

Bridging the Gap Between Process Hazard Analyses & Emergency Response Plans – A Proposal

Manuel (Manny) Marta, P. Eng.
NOVA Chemicals
Sarnia, Ontario

CSCChE Conference
Hamilton, Ontario
October 2003

Federal Environmental Emergency (E2) Regulation

- Environmental Emergency
 - An uncontrolled, unplanned or accidental release of a substance into the environment; or the reasonable likelihood of such a release that may **affect the environment, human life or health**, or the environment on which human health depends
- Objectives
 - a "safety net" for the comprehensive management of environmental emergencies.
 - address the **prevention** of, **preparedness** for, **response** to or **recovery** from an environmental emergency
 - Owner liable for restoring damaged environment and costs related to responding to environmental emergency

“Connecting the Dots”

– Prevention

- Process Hazard Analyses and Management of Change to Facilities (primarily Process Safety Function)

– Preparedness and Response

- ER Plans (ER Function)

– Recovery

- Environmental Recovery Plans (primarily Environmental Function)

PHA's & ER Plans - Defining The Gap

- What Process Hazard Analyses (PHAs) Do
 - Typically managed/ coordinated by Process Safety personnel
 - Involves hazard/ risk reviews with input from operations & maintenance
 - Divide manufacturing site into units/ areas
 - Prioritize areas for order of analysis according to hazard level/ risk level
 - During analyses consider deviation, causes, hazards, consequences, existing safeguards
 - Recommendations for “under-protected” deviations
 - Procedural
 - Engineered solution

PHAs

- Recommendations
 - When current safeguards are inadequate
 - General Types
 - Procedural
 - Engineered Systems
 - Passive
 - Active
- Emergency Response
 - Always assumed available as last resort to manage residual risk if all safeguards to prevent loss-of-containment should fail

PHA's

- Outputs
 - Hazard Review Worksheet
 - Recommendations
 - Hazard Summary
 - Area
 - General & Specific Hazard
 - Reference to Generic ER Plan for Each Hazard Type

Typical Emergency Response (ER) Plans

- ER Plans done for general commonly understood hazards (coordinated by ER people)
- Assessments for ER Plans are done independently from PHAs
- Considers C.A.E.R.
 - Community Awareness (includes preparedness)
 - Emergency Response (includes public response or evacuation alerts)
- Industry-Community Mutual Aid
- Elements
 - People (ie, trained emergency responders with proper personal protective clothing/equipment)
 - Equipment (fire trucks, hoses, firewater monitors, foam injection systems)
 - Plans & Drills

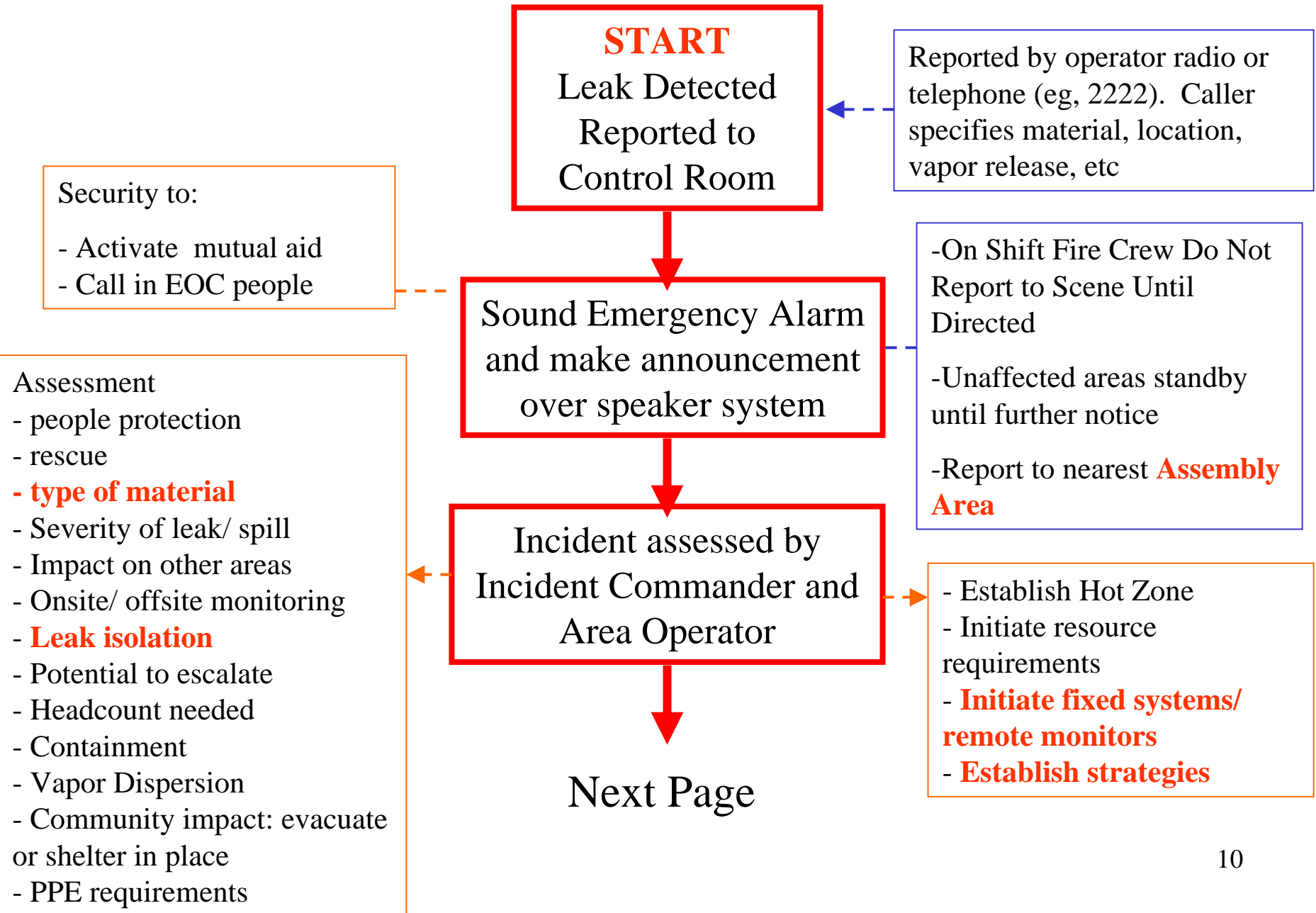
ER Plans

- Examples of Generic ER Plans
 - Toxic/ spill/ vapor release
 - Explosion/ fire
 - Emergency Alarm Activation/ Neighbour Notification
 - Critical Injury/ Fatality
 - Environmental Occurrence
 - Weather emergency
 - Industrial rescue
 - Workplace violence
 - Civil unrest
 - Air monitoring
 - Hazmat/ Liquid Hydrocarbon Spill Decision Flowchart

ER Plans

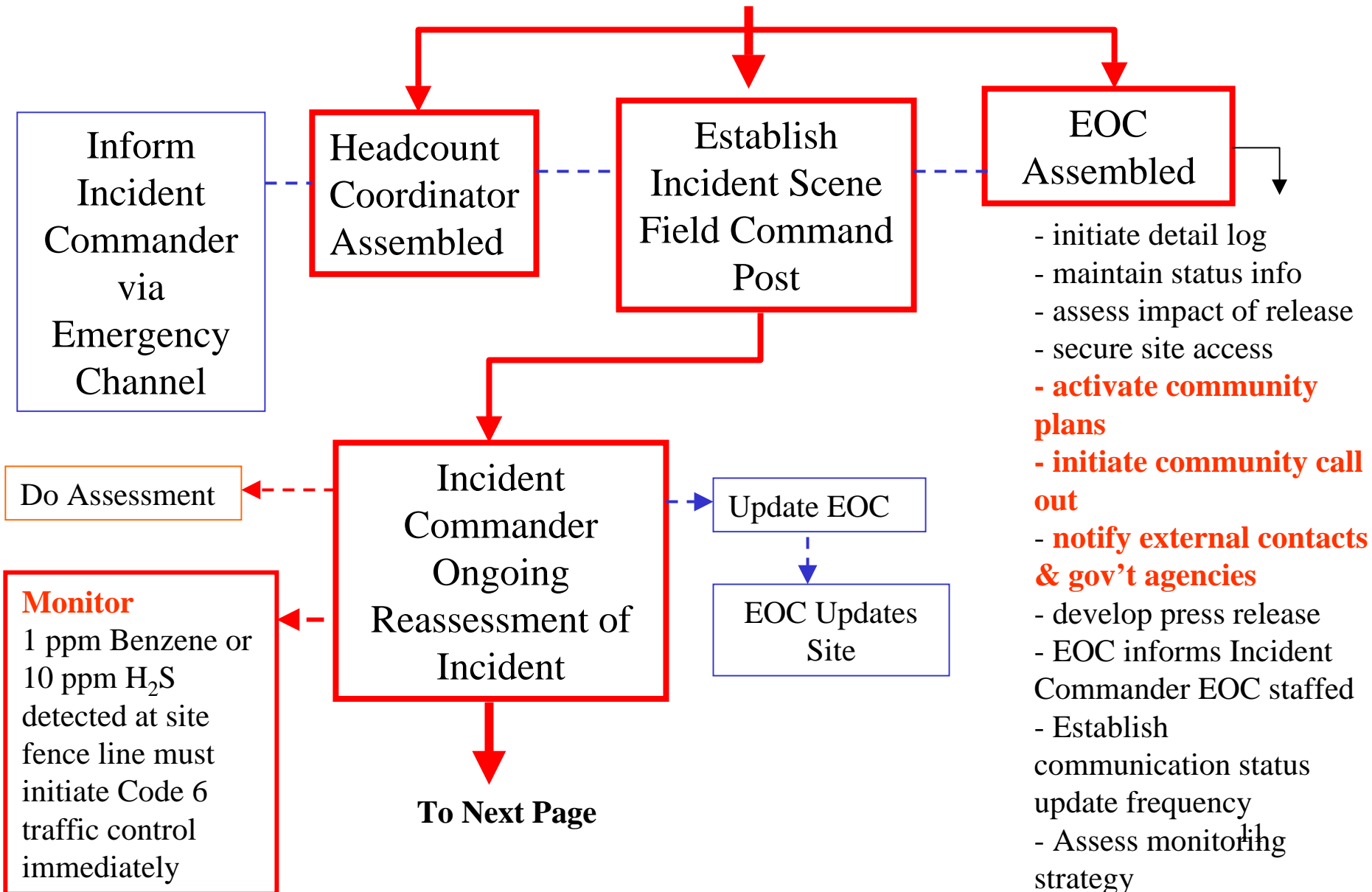
- Examples of Generic ER Plans (Continued)
 - Bomb threat
 - Hydrogen Sulfide toxic gas release
 - Laboratory release
 - Potable water supply emergency
 - Third party emergency response
 - Biological threat
 - Radioactive sources

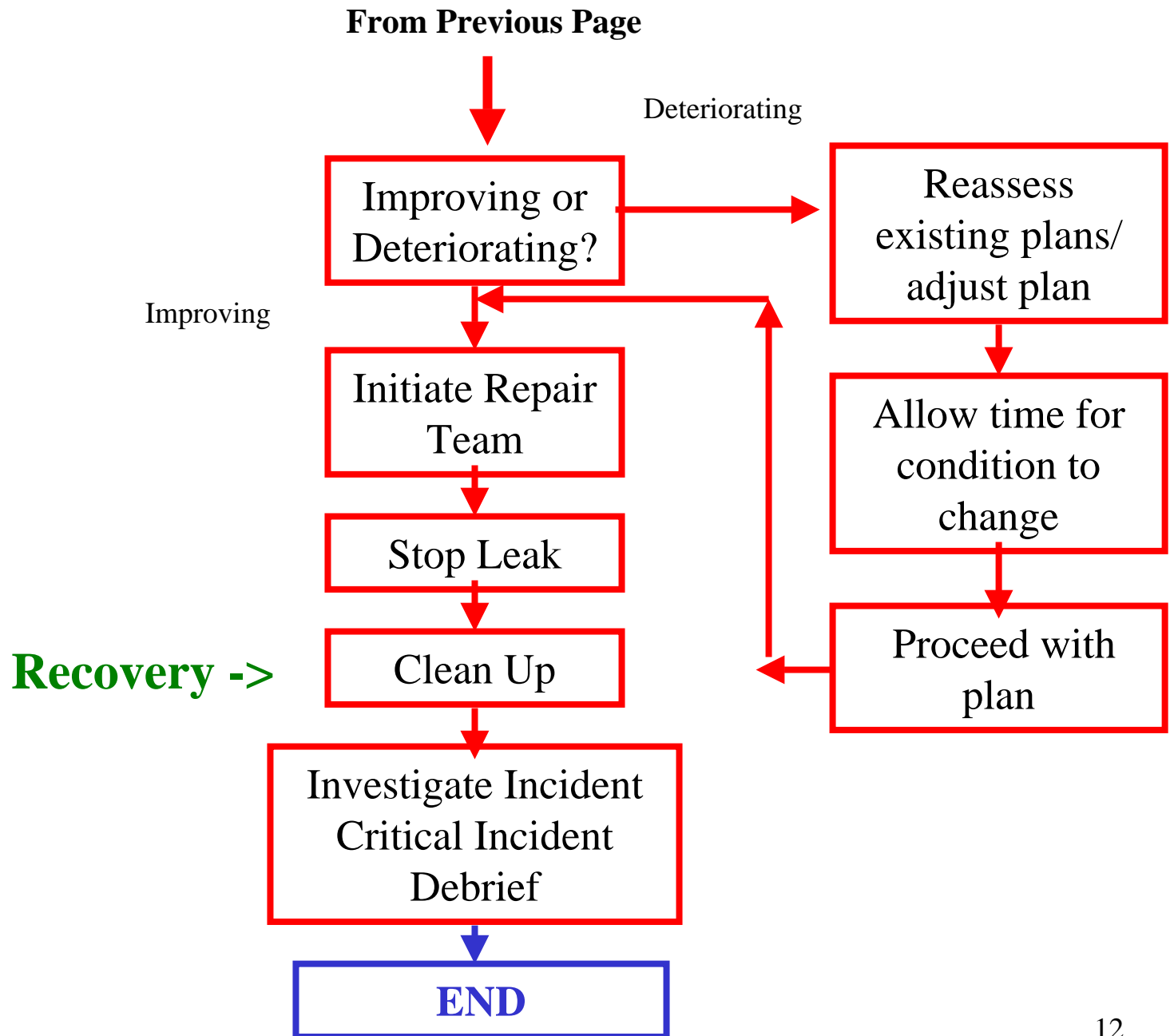
Example - Toxic/ Spill/ Vapor Release Decision Flowchart



Example - Toxic/ Spill/ Vapor Release Decision Flowchart

From Previous Page





Bridging PHAs & Generic ER Plans – Current Situation

- PHAs – done by Process Safety
- Generic ER Plans – done by ER
- Hazard & Generic ER Plan Summary
Includes:
 - PHA Hazard Summary (Process Safety)
 - ER Plan Reference (ER)

Hazard – ER Plan Matrix Structure

- For each site develop matrix
- Columns
 - Process & Area Information
 - Unit
 - Area
 - Feed or Storage Chemicals
 - Products

Hazard – ER Matrix Structure (Cont'd)

–Columns (continued)

–Hazards (Chemical & Facility Hazards)

- Un-ignited flammable vapor release
- Fire (vapor, pool, tank) / Explosion (vapor cloud, physical, reaction, BLEVEs)
- Toxic Vapor Release
- Radioactive release
- Release occurring off-site to environment (eg, pipelines)
- Non-Chemical Hazards (eg, falling into water; impact by moving railcars, other)

ER information on Matrix

- Underneath each hazard type – identify reference for generic ER decision flow diagram

- Example

Site: xyz

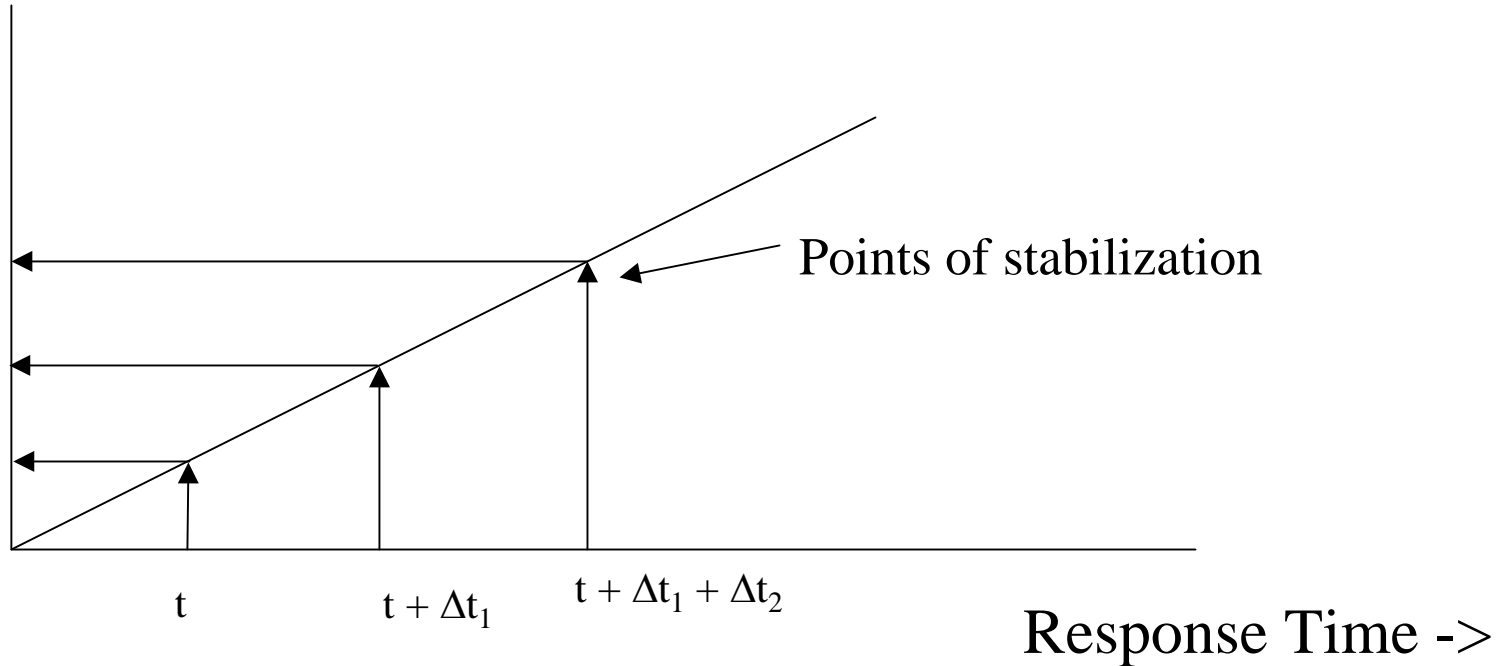
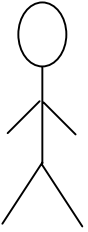
More Hazards ->

Unit	Area	Feed or Storage Chem	Products	PHA Identified Hazards (by Process Safety Engineers) (chemical and facility hazards) (Not all shown)				
				Unignited flamm vapor cloud	Fire/ Explosion (incl. BLEVEs)	Toxic Vapor Release	Release Off-Site to Env	Radioactive release
				ER Flow Dia xxx	ER Flow Dia xxx	ER Flow Dia xxx	ER Flow Dia xxx	ER Flow Dia xxx
DPG	Aromatics	C6 – C8 Heart Cut	C ₆ C ₈ Raffinate Arom. Extract	X	X			

Timing is Important

Impact
Potential

\$



The sooner the point of stabilization is reached the lower the impact potential. Effective bridging of PHAs with Generic ER Plans minimizes times to stabilization.

How Can We Make ER More Effective

- ER “Pre-plans”
 - A detailed look at specific potential emergency situations
- Do for each PHA area or sub-area

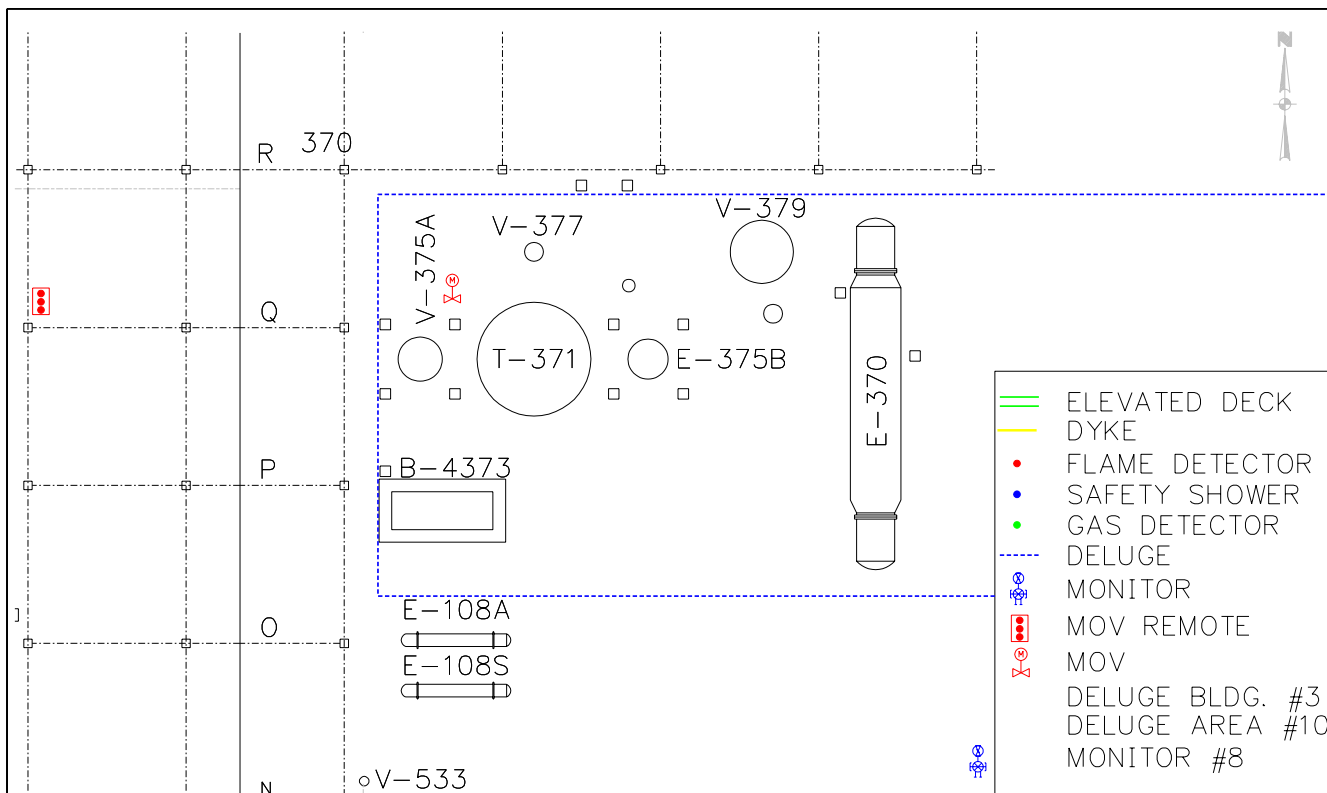
Example

Pre-Plan No. _____

Area Name: C2 Splitter

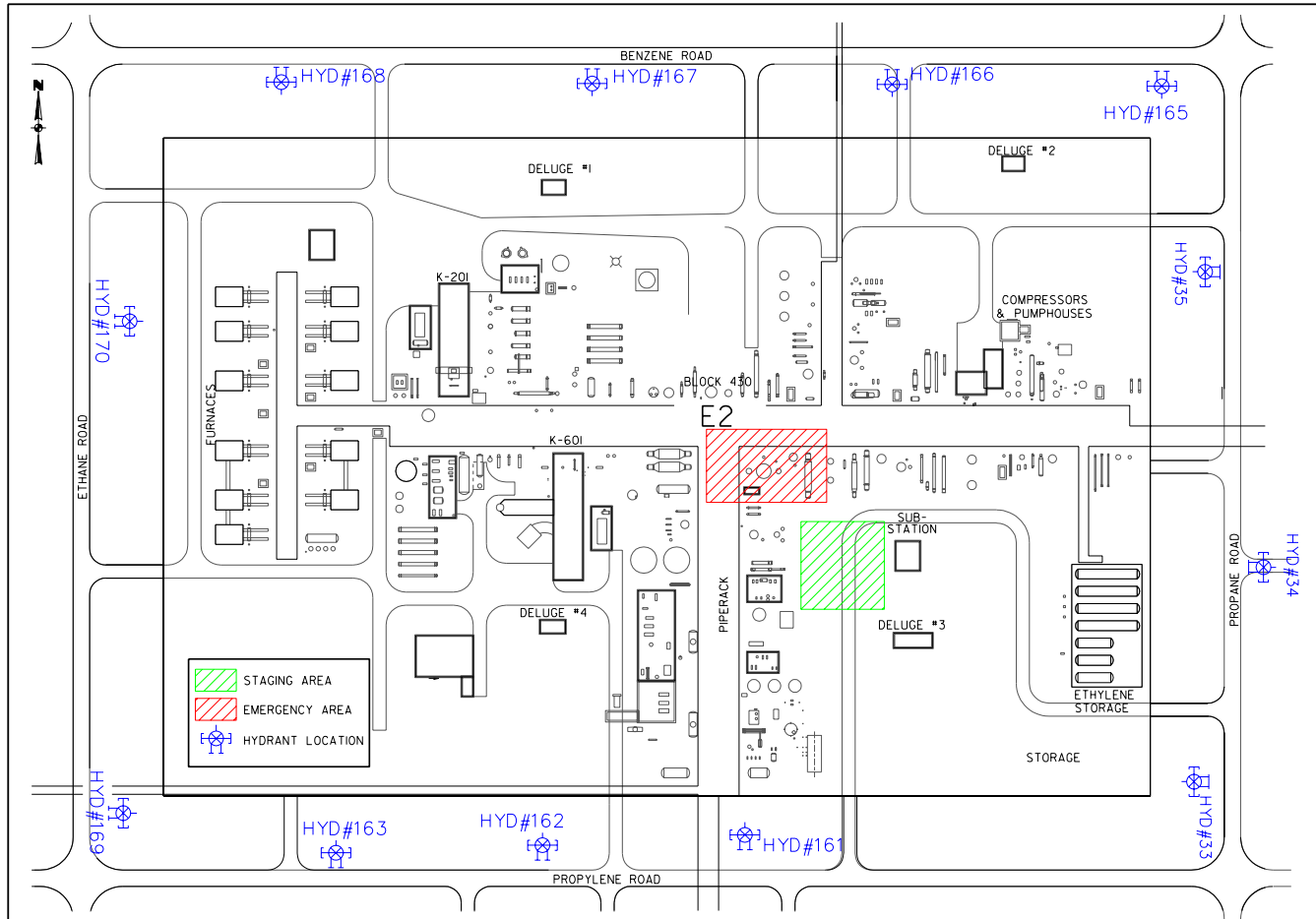
General Area Map

(Show main streets, access routes, assembly points, staging areas, pin point emergency area and shade area)



Specific Area Map

(Show monitor locations, hydrant locations, deluge piping, vessels and piping, faint grid, key isolation valves, area grade and slope, access points, staging areas)



Highlights ->

Special Considerations	What Can Hurt?	What Can Help?

Pre-Plan Example (Cont'd)

- Special considerations – none
- What Can Hurt?
 - Vessel fracture due to sub-cooling
 - Excessive accumulations of fire and deluge water due to poor storm drainage
- What Can Help?
 - Use of deluge system # 10, Deluge House #3
 - Use of portable monitors
 - Additional hose lines from Monitor #7 located due east 350 feet

Pre-Plan Example (Cont'd)

- Material Hazards
 - Type: ethane/ ethylene/ propane
 - Press (max): 1700 kPa
 - Temp (min/ max): -80 °C to 40 °C
 - Volume (mgs/l): 1,000 mgs/ 1,000,000 litres
 - Liquid/ Gas: expansion rate = 300:1 liquid to vapor
 - Flammability: 6% - 37% in air due to hydrogen

Pre-Plan Example (Cont'd)

- Area Specifics
 - Surface: concrete and asphalt
 - Drainage/ Slope: Poor to east and south;
Access/ egress: excellent from south with south wind. Congested from north/west or east
 - Ignition sources: GT-601 (West), FV-905 (SW) approx. 200 feet
 - Congestion: Difficult to access manual isolation valves due to piping and platforms

Pre-Plan Example (Cont'd)

- Isolations
 - MOV's: MV-3717 (Bottoms); MV-3726 (O/H's); MV-3742 (Reflux); MV-4120/ 4130 (Reactors); field and control room switches
 - Manual: FV-3791, FV-3793, VF-3711, FV-3818, FV-3740, FV-3735
 - Electrical: MCC Sub-station #21 and #22

Pre-Plan Example (Cont'd)

- Exposure Potential
 - Piperack/ High Lines: Fireproofing up to 20 ft; 3-4 layers of pipe
 - Structural Steel: Fireproofing up to 20 feet
 - Instrumentation: Analyzer building #4373 including H₂/N₂/O₂ and helium bottles and 600 V electrical

Pre-Plan Example (Cont'd)

- Safety Systems
 - Deluge: Area # 10 Deluge Bldg #3 (4353)
 - Hydrants: 400 ft to hydrants #17 and #16 east of 11th street
 - Monitors: Number 8 located due south
 - Gas Detection: Located at PM-374A/B Reflux Pump 100 ft west

Pre-Plan Example (Cont'd)

- Other Resources Required
 - Utilize fire truck for pipes
 - Consider removal of collected water
- Recommendations
 - Vapor Release: removal of liquids while maintaining equipment pressures
 - Fire: Equipment cooling; removal of hydrocarbons to extinguish fire
- Pertinent MSDS Data (eg, fire fighting, reactivity, spill treatment, etc)
- Other Information

ER Pre-Plans

- Completed by Operations
- Validated by ER Coordinators or Site Emergency Planning Committee

Bridging the Gap Between PHAs and ER Plans – the Opportunity

More Hazards ->

Unit	Area	Feed or Storage Chem	Products	Pre-Plans (NEW)	PHA Identified Hazards (by Process Safety Engineers) (chemical and facility hazards) (Not all shown)				
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Acknowledgements

- Mr. Doug Hill NOVA Chemicals
Emergency Response
- Mr. Ron Lebel NOVA Chemicals
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