

Incorporating Prevention through Design Methods into the Design & Re-design Process

Frank M. Renshaw, PhD, CIH, CSP
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PREVENTION THROUGH DESIGN INITIATIVE

A SYSTEMATIC, STEP-BY-STEP APPROACH

Step 3

Monitor the Impact
of PtD on Eliminating
Hazards & Minimizing
Risks

Step 2

Incorporate PtD into
Work Processes and
Health & Safety
Management Systems

Step 1

Create Awareness
of PtD in All Sectors,
Organizations ,
Agencies & Schools

PREVENTION THROUGH DESIGN METHODS

Eliminating Hazards & Controlling Risks *at the Source* or as Early as Possible in the Life Cycle



Method



Method

Including Design & Re-design of New & Existing Facilities, Equipment, Tools, Processes, Products & Work Methods

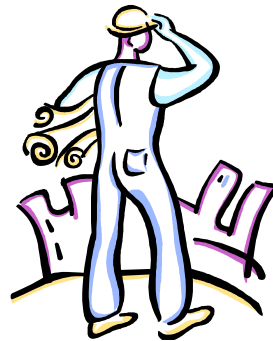
Including Prevention Methods in All Designs that Impact Workers and others on the Premises



Method

Capital Project Process (CPP)

The mechanism used within an organization to manage the development and execution of capital projects from idea conception through start-up and process optimization.



Coatings Manufacturing Plant



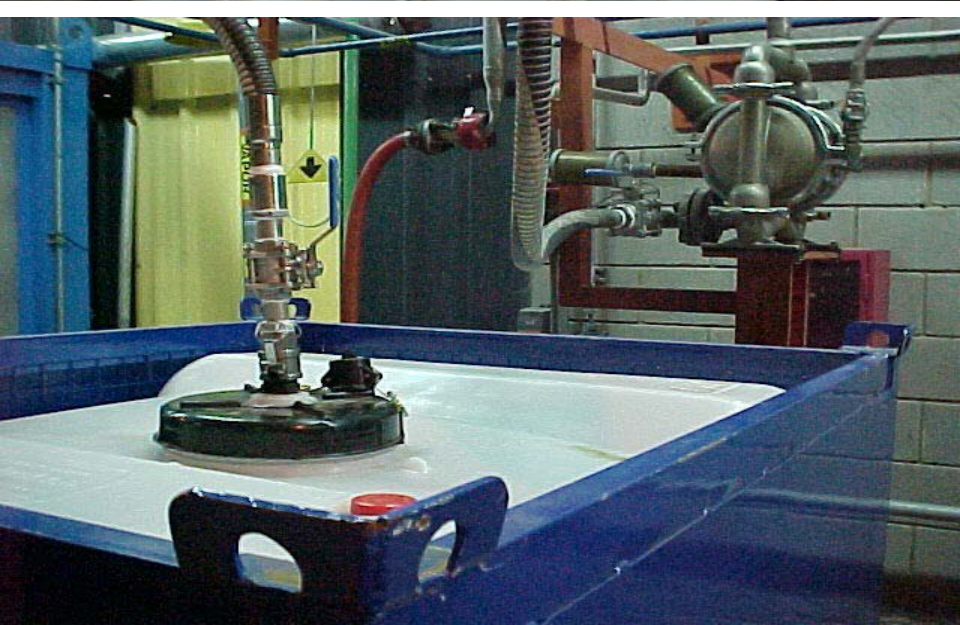
Waste Water Treatment Unit



New Technical Center



Eliminating Open Systems



Retrofitting Laboratory Hoods



New Acquisition - Completion - Start-up



Key Partners

Safety Services

Industrial Hygiene

Occupational Health Services

Environmental Services

Security

Company Fire Brigade

Project Leader

Project Team

Specialist Engineer

Site Manager

Project Owner

Technical Services/Maintenance

Safety Contractor Engineering

Safety Coordinator Design

Safety Coordinator Construction

Notified Body/Official Organizations

Public/Community Fire Brigade

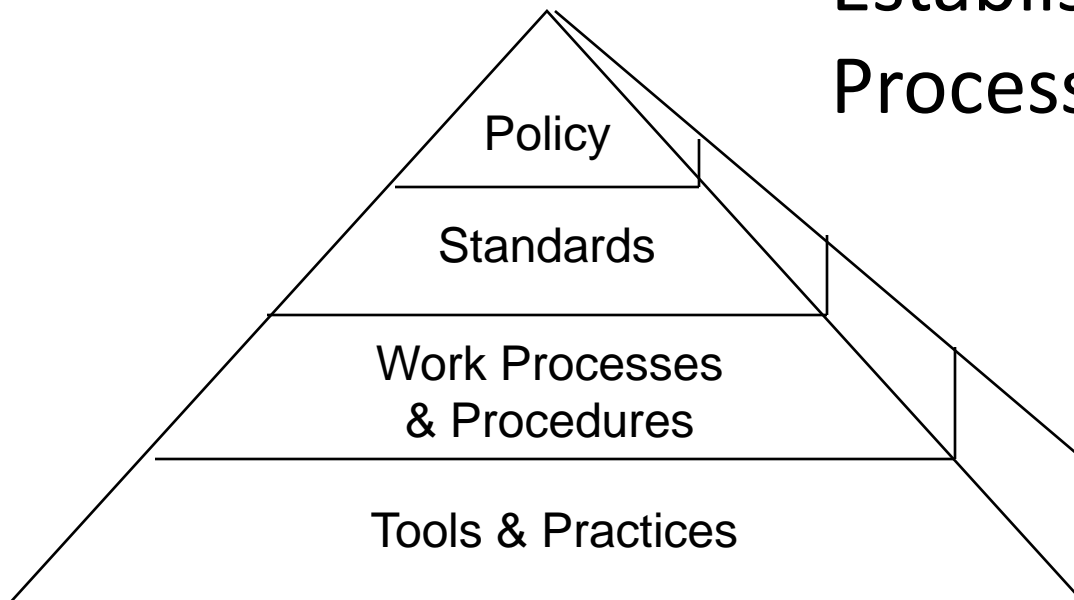
Insurance

Contractor

Incorporating PtD Methods into CPP

- Key Essentials -

- Setting Policy & Standards



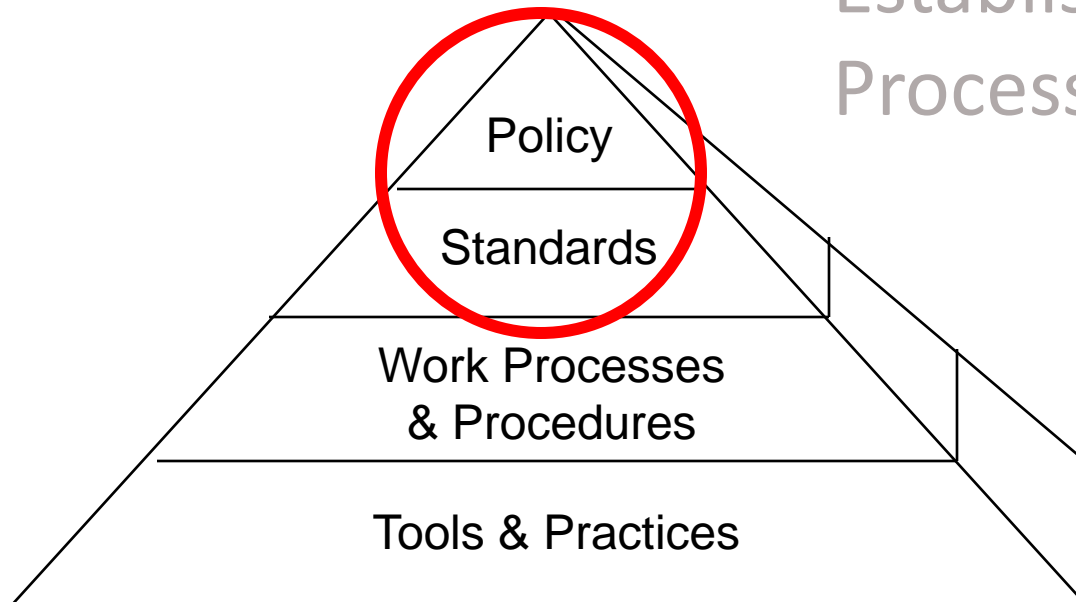
- Establishing Work Processes & Procedures

- Applying Tools & Practices

Incorporating PtD Methods into CPP

- Key Essentials -

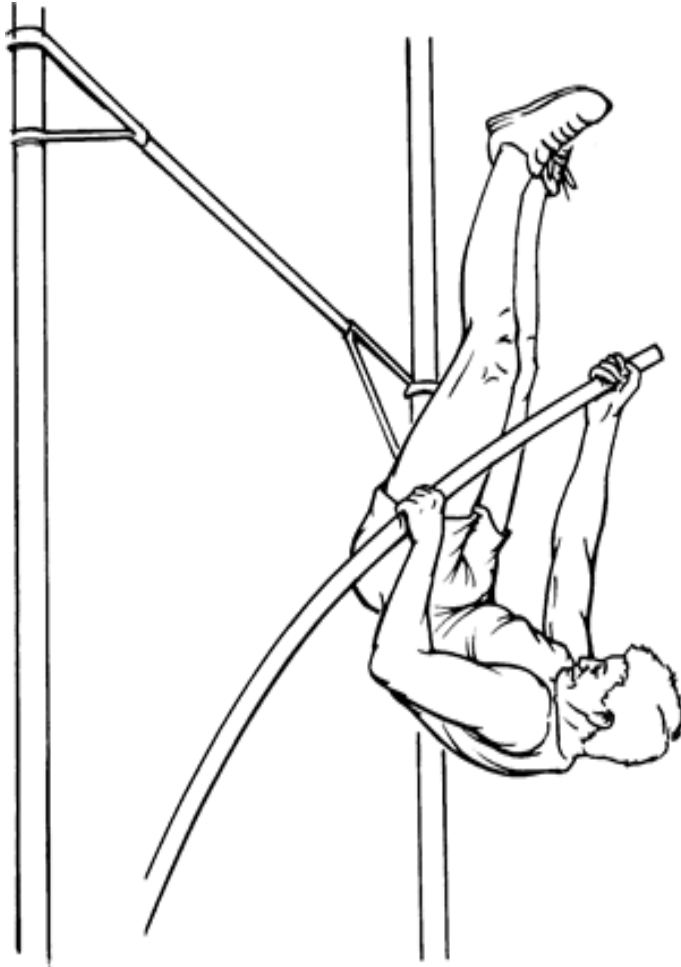
- **Setting Policy & Standards**



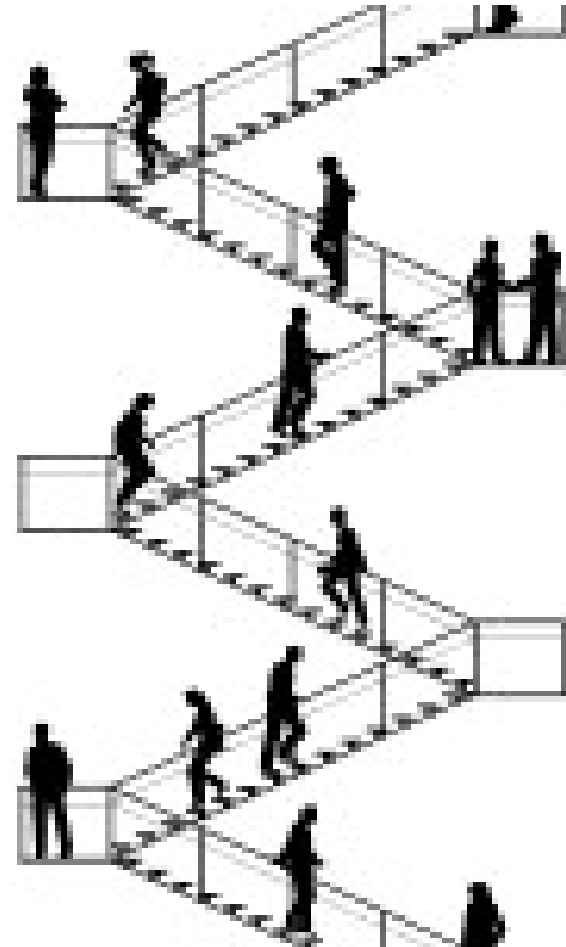
- Establishing Work Processes & Procedures

- Applying Tools & Practices

Incorporating PtD into EHS Policy



Pole Vault Approach



Steady Climb Approach

XYZ Company

Model Environmental, Health, and Safety Policy*

The XYZ Company is the world's leading manufacturer of ___ products. Our environmental, health, and safety values are of the utmost importance to us. They are embodied in the guiding principles set forth in this policy. They reflect our respect and care for the environment, our employees, contractors, customers and communities. We are committed to incorporating these values into everything we do as we seek to improve the quality of life and the environment through our products and services.

Our Guiding Principles are:

- We will design our businesses, processes and products with full consideration for the needs of the present global community and the impact of our design decisions on the ability of future generations to meet their needs.
- ***We will include "Prevention through Design" considerations in the design and redesign of all facilities, equipment, processes, work methods and products, and will incorporate methods of safe design into all phases of hazard and risk mitigation.***
- We will continuously review and improve our worldwide operations, processes, and products, with the goal of making them free of adverse environmental, health, and safety impacts for all of our stakeholders.
- We will meet or exceed all applicable laws, regulations, and XYZ Company standards.
- -----
- -----

Every employee and contractor is responsible for compliance with this policy. We will audit our performance and the Board of Directors will monitor our commitments and progress.

*Adapted from the former
Rohm and Haas Company

OHS Management System Standard*

3.1 Management Leadership

3.1.2 OHS Policy

The organization's top management shall establish a documented occupational health and safety policy as the foundation for the OHSMS. This policy shall include a commitment to:

- A. Protection and continual improvement of employee health and safety;
- B. Inclusion of "Prevention through Design" considerations in design and redesign of all facilities, equipment, processes, work methods and products, and incorporation of safe design methods into all phases of hazard and risk mitigation ;**
- C. Effective employee participation;
- D. Conformance with the organization's health and safety requirements; and
- E. Compliance with applicable laws and regulations.

*Proposed Amendments to ANSI/AIHA Z10-2005

5.1 OHSMS Operational Elements

5.1.2 Design Review and Management of Change

The organization shall establish and implement processes **which incorporate Prevention through Design concepts** to identify, and take appropriate steps to prevent or otherwise control hazards and reduce potential risks associated with:

- A. New processes or operations at the design stage;
- B. Changes to its existing operations, products, services or suppliers.

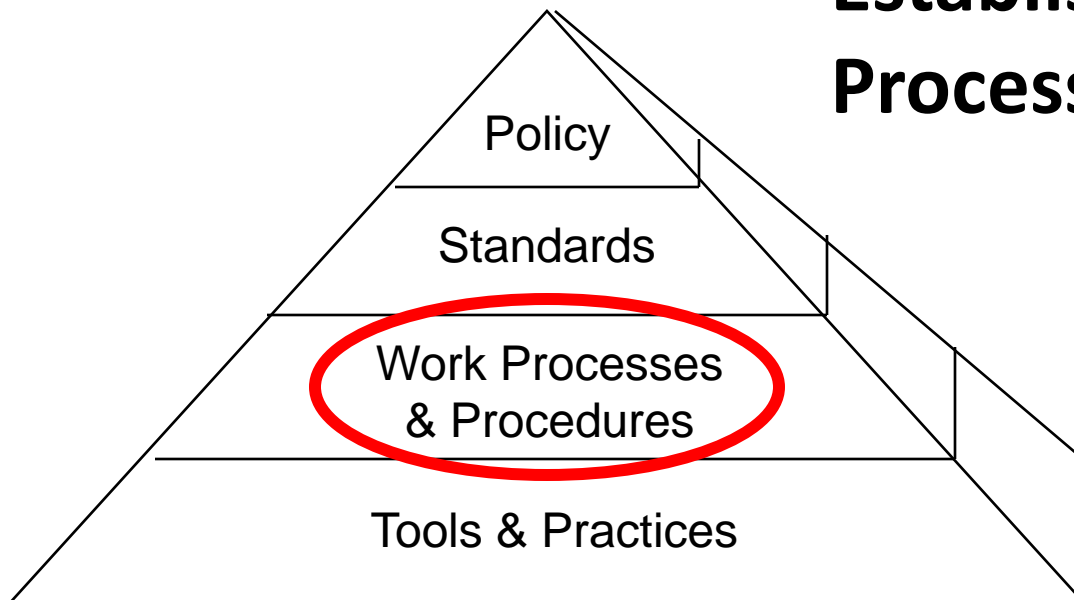
The process for design reviews and management of change shall include:

- a. Identification of tasks and related health and safety hazards as early as possible in the life cycle of facilities, equipment, processes, work methods and products;**
- b. Consideration of hazards associated with human factors;
- c. Consideration of control measures, taking into account the hierarchy of controls;**
- d. Review of applicable regulations, codes and standards;

Incorporating PtD Methods into CPP

- Key Essentials -

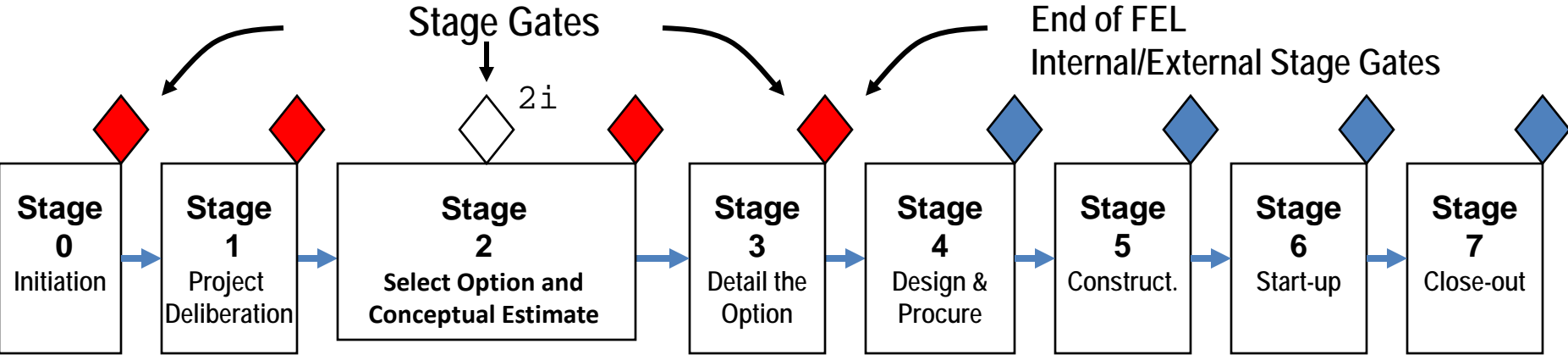
- Setting Policy & Standards



- **Establishing Work Processes & Procedures**

- Applying Tools & Practices

Capital Project Process Summary Map



Ongoing Activities: VEP's, Performance Measurements, Quality Audits, Progress Reporting, Cost and Schedule Control, Total Value Added

-  = Decision Gate
-  = Progress / Status Gate
-  2i = Agree to proceed on "selected option".
-  2 = Conceptual estimate review and approval - agreement to move into detail the option.

CPP	STAGE 1 Project Deliberation	STAGE 2 Select/Detail Option	STAGE 3 Design/ Procurement	STAGE 4 Construction	STAGE 5 Start-up	STAGE 6 Closeout
	Project mission, initial goals and objectives, scope 1.1.1	Finalized goals and objectives 2.1.1	Updated goals and objectives 3.1.1	Detailed construction plan and schedule 4.1.1	Commissioning & start-up plan and detailed schedule 5.1.1	Closeout Plan 6.1.1
	Generate & initial screen of options 1.1.2	Select best option, finalized project scope document (IBL/OBL) 2.1.2	P&IDs, mechanical, electrical, civil, structural, control system programs all complete 3.1.2	Construction roles & communication plan 4.1.2	Operating rates documented 5.1.2	Final acceptance documentation 6.1.2
Key Project Execution & Design Deliverables	Project execution strategy 1.1.3	Project execution plan 2.1.3	Detailed spare parts list 3.1.3	Facility mechanically complete (approved for commissioning) 4.1.3	Facility operating to specifications 5.1.3	Project critique, customer feedback, closeout report 6.1.3
	Afford to spend model 1.1.4	Finalized design basis, process description, PFDs, P&IDs, control philosophy, site plan, list of materials, major equipment quotes/bids 2.1.4	All equipment purchase orders issued 3.1.4	As-built, quality assurance, spare parts, turnover documentation 4.1.4	Revised operating and maintenance procedures, and documentation for design changes (as-built) issued 5.1.4	Appropriate learnings & design ideas communicated 6.1.4
	Order of Magnitude estimate 1.1.5	Finalized economic analysis & AR submitted 2.1.5	Cost compliance report 3.1.5	Construction cost report 4.1.5	Revised start-up cost estimate 5.1.5	Project & equipment files submitted to facility 6.1.5
	Prevention through Design principles in project scope 1.1.6	Prevention through Design compliance 2.1.6	Prevention through Design compliance 3.1.6	Prevention through Design compliance 4.1.6	Prevention through Design compliance 5.1.6	Prevention through Design compliance documentation 6.1.6
			Bayberry EHS Consulting, LLC			19

CPP	STAGE 1 Project Deliberation	STAGE 2 Select/Detail Option	STAGE 3 Design/ Procurement	STAGE 4 Construction	STAGE 5 Start-up	STAGE 6 Closeout
OHS Stage Gates	Early OHS Hazards & Risks Review 1.1	OHS Project Plan Review 2.1	OHS Project Design Review 3.1	OHS Project Construction Review 4.1	OHS Project Start-up Review 5.1	OHS Project Evaluation 6.1
OHS Deliverables	Preliminary OHS project plan 1.2.1	Refined OHS project plan 2.2.1	OHS Design Review complete, recommendations resolved, actions tracked 3.2.1	Pre-construction safety plan 4.2.1	Pre-start-up OHS Review completed & actions addressed 5.2.1	Assessment of residual risk versus targets 6.2.1
	Peliminary regulatory & permit plan 1.2.2	OHS Hazard Analysis & Risk Assessment requirements defined, studies initiated as needed 2.2.2	Hazard Analysis - Risk Assessment studies complete, recommendations resolved, risk targets met, actions tracked 3.2.2	Construction permits 4.2.2	Completed site acceptance testing of equipment & OHS devices 5.2.2	Prevention through Design compliance verification 6.2.2
	Early identification of significant & unique OHS hazards & risks 1.2.3	Regulatory & permitting requirements defined, documents submitted 2.2.3	Appropriate permit applications & regulatory approval 3.2.3	Construction safety program effectiveness verification 4.2.3	Completed checks, tests & critical retrofits 5.2.3	Feedback on OHS standards and modifications initiated as appropriate 6.2.3
	Early identification of Prevention through Design opportunities 1.2.4	Insurance assessmt. complete, fire protection & security requirements finalized 2.2.4	Detailed drawings reviewed & approved 3.2.4	Regulatory permit completion and approval verification 4.2.4	Preliminary industrial hygiene exposure monitoring complete 5.2.4	
		Equipment specs approved, checks & test protocols developed 2.2.5			All incidents investigated and impact of root causes on design/operation addressed 5.2.5	

OHS Deliverables Planning Template

Project:					
Manager:					
Date:					
OHS Deliverable	Description	Date Completed mm/dd/yy	Deliverable Documented (Y/N)	Actions Tracked (Y/N)	Proj. Mgr. Reviewed (Y/N)
1.1	Early OHS Hazards and Risks Review				
1.2.1	Preliminary OHS project plan				
1.2.2	Preliminary regulatory & permit plan				
1.2.3	Early identification of significant & unique OHS hazards & risks				
1.2.4	Early identification of Prevention through Design opportunities				
2.1	OHS Project Plan Review				
2.2.1	Refined OHS project plan				
2.2.2	Hazard Analysis & Risk Assessment requirements defined, studies initiated				
2.2.3	Regulatory & permitting requirements defined, documents submitted				
2.2.4	Insurance assessment complete, fire prot. & security requirements finalized				
2.2.5	Equipment specifications approved, checks & test protocols developed				
3.1	OHS Project Design Review				
3.2.1	OHS Design Review complete, recommendations resolved, actions tracked				
3.2.2	Hazard Anal.-Risk Assess. complete, recommend. resolved, risk targets met				
3.2.3	Appropriate permit applications & regulatory approval				
3.2.4	Detailed drawings reviewed & approved				
4.1	OHS Project Construction Review				
4.2.1	Pre-Construction safety plan				
4.2.2	Construction permits				
4.2.3	Construction safety program effectiveness verification				
4.2.4	Regulatory permit completion and approval verification				
5.1	OHS Project Start-up Review				
5.2.1	Pre-start-up OHS Review completed & actions addressed				
5.2.2	Completed site acceptance testing of equipment & OHS devices				
5.2.3	Completed checks, tests & critical retrofits				
5.2.4	Preliminary Industrial hygiene exposure monitoring complete				
5.2.5	All incidents investigated and impact of root causes addressed				
6.1	OHS Project Evaluation				
6.2.1	Assessment of residual risk versus targets				
6.2.2	Prevention through Design compliance verification				
6.2.3	Feedback on OHS standards & modifications initiated				

Management of Change

Definition

A system to assess and address the EHS impact of changes to a process, facilities, or organization before the changes are made.

Key Principles

- Every change must be managed.
- Changes must not be made without an appropriate review.
- The type of review should be consistent with the complexity of the change
- MOC systems should be simple to use

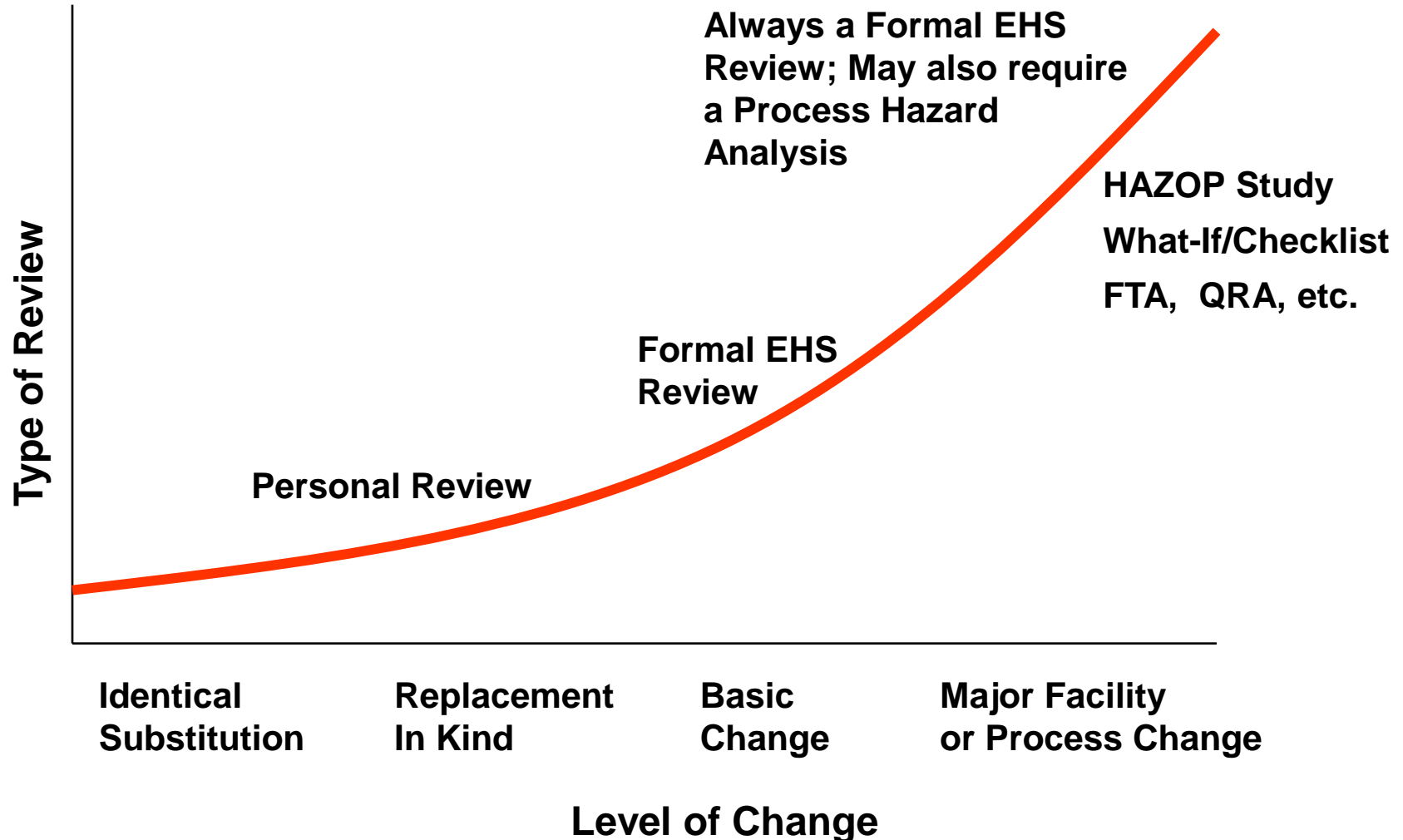
What Level Are These Changes ?



- | | | |
|---|--|--------------------------|
| 1. New filtration system in the plant | | ● Identical Substitution |
| 2. New pump identical to the one it replaces | | ● Replacement in Kind |
| 3. Change of valve for identical type from different manufacturer | | ● Basic Change |
| 4. Change of valve for a different type | | ● Major Change |
-
- A large grey 'X' is drawn over the entire list, crossing out all four items and their corresponding change levels.

FLL and OMT Training

Management of Change Process – Matching the Type of EHS Review to the Level of Change

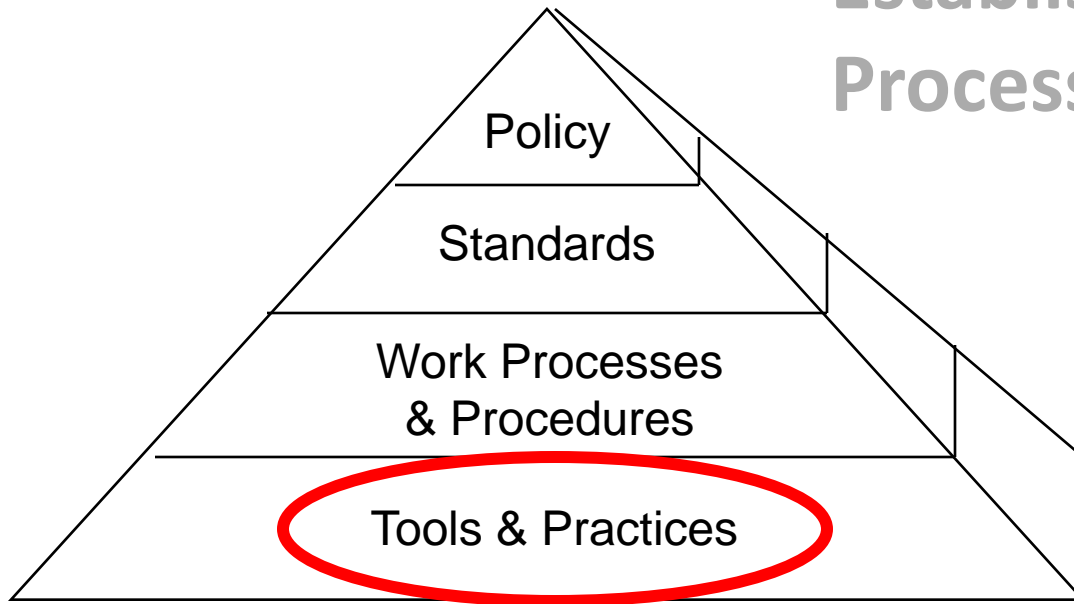


Incorporating PtD Methods into CPP

- Key Essentials -

- Setting Policy & Standards

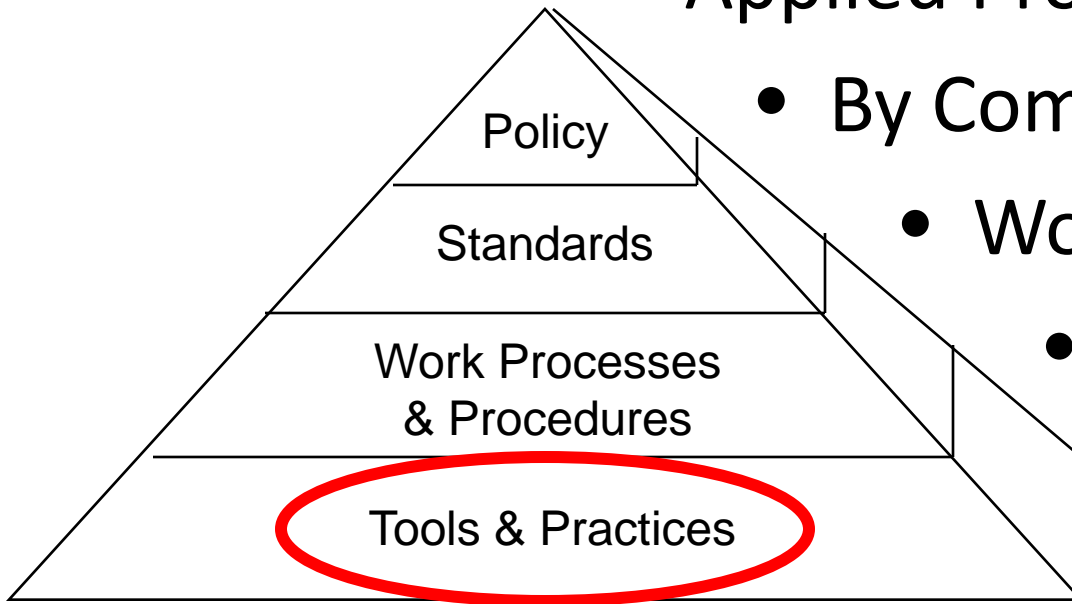
- Establishing Work Processes & Procedures



- **Applying Tools & Practices**

Applying Tools and Practices

- Robust
 - In Sync with CPP
 - Applied Properly & Consistently
 - By Competent People
 - Working Together
 - Straightforward & Simple as Possible



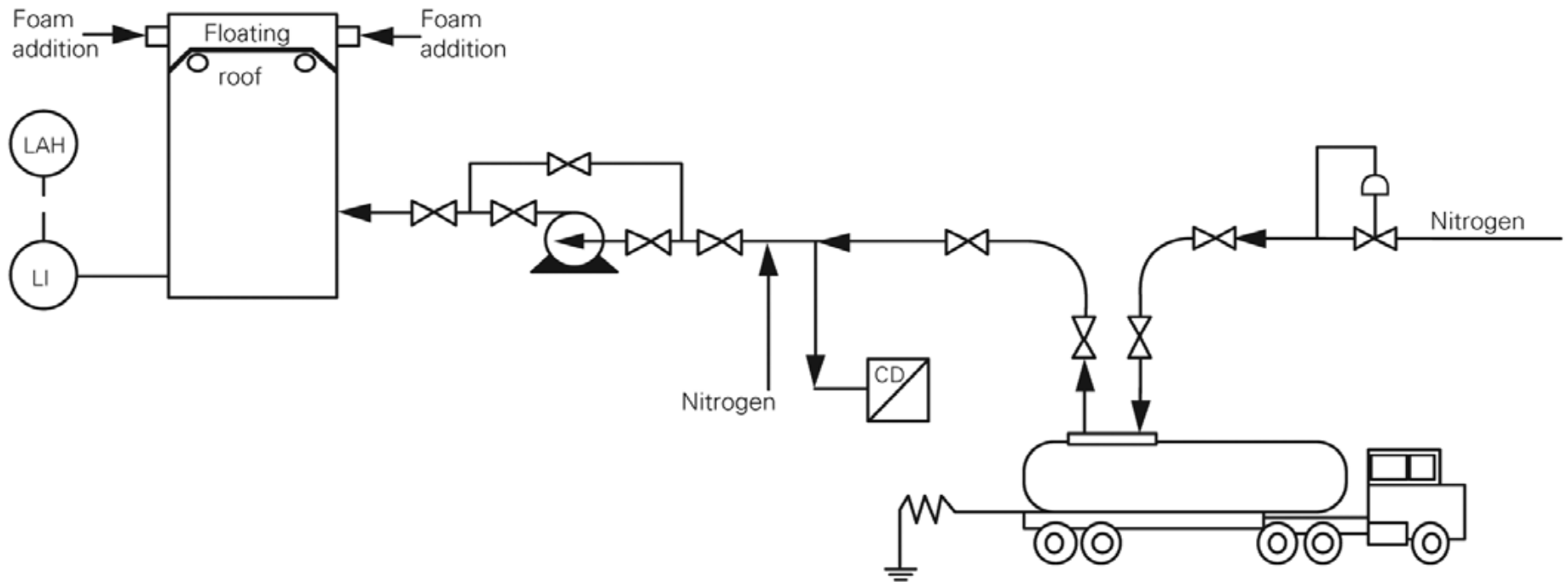
Process Hazard Analyses

HAZOP – What-If/Checklist – FTA – QRA

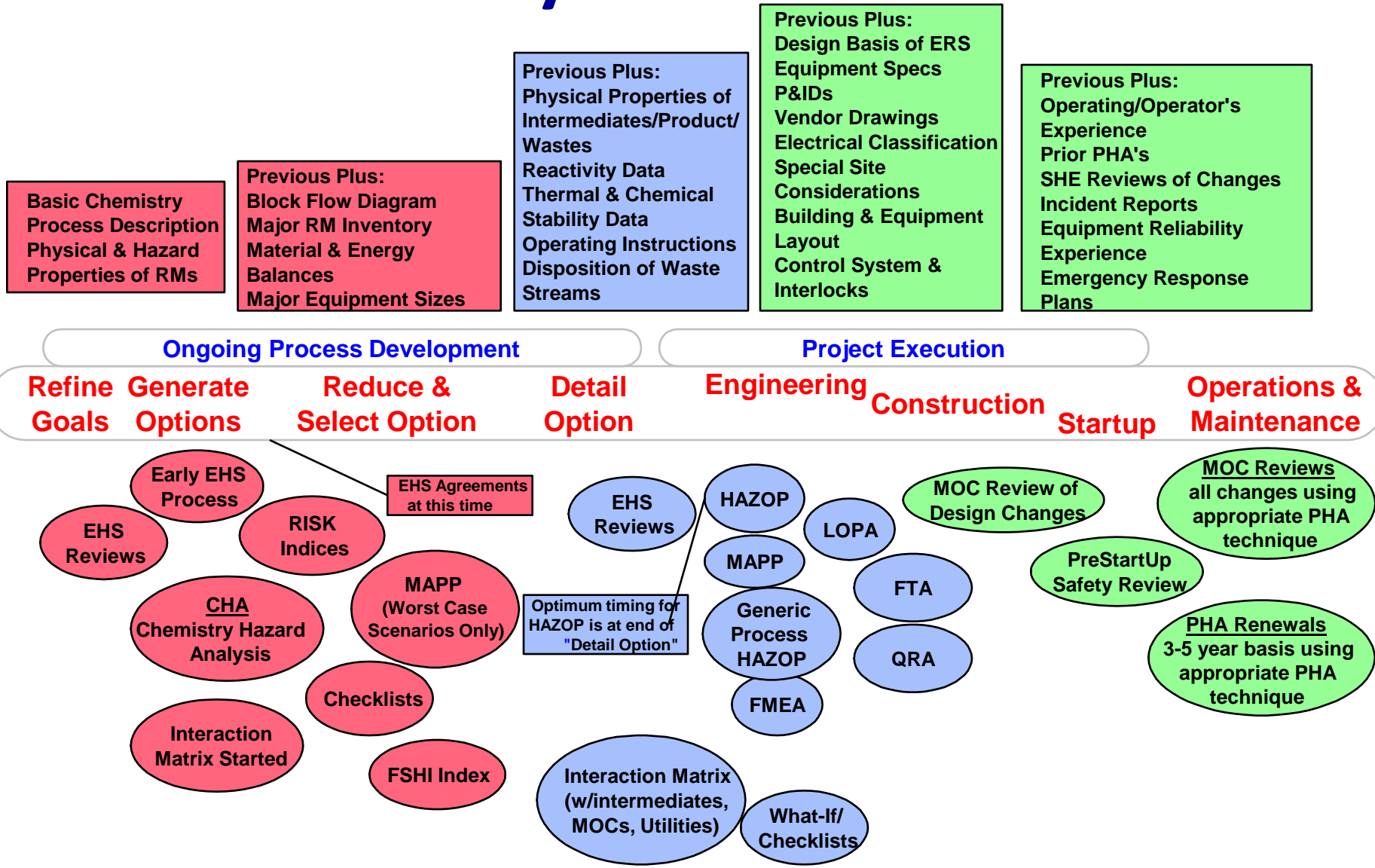


Robust Tools! Robust Tools! Robust Tools! Robust Tools!

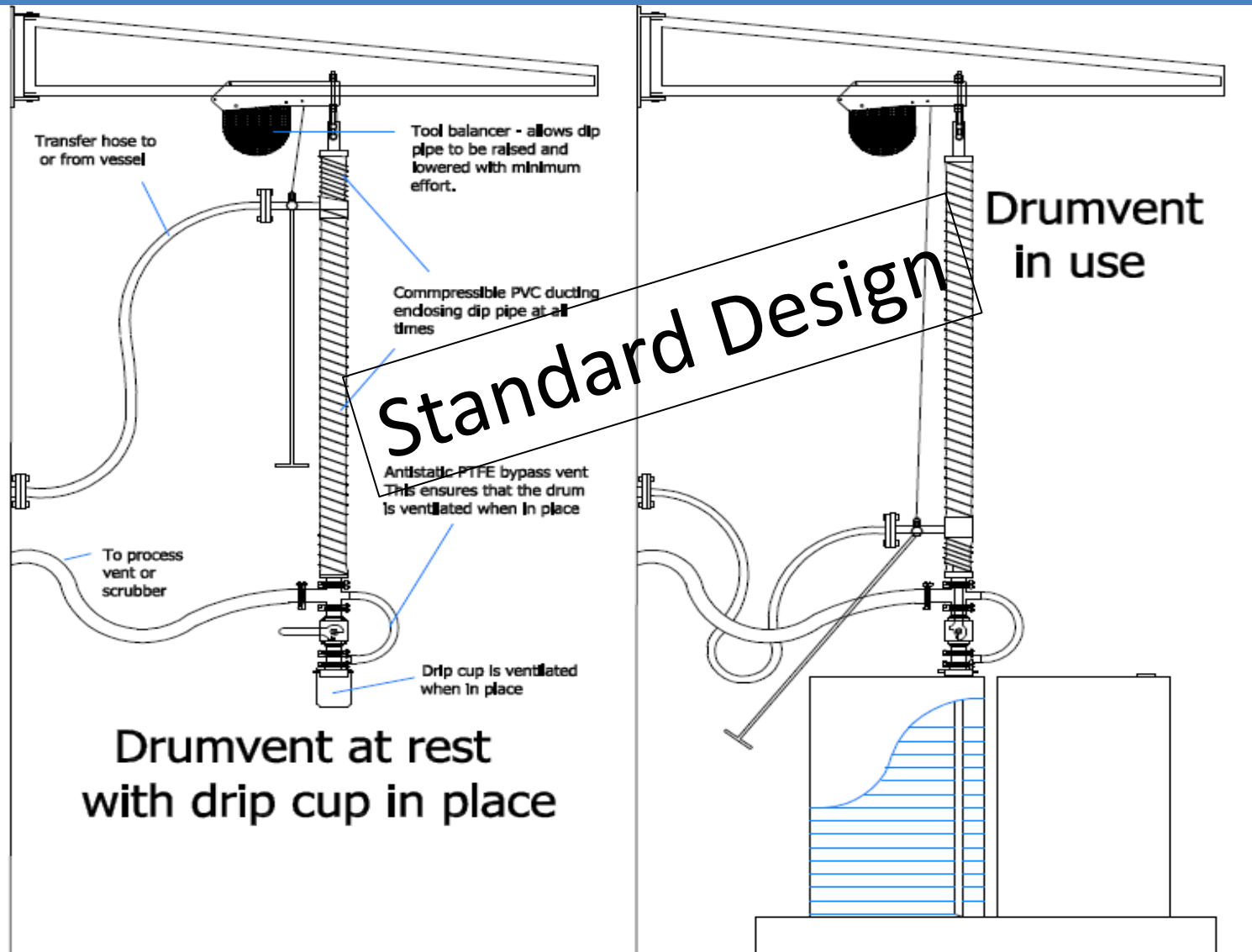
Top Unloading



In Sync with CPP



Applied Properly and Consistently



CTTL Drumvent*



*CTTL - Chemical Transfer Technology Ltd, Newcastle, UK

Bayberry EHS Consulting, LLC

Enclosed, Ventilated Drum Hood



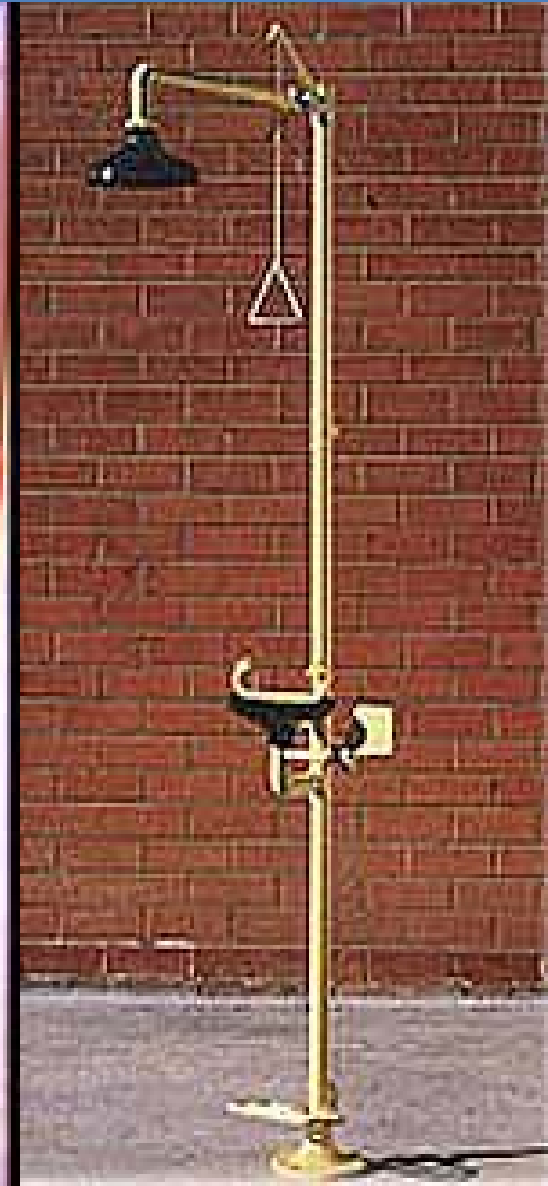
Competent People to Apply Tools



Working Together



Straightforward & Simple



Emergency Eyewash and Shower Equipment			OSHA-29CFR*
No.	Item	Complete (Y,N,N/A)	Section in Standard
	Requirements apply where the eyes or body of any person may be exposed to materials which can cause serious injury on contact (e.g., corrosive and severely irritating chemicals), or produce serious toxic effects by absorption through the skin (e.g., acrylonitrile).		
1	Medical Services and First Aid. Where the eyes or body of any person may be exposed to injurious corrosive materials, suitable facilities for quick drenching or flushing of the eyes and body shall be provided within the work area for immediate emergency use.		1910.151(c) 1926.50(q)
2	General Requirements for Dipping and Coating Operations. Emergency shower and eyewash station must be provided close to dipping or coating operations when working with liquids that may burn, irritate or otherwise harm the skin.		1910.124(g)(2)
3	13 Carcinogens (4-Nitrobiphenyl, etc.) Emergency deluge showers and eyewash fountains supplied with potable water must be provided near, within site of, and on same level where direct exposure to ethyleneimine or beta-propiolactone would likely result from equipment failure or improper work practices.		1910.1003(d)(2)(vi) 1915.1003
4	Acrylonitrile. Employer must assure that, in the event of skin or eye exposure to liquid acrylonitrile, the affected employee shall shower immediately.		1910.1045(m)(3) 1915.1045
5	Formaldehyde. Quick drench showers must be conveniently located where employees' skin may be splashed with > 1% formaldehyde solution, and eyewash facilities provided within immediate work area where there is possibility of splash with $\geq 0.1\%$ formaldehyde solutions.		1910.1048(i)(2) 1910.1948(i)(3) 1915.1048
6	Occupational Exposure to Hazardous Chemicals in Laboratories. Laboratory facilities handling hazardous chemicals should have easily accessible drench-type safety showers and eyewash fountains. (Non-mandatory)		1910.1450 Appendix A 1915.1450

Summary

- First Seek to Understand
 - PtD Methods
 - CPP Process
 - Partners
- Then Implement the Key Essentials
 - Setting Policy & Standards
 - Establishing Work Processes & Procedures
 - Applying Tools & Practices
- Always Be a PtD Champion