

The World's Best PHA Software



from the world's leading PHA consultants

Comprehensive Program

[illegible]

World-class PHA software integrated with Microsoft® Office

Multiple Analysis Methods

- All the analysis methods you need for a comprehensive PHA
- Seamless switching between:
 - **HAZOP**
 - **What-if**
 - **Checklist**
 - **FMEA**
 - **LOPA**
 - *Your custom method*

The screenshot displays the LEADER software interface for Process Hazard Analysis (PHA). The left pane shows a hierarchical tree of analysis methods:

- Line**
 - 1 HAZOP of a line
 - 1 High flow
 - 2 Low/no flow
 - 3 Reverse flow
 - 4 Misdirected flow
 - 5 High temperature
 - 6 Low temperature
 - 7 High pressure
 - 8 Low pressure
 - 9 High concentration
 - 10 Loss of containm
 - 11 Startup
 - 12 Shutdown
 - 13 Maintenance/sar
 - 2 Checklist for a line
- Column**
 - 3 What-if of a column
 - 1 What if the colum
 - 2 What if the colum
 - 3 What if a column
 - 4 What if the gas fo
 - 5 What if there wer
 - 6 What if a slug of v
 - 4 Checklist for a colum
- Pump**
 - 5 FMEA of a pump
 - 1 External leak/rupt
 - 2 Fails to start

The right pane shows the 'FMEA Worksheet: 5 - FMEA of a pump'. It has tabs for 'All', 'Root Causes', 'Effects', 'Safeguards', and 'Actions'. The 'Root Causes' tab is active, showing a table with columns 'No.', 'Link', and 'Root Cause/Related Failure Mode'. The 'Effects' tab is also visible, showing a table with columns 'No.', 'Link', and 'Local Effect'. The 'Safeguards' tab shows a table with columns 'No.' and 'Safeguard'.

No.	Link	Root Cause/Related Failure Mode
5.1		External leak/rupture
		Click here to add a new Root Cause
1		Seal failure
2		Excessive vibration
3		Valve leaking

No.	Link	Local Effect
		Click here to add a new Effect
1		Small/large release

No.	Safeguard
	Click here to add a new Safeguard
1	Isolation valve
2	Check valve
3	Low flow indicator/alarm on seal flush
4	Minimum flow line
5	Plugs in casing/vent/drain valve
6	Remote shutdown capability

Expert Analysis Setup

Chemical Process Library1 (Base) - LEADER 2015

File Edit Tools Worksheet Master Lists LOPA Reports Window Help

Checklist

- 2 Barge/Marine Vess
- 3 Dust Checklist: Col
- 4 Dust Checklist: Cy
- 5 Dust Checklist: Dry
- 6 Dust Checklist: Ele
- 7 Dust Checklist: Fal
- 8 Dust Checklist: Fac
- 9 Dust Checklist: Flu
- 10 Dust Checklist: Gi
- 11 Dust Checklist: M
- 12 Dust Checklist: M
- 13 Dust Checklist: M
- 14 Dust Checklist: Pe
- 15 Dust Checklist: Si
- 16 Dust Checklist: Ti
- 17 Facility siting
- 18 Generic and inher
- 19 HEP Building and
- 20 HEP Compressors
- 21 HEP Electrical Po
- 22 HEP Environment
- 23 HEP Fire Protecti
- 24 HEP Furnaces and
- 25 HEP Heat Exchang
- 26 HEP Instrumentat
- 27 HEP Maintenance
- 28 HEP Management
- 29 HEP Miscellaneous
- 30 HEP Operating Ar
- 31 HEP Operations C
- 32 HEP Piping and V
- 33 HEP Pressure and
- 34 HEP Process Mat
- 35 HEP Process Unit
- 36 HEP Pumps Ched
- 37 HEP Reactors Che
- 38 HEP Vessels (Tar
- 39 HEP Yard Safety

Master List: Sections

Customize Show/hide columns Publish Import Refresh

Data to get from Library: ☐ Causes ☐ Consequences ☐ Safeguards

No.	Method	Name (becomes Library Type)
		Click here to add a new Section
85	FMEA	Nozzle
86	FMEA	Power supply
87	FMEA	Pump
88	FMEA	Reactor, batch
89	FMEA	Reactor, continuous
90	FMEA	Relay/Breaker/Fuse/Sv
91	FMEA	Relief device
92	FMEA	Sensor element
93	FMEA	Sensor switch
94	FMEA	Step
95	FMEA	Tank/Vessel
96	FMEA	Transducer
97	FMEA	Transformer
98	FMEA	Transmitter
99	FMEA	Utilities and services
100	FMEA	Valve
101	HAZOP	Column
102	HAZOP	Compressor
103	HAZOP	Fan
104	HAZOP	Furnace
105	HAZOP	Heat exchanger
106	HAZOP	Hose
107	HAZOP	Line/Pipe
108	HAZOP	Other
109	HAZOP	Pump
110	HAZOP	Reactor, batch
111	HAZOP	Reactor, continuous
112	HAZOP	Step (eight-guide-word
113	HAZOP	Step (three-guide-word
114	HAZOP	Tank/Vessel
115	HAZOP	Utilities and services
116	Safeguard...	Generic and inherent s
117	What-if	Column
118	What-if	Compressor
119	What-if	Furnace
120	What-if	Heat exchanger
121	What-if	Line/Pipe

HAZOP Worksheet: 104 - Furnace

All Causes Consequences Sa

Item	Deviation
104.1	High combustion air/stack flow

Causes

No.	Link	Cause
		Click here to add a new
1		Burner management sys
2		Damper opening

Consequences

No.	Link	Consequence
		Click here to add a new
1		Inefficient operation

Safeguards

No.	Safeguard
	Click here to add a new Safegu
1	Firebox pressure indication
2	High firebox pressure alarm

- Complete sets of topics added instantly based on selected method and section type
- Vast **LEADER Library** puts hundreds of standard HAZOP deviations, what-if questions, checklist topics, and failure modes at your fingertips
- Add your own custom topics to any section, to the Library, or to a project template that you create
- Copy, reorder, and renumber topics to your liking; **LEADER keeps everything linked and organized**

User-friendly Worksheets

HAZOP Worksheet: 1 - chlorine railcar

Item	Deviation	Initiating Event	Initiating Event Type	Frequency	Opp/yr	IE Comment	Enabling C...	ECProb
1.9	Loss of containment	Operator failing to close or inadvertently opening a valve to the atmosphere (e.g., a valve at a hose connection)	Operator Failure (to execute a complete, routine procedure; well-trained operator, unstressed, not fatigued)	1E-2	100	Typical per-opportunity value for operator failure to execute a complete, routine procedure assuming operator is well trained, unstressed, and not fatigued. This value needs to be adjusted, multiplying it by the number of opportunities per year. Then, this comment should be revised.	Time at risk	0.1

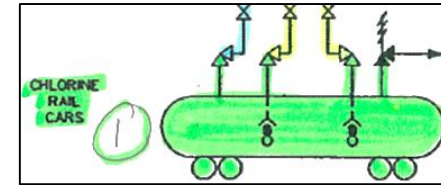
No.	Link	Cause
1		Corrosion/erosion

No.	CBC	Link	Consequence	IP	PP	FP	Matrix	S	UL	UR	L	R	PL	PR
1			Large release of chlorine from ruptured railcar; toxic hazard				Release	S5	1E-1	H	1E-1	H	1E-1	H
2			Steady release of chlorine from a ruptured connection; toxic hazard									MH	1E-1	MH
3			Steady release of chlorine from a leak connection; toxic hazard									L	1E-1	L

No.	CBC	Safeguard
1		Chlorine repair kit
2		Derailer and warning flag to prevent impact
3		Limited vehicular access to area
4		Maintenance/operator response as required
5		Operator periodically monitoring the railcar
6		Personal protective equipment in the area
7		Plugs installed in all chlorine valves to the area
8		Relief valve on each railcar for mitigating releases
9		Supplier maintenance of railcars
10		Video monitoring of the unloading area

No.	CBC	Type	Action	Respo...	I...	P...	PFOD Comm...
Rec 1		Recommend	Consider warning operators of the potential for overfilling a tank car because of a vaporizer shutdown soon after a new railcar is connected to the unloading system	D. Woodward			
Rec 4		Recommend	Review the drainage system for the unloading area, and identify the areas that may be affected by a large chlorine release	K. Grady			
Rec 5		Recommend	Consider providing a water deluge system in the unloading area to help mitigate chlorine releases from the railcar				
Rec 6		Recommend	Consider prohibiting the use of heavy equipment (e.g., cranes) in the unloading and vaporizing area unless special precautions to prevent equipment damage are enacted	M. Samuels			
Rec 7		Recommend	Consider installing a chlorine detection system in the unloading and vaporizing area to help detect chlorine releases (especially at likely release points)				
Rec 8		Recommend	Consider providing a high pressure alarm for each vaporizer				
Open 8		Open Item	Verify that periodic maintenance and inspections are being performed in accordance with Chlorine Institute recommendations	M. Samuels			

- Layout maximizes usability
- Multiple tabbed views
- Highlighted to match P&IDs
- Quick navigation
- Adjustable font size
- WordWrap on/off
- Customizable columns
- Risk ranking with customizable matrixes
- Cause-by-cause and consequence-by-consequence modes
- Smart copy/paste



Efficiency Tools

HAZOP Worksheet: 1 - Chlorine railcar

All	Causes	Consequences	Safeguards	Action Items	Team M...
Item	Deviation	Initiating Event	Initiating Event T...	Freque...	Opp.
1.1	High level				
No.	Link	Cause			
		high conc	concentration		
1		Cause			
2		Acid corrosion caused by a high concentration of water			
3		Acid corrosion caused by high concentration of water			
		Acid corrosion resulting from a high concentration of water			
		High concentration of organic contaminants - Compressed air system			
		High concentration of water - Chlorine railcar			

- AutoType
- ShortHand
- AutoCorrect
- AutoSearch Picklists
- LEADER Links

Edit AutoText

AutoType ShortHand AutoCorrect Load/Save File

☒ Use ShortHand

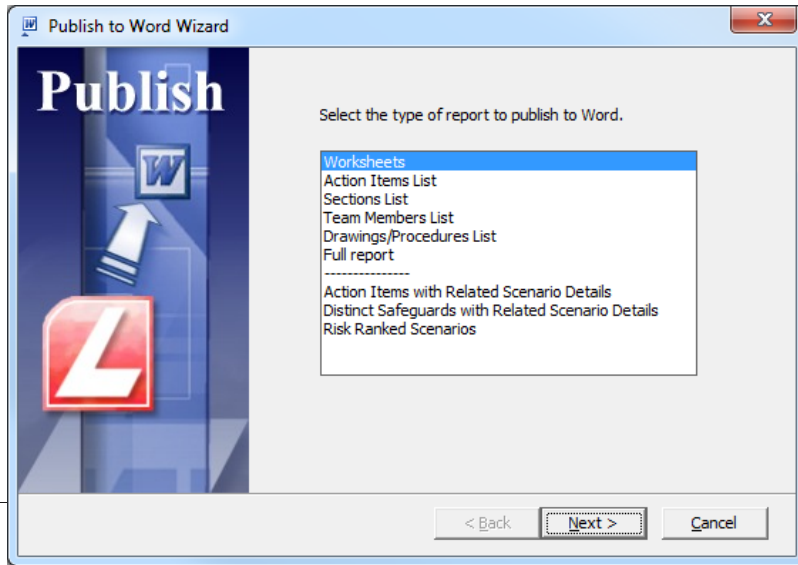
Shorthand	Complete Term
click to add ShortHand.	
deg	°
degC	°C
degF	°F
degrees	°
dept	department
devm	Deviation during maintenance
devsample	Deviation during sampling
devsd	Deviation during shutdown
devsu	Deviation during startup
efv	excess flow valve
eo*	ethylene oxide
epl	(environmental permit issue)
fah	high flow alarm
fahh	high-high flow alarm
fal	low flow alarm
fall*	low-low flow alarm
fcv	flow control valve
fi	flow indication
fri	Release of flammable material; fire hazard potentially affecting a large area
frm	Release of flammable material; fire hazard potentially affecting a medium area
frs	Release of flammable material; fire hazard affecting a small area
fxrl	Release of flammable material; fire/explosion hazard potentially affecting a large area
fxrm	Release of flammable material; fire/explosion hazard potentially

Break Timer



- Helps manage your team's breaks
- Changes colors when break is almost over
- Audible alert brings team back together

Full Reports Published to Word



No.: 1		CHLORINE RAILCAR									
Drawing: D.20.03.F.100.17, D.20.03.P.001, Procedure: SOP-03-001											
Item	Deviation	Causes	Consequences	Matrix	S	ML	MR	Safeguards	Action Item		
1.1	High level	Railcar overfilled by supplier Reverse flow in the chlorine unloading line soon after a new railcar is connected to the unloading system (linked from 3.3) Misdirected flow to the idle railcar from the chlorine unloading line (if the idle railcar is already full) (linked from 3.4)	High pressure (linked to 1.5)					Good supplier loading practices DOT regulations to allow sufficient head space for thermal expansion of liquid chlorine Tank car weighed when received	Rec 1. Consider warning operators of the potential for overfilling a tank car because of a vaporizer shutdown soon after a new railcar is connected to the unloading system		
1.2	Low level		No consequences of interest								
1.3	High temperature	External fire High ambient temperature	High pressure (linked to 1.5)					Concrete crossbys on rail spur Dike preventing any combustibles spilled nearby from reaching the unloading rack area	Open 1. Verify that fire protection equipment located at the unloading rack area		
1.4	Low temperature	Flashing of chlorine while using the eductor in the neutralization system to clear the chlorine from the line	Potential brittle fracture of piping, resulting in a loss of containment (linked to 1.9)						Open 2. Verify that chlorine handling equipment can withstand ambient temperatures of chlorine		
1.5	High pressure	High level with subsequent liquid thermal expansion (linked from 1.1) High temperature (linked from 1.3) Violent reaction caused by high concentration of organic contaminants (linked from 1.7) High pressure - Compressed air system (linked from 2.7) High pressure - Chlorine vaporizer (linked from 4.5)	Potential loss of containment (linked to 1.9) Release of flammable material through the railcar relief valve; fire/explosion hazard affecting a medium area	S/E	S1	F7	LM		Open 3. Verify that maximum air compressor discharge pressure is less than 225 psig. If the air compressor could force the relief valve on a chlorine railcar to open, consider providing a relief		
LEADER Macros											
Reformat Tables											
Manipulate Columns											
Format for table											
Remove vertical											

LEADER Macros	
Reformat Tables	Format for taking handwritten notes
Manipulate Columns	Remove vertical border lines
Modify Column Headers	Prevent row breaks across pages
AutoFormat Text	Fix deviation breaks across pages
Copy Intelliscribe Lists	Add bottom border to each page

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Table 4 List of Analysis Sections

No.	Type	Name	Description	Design
1	Tank/Vessel	Chlorine railcar	CHLORINE RAILCAR	Receive 90 pressure chlorine
2	Line/Pipe	Compressed air system	COMPRESSED AIR SYSTEM	Pressurize railcar
3	Line/Pipe	Chlorine unloading line	CHLORINE UNLOADING LINE	Transfer chlorine through valve
4	Heat Exchanger	Chlorine vaporizer	CHLORINE VAPORIZER	Vaporize chlorine
5	Line/Pipe	Chlorine gas supply line for bleaching line A	CHLORINE GAS SUPPLY LINE FOR BLEACHING LINE A	Deliver chlorine to bleach product
6	Step (eight-guide-word approach)	Step 4: Verify railcar empty	STEP 4: Verify in the field that one railcar is almost empty (check springs) and another railcar is ready to unload	

Table 3 Analysis Recommendations

No.	Recommendation	Responsible
1	Consider warning operators of the potential for overfilling a tank car because of a vaporizer shutdown soon after a new railcar is connected to the unloading system	D. Woodward
2	Consider providing warning signs on nearby plant air connections that remind operators not to use plant air for padding chlorine railcars	D. Woodward
3	Consider using nitrogen instead of air to pad the railcars	K. Grady
4	Consider installing a chlorine detection system in the unloading and vaporizing area to help detect chlorine release (especially at likely release points)	K. Grady
5	Review the drainage system for the unloading area, and identify the areas that may be affected by a large chlorine release	K. Grady
6	Consider prohibiting the use of heavy equipment (e.g., cranes) in the unloading and vaporizing area unless special precautions to prevent equipment damage are enacted	M. Samuels
7	Consider increasing the frequency of calibrating the dew point analyzer and prohibiting the use of the air compressor when its moisture analyzer is not working	M. Samuels
8	Enforce safety requirements for wearing proper respirator protection while connection/disconnecting railcars	D. Woodward

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Project No. 2008-001

PHA of the Chlorine Unloading and Bleachdown System

Leader: Richard Thomas
Scribe: Alan Jansen

Site: Agribare USA
Plant: Poly Mtl
Unit: Bleach Process
System: Racine Unloading System

August 2009



Advanced Data Analysis

Search Utility - [Topics and Consequences : Select Query]

File Edit Insert Records Window Help

Team Drawings Sections Deviations Causes Consequences Safeguards Actions DevsWithoutData CausesButNoConseqs ConseqsButNoSGs SpecificConseqWithoutSpecificSG AuditCBCAssoc

Filter By Selection Filter Excluding Selection Filter By Form Apply Filter Remove Filter/Sort Find... Find Next Replace...

Location	No	Consequence	Matrix	S	ML	MR	UL	UR	PL
3.12 Loss of containment - Chlorine unloading line	1	Large release of chlorine to the atmosphere	Release	S5	F2	LM	F5	H	
1.9 Loss of containment - Chlorine railcar	1	Catastrophic release of chlorine from a ruptured railcar	Release	S5	F2	LM	F3	MH	
1.9 Loss of containment - Chlorine railcar	2	Steady release of chlorine from a rupture connection	Release	S4	F3	LM	F4	MH	
2.3 Reverse flow - Compressed air system	3	Potential violent release of chlorine from the air system	Release	S4	F3	LM	F4	MH	
3.6 Misdirected flow to the idle chlorine vaporizer - Chlorine unloading line	1	Excess chlorine resulting in a medium release	Release	S3	F5	MH	F6	H	
4.3 High temperature - Chlorine vaporizer	2	Exothermic reaction and potentially violent release	Release	S3	F5	MH	F5	MH	
3.5 Misdirected flow to the neutralization system - Chlorine	1	Excess chlorine resulting in a medium release	Release	S3	F4	LM	F6	H	
5.11 Loss of containment - Chlorine gas supply line for bleaching line A	1	Medium release of chlorine	Release	S3	F4	LM	F6	H	
5.5 Misdirected flow to bleaching line B - Chlorine gas supply line for	2	Potential medium release of chlorine	Release	S3	F4	LM	F5	MH	
3.4 Misdirected flow to the idle railcar - Chlorine unloading line	1	Small release of chlorine	Release	S3	F3	L	F6	H	
2.11 Loss of containment - Compressed air system	1	Rupture in the system resulting in a medium release	Release	S3	F3	L	F5	MH	
3.6 Misdirected flow to the idle chlorine vaporizer - Chlorine unloading line	4	Unexpected chlorine release from vaporizer and piping	Release	S3	F2	L	F4	LM	
4.9 Tube leak or rupture - Chlorine vaporizer	1	Medium release of chlorine	Release	S3	F2	L	F3	L	
2.3 Reverse flow - Compressed air system	2	Potential medium release of chlorine to the atmosphere through the air system	Release	S3	F2	L	F3	L	
5.5 Misdirected flow to bleaching line B - Chlorine gas supply line for	1	Overchlorination in bleaching line B (small release of chlorine)	Release	S2	F5	LM	F6	MH	
5.1 High flow - Chlorine gas supply line for bleaching line A	1	Overchlorination in the bleach process and a small release of chlorine	Release	S2	F5	LM	F6	MH	
4.3 High temperature - Chlorine vaporizer	1	Accelerated corrosion	Release	S2	F5	LM	F6	MH	
1.9 Loss of containment - Chlorine	3	Steady release of chlorine from a leaky connection	Release	S2	F4	L	F5	LM	

Search Utility

C:\...\Chlorine Unloading and Blowdown.lbr

Basic Searches	Advanced Searches
<input type="button" value="Team"/>	<input type="button" value="Deviations having no data"/>
<input type="button" value="Drawings"/>	<input type="button" value="Causes where there are no consequences"/>
<input type="button" value="Sections"/>	<input type="button" value="Non-linked consequences of interest where there are no safeguards or action items"/>
<input type="button" value="Deviations"/>	<input type="button" value="Consequences having certain text where there are no safeguards having certain text"/>
<input type="button" value="Causes"/>	<input type="button" value="CBC deviations having non-associated items"/>
<input type="button" value="Consequences"/>	
<input type="button" value="Safeguards"/>	
<input type="button" value="Action Items"/>	

Action Item Manager

- Track action items from multiple projects
- Filter and sort by any field
- Print or e-mail summary or detail reports
- Share action item database across network

Action Items

PHA of the Chlorine Unloading and Blowdown System
 Plant: Pulp Mill Site: Anywhere USA Last Meeting: 1/1/1900

Recommendation 6 Identifier:

Consider prohibiting the use of heavy equipment (e.g., cranes) in the unloading and vaporizing area unless special precautions to prevent equipment damage are enacted

Priority: Due Date: 8/31/2012 Resolution: Develop policy Status History: Policy being drafted

Responsibility: M. Samuels Est. Completion: 8/31/2012

Status: Resolved Completed: 8/10/2012

August, 2012

	Su	Mo	Tu	We	Th	Fr	Sa
1.							
2.	29	30	31	1	2	3	4
3.	5	6	7	8	9	10	11
4.	12	13	14	15	16	17	18

Consequence Matrix

	Matrix	S	L	L	M	M	F	F
Catastrophic release of chlorine from a ruptured ra	Release	S5	F4	H	F4	H	F4	H
Steady release of chlorine from a rupture connectic	Release	S4	F4	MH	F4	MH	F4	MH
Medium release of chlorine	Release	S3	F6	H	F4	LM		
	Release	S5	F5	H	F2	LM		
	Release	S3	F5	MH	F3	L		
	Release	S2	F4	L	F4	L	F4	L

Action Items Manager

Action items from the following projects are included:

- PHA of the Chlorine Unloading and Blowdown System
- Hazard review of isostripper addition to the HF Alky unit
- Example Hazard Review

Update selected .LDR file

Remove selected project

Add a project...

View action items based on the following criteria (leave blank to view all):

Projects: PHA of the Chlorine Unloading and Blowdown System
 (Ctrl+click or Shift+click to select multiple)

Plant: Site:

Action text:

Action Type: Recommendation Priority:

Responsibility: D. Woodward Status: Resolved

Due Date: Before 09/30/2012

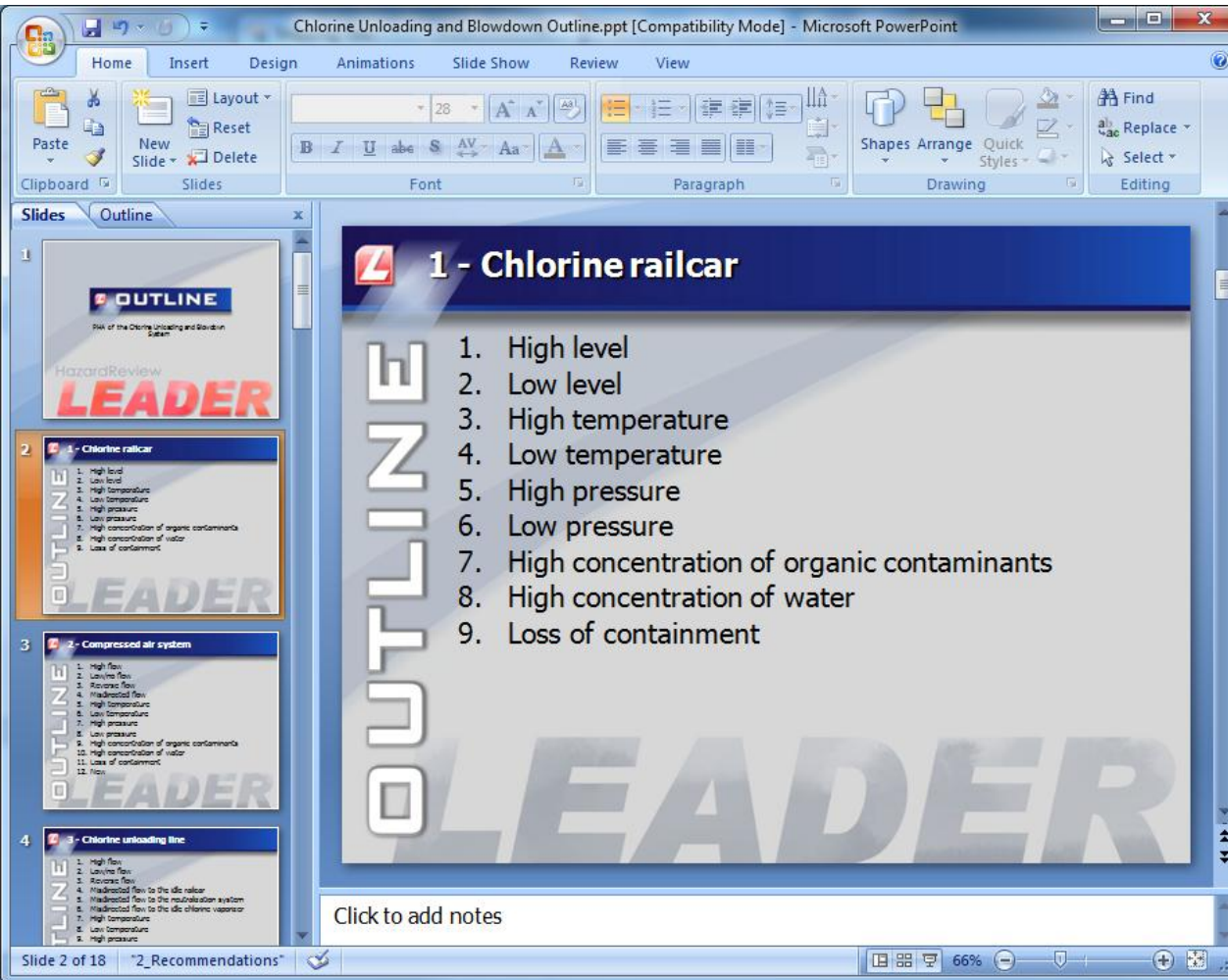
Last Meeting:

View Action Items...

Exit

LEADER

PowerPoint Presentations



- Create a professional presentation with one click
- Present analysis outline to team
- Present analysis recommendations to management

Change Management & Tracking

Master List: Changes

Show/hide columns Refresh Show Changes

Name	Description	Date
Click here to a...		
PHA	2005 PHA	03/01/2005
MOC 06-37	MOC 06-37 relief valves added to vaporizers	02/01/2006

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VAPORIZER

Causes	Consequences	Matrix	S	UL	UR	ML	MR	PL	PR	Safeguards	Action Items
High pressure (linked to 4.5)											
Tube leak or rupture (linked to 4.9)											
Low temperature - Chlorine gas supply line for bleaching line A (linked to 5.7)										Temperature indication and low temperature alarm in control room for the vaporizer that is indicated by the selector switch	Rec 21 Rec 22
High level (linked to 4.1)											
High pressure - Chlorine railcar (linked to 1.5)										Local pressure indication <u>Relief valve on tube side of each chlorine vaporizer to protect against overpressurization</u>	
Potential damage to the vaporizer if isolated from the relief valve on the chlorine railcar (linked to 4.9)											
Potential vaporizer collapse during chlorine evacuation through the eductor in the neutralization system, resulting in a small release of chlorine											
4.6	Low pressure	Operator using the neutralization system eductor to remove chlorine from the vaporizer									Open 4

Summary of Changes

Click Publish to create a detailed change report...

Publish

Summary of Changes

The following changes were made between 'PHA' and 'MOC 06-37':

Sections that were edited:
HAZOP - 1. Chlorine railcar,
HAZOP - 3. Chlorine unloading line,
HAZOP - 4. Chlorine vaporizer

The Recommendations Master List was changed

Deleted: 1
Open 10

Deleted: Rec 24

LOPA and SIL Evaluation

- LOPA Wizard screens scenarios based on risk
- Rolls up complex, linked HAZOP scenarios
- Helps comply with ISA S-84 requirements
- Implements the CCPS LOPA approach
- Provides lookup tables for frequencies and probabilities
- Provides summary of IPLs and SIL requirements for all scenarios

The screenshot displays the LOPA Wizard software interface. The main window, titled "LOPA12 Worksheet: 3 - LOPA 2.12.1. Release of process material; fire/explosion/toxic hazards", shows a table of scenarios and their associated protections. A dialog box titled "LOPA Wizard" is open, showing the "Select Risk Criteria and Candidate Protection Layers" screen.

LOPA12 Worksheet: 3 - LOPA 2.12.1. Release of process material; fire/explosion/toxic hazards

All	Impacts	Existing Protections	Recommended Protections	Team Members & Drawings		
Item	Scenario...	Scenario	Initiating Event	Type	Frequency	IEComment
3.1	2.12.1.1	High pressure DUE TO Gas blowthrough due to low level in accumulator	Level control valve opening too far	BPCS Instrument Loop Failure	1E-1	Used typical value for a BPCS instrument loop failure

Select Risk Criteria and Candidate Protection Layers

Limit scenarios based on unmitigated or mitigated risk rankings. Choose whether to include related safeguards and/or action items as candidate protection layers.

Only include scenarios ranked with these risk matrices:

- ☒ S: Safety
- ☐ O: Operability
- ☐ E: Environmental

Only include scenarios ranked in these risk cells:

- ☐ RED risk cells
- ☐ YELLOW risk cells
- ☐ ORANGE risk cells
- ☒ Risk cells flagged for LOPA

Use these risk rankings:

- ☒ Unmitigated
- ☐ Mitigated

Candidate protection layers to include:

- ☒ Safeguards
- ☒ Action Items

Existing Protections

No.	Link	Impact	IP	PP	FP	Matrix	S	UL	UR	L	R	PL	PR
1		Release of process material;				S	S4	1E-1	J	1E-3	N	1E-4	A

Recommended Protections

No.	Type	Protection	IPL Type	PFOD	PFOD Comment
Rec 1	Recom	Consider providing a low level interlock independent of the level control loop to stop flow and prevent gas blowthrough	SIL-1 SIF	1E-1	Used typical value for a SIL-1 interlock, independent of other interlocks

Lookup Tables

IPL Type	PFOD	PFOD Comment
Human response (10 min available)	1E+0	Used typical value for human response with 10 minutes available for response; notification is independent of initiating event and other IPLs, and operator training includes required response
Relief device	1E-2	Used typical value for a relief valve or rupture disk in clean, non-corrosive service; assumes maintenance per industry standards

Recommended Protection Summary

Protection	Frequency	Comment
BPCS	1E-1	Basic process control system; automatic
Human response (10 min available)	1E+0	Human response with 10 minutes available
Human response (40 min available)	1E-1	Human response with 40 minutes available
Passive	1E-1	Passive device (e.g., a dike with good
Relief device	1E-2	Relief valve or rupture disk (effective
SIL-1 SIF	1E-1	SIL-1 interlock independent of other in
SIL-2 SIF	1E-2	SIL-2 interlock independent of other in
SIL-3 SIF	1E-3	SIL-3 interlock independent of other in



Thank You

for evaluating



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and use **LEADER** free for a PHA
and publish your results to Word

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