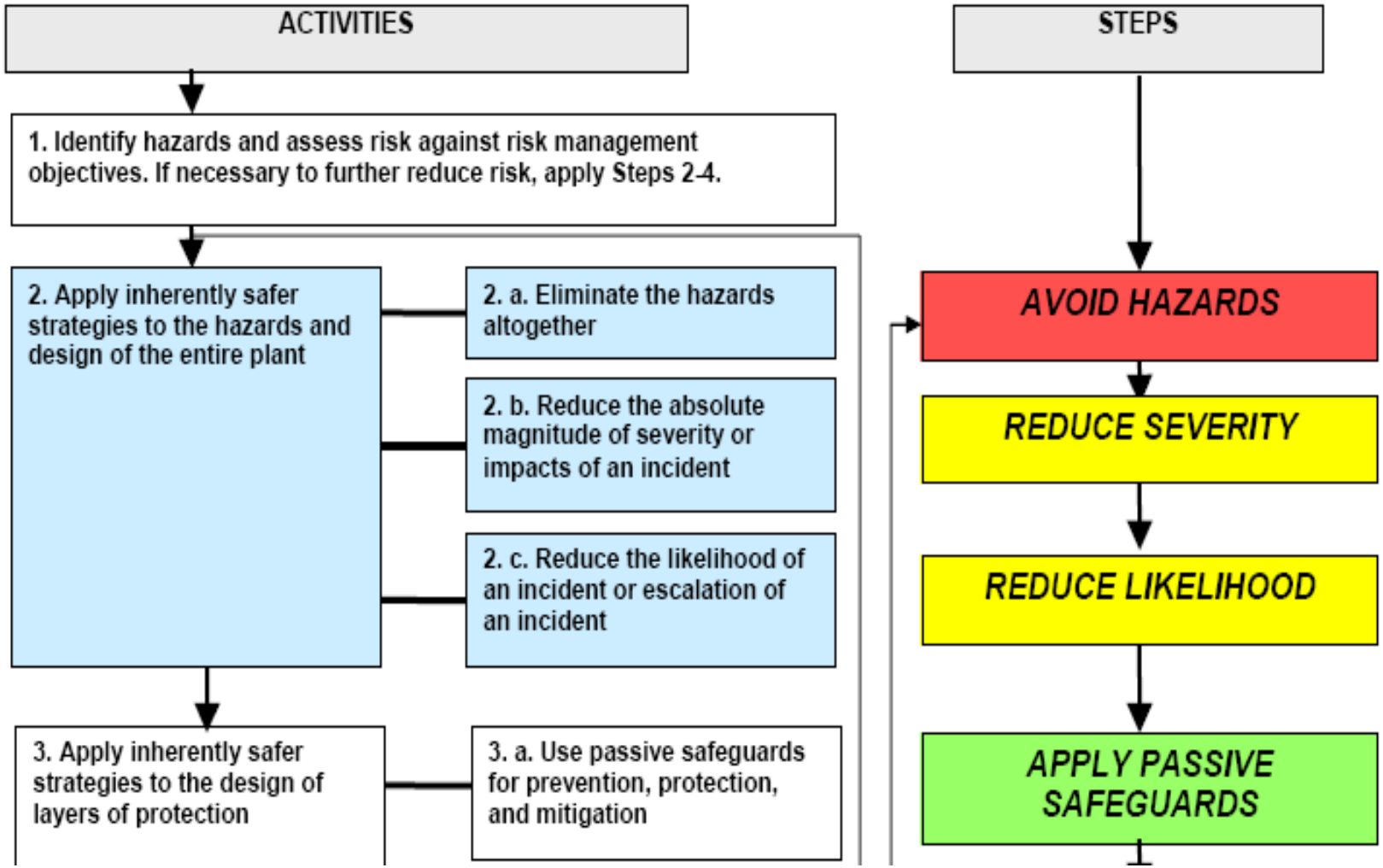
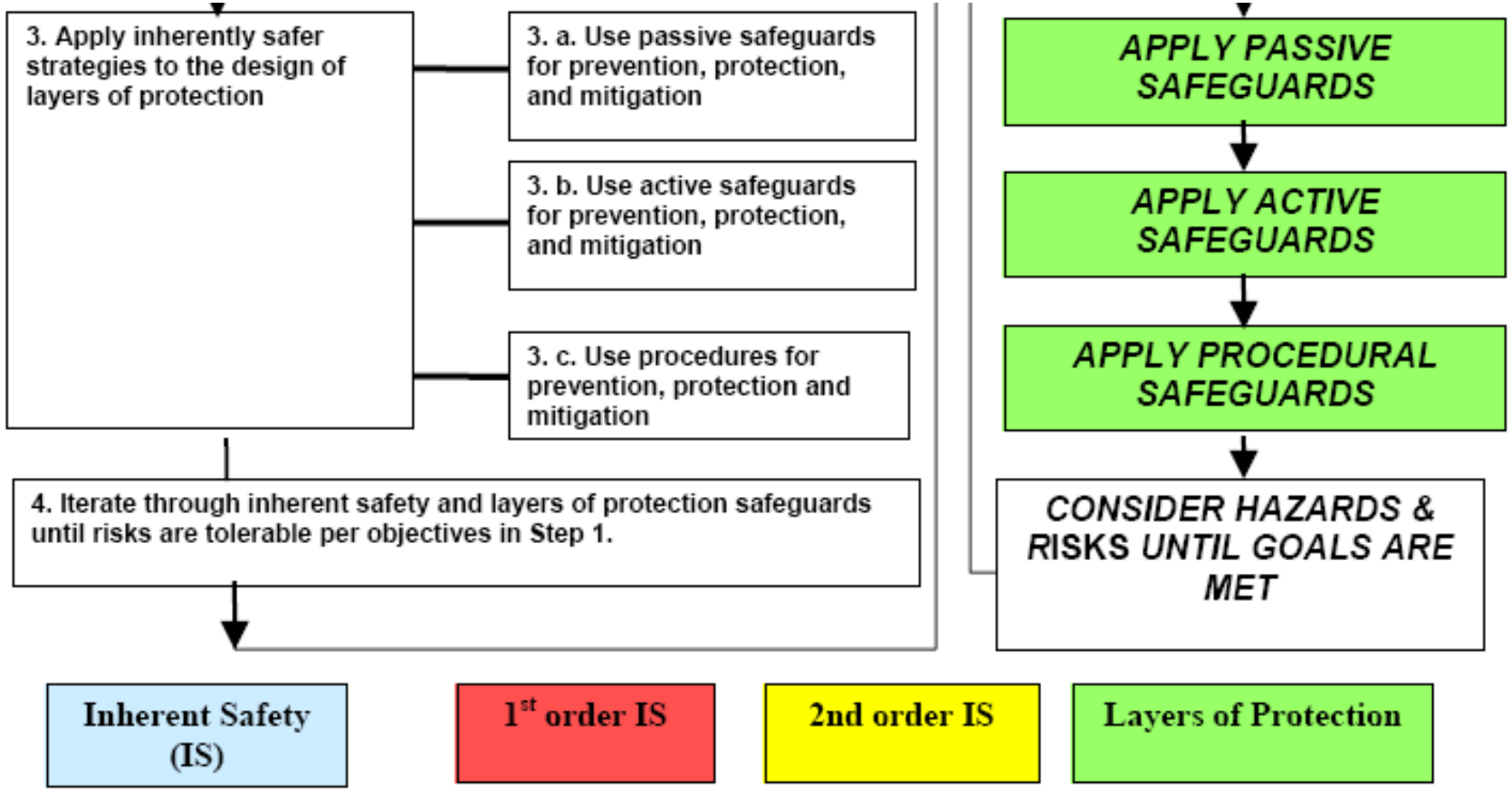
Practical Application of IST

- Inherent Safety will usually not eliminate all risks, but Inherent Safety opportunities can often reduce hazards and increase overall safety.
- The reduction of hazards should be first priority in identifying Inherent Safety opportunities.
- Inherent Safety is usually most impactful for new processes and facilities (applied early in process life cycle).
- Inherent Safety can be useful for existing facilities.

Practical Application of Inherent Safety (continued)



Practical Application of Inherent Safety (continued)



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Continuing Inherent Safety Challenges

- Focusing upon inherent safety as the single best answer can lead to sub-optimal risk decisions.
- Regulating Inherent Safety is problematic - neither industry nor government are clear on how to regulate inherent safety fairly and adequately
- Inherent Safety may conflict with other goals or transfer risks
- Regulation may limit application of Inherent Safety
  - Need to study/document every suggestion
  - Compliance studies vs “way of doing business”
  - Divert resources from more urgent issues

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Future Needs

- Expand application of Inherent Safety in the life cycle of the chemical process and overall process safety strategy
- Inherent safety is not a standalone activity, and should be integrated into other risk assessment activities.
- Evaluation of the cost-benefit of Inherent Safety measures as compared to other traditional risk mitigation measures (e.g., passive, active, procedural)
- Better understanding of Inherent Safety trade-off (Macro Impacts)
- New CCPS guideline in development (3rd edition)
  - Focus on implementation of Inherent Safety
  - Increased and practical examples

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Thank you!
Questions/Discussion?

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