

Risk Based Approach to Assessing Acute Human Health Risks During and After a Spill

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Outline

- WHY?
- Objective of Assessing Public Health Risk
- What is Risk Based Approach and Components of an Acute HHRA
- Challenges of Acute HHRA
- Lessons Learned
- Components of a World Class Acute HHRA

WHY?

- Public perception that health risk occurs during spill events
 - The Public smell the odours
 - Some people don't feel well
 - Experience short term effects
- The Public still has concern despite the reassurances of the responsible party

WHY?

“Residents in the neighborhood – located near the tank farm – reported that the smell contributed to nausea and headaches, and they were concerned about long-term health implications”

“Documents obtained through the Michigan Department of Community Health reveal that 145 people were treated by health care providers after the July 25, 2010 spill that polluted local wetlands and the Kalamazoo River, and 320 locals reported experiencing illnesses in surveys.

A total of 41 calls were also made to poison control, the most common symptoms being headaches, nausea, vomiting and respiratory problems.”

WHY?

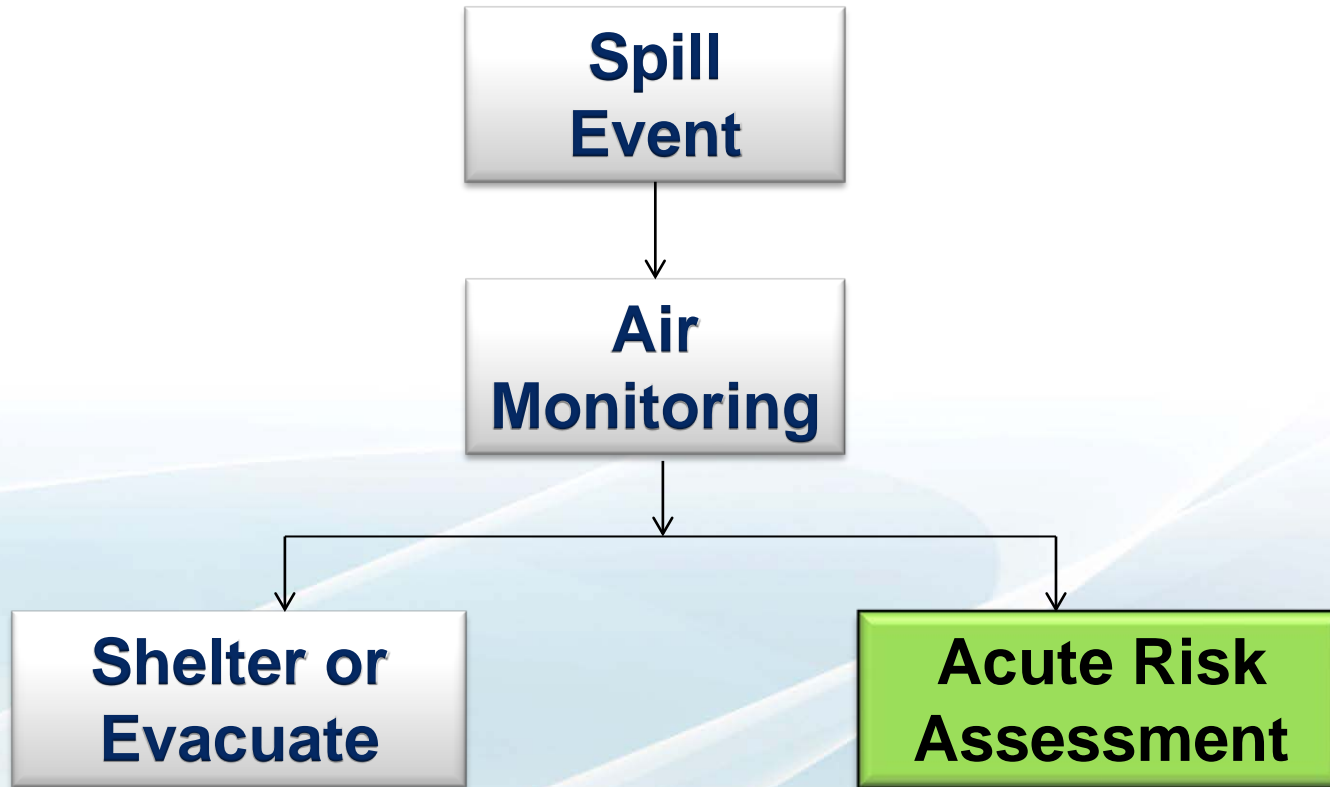
- Usually the ambient air data gathered during a spill event **CANNOT** be used in a risk assessment
 - Detection limits of instruments higher than acute criteria
 - No rigorous plan or planning for public monitoring – most occupational monitoring
 - Always reactive not proactive planning
 - Even if no short term or long term health risks it is hard to **PROVE IT**

Objective of Assessing Public Health Risk

- The predominant exposure pathway for public receptors during a spill event is the **inhalation pathway**.
- This is due to the volatilization of chemical components within the product, after a spill, become airborne and can be carried towards areas inhabited by human receptors.

Objective: Evaluate the potential for adverse health effects to human receptors from exposure of chemicals in ambient air during a spill event

Objective of Assessing Public Health Risk

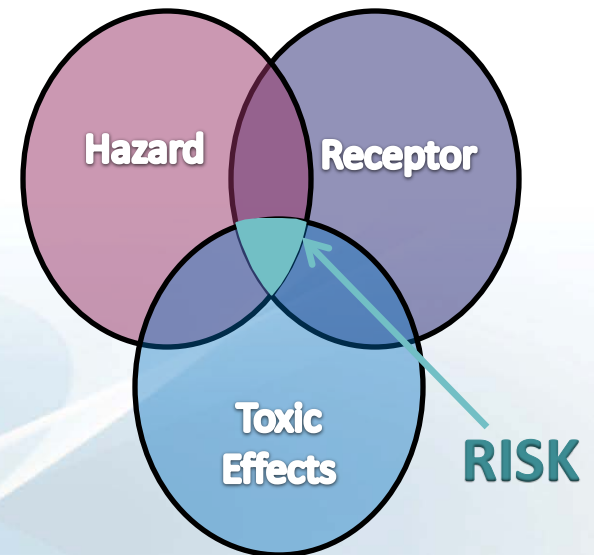
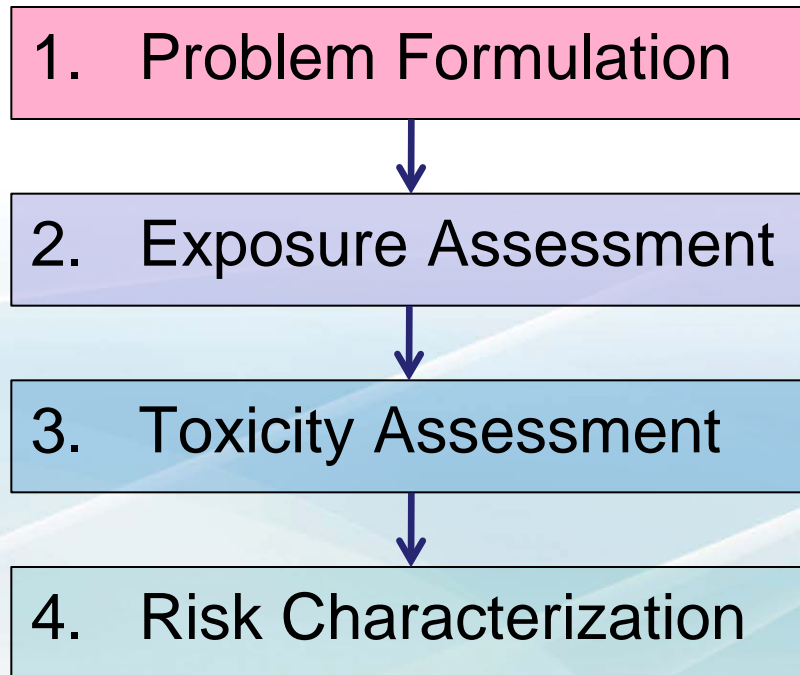


What is a Risk Based Approach

An evaluation of the **potential for adverse health effects** to human **receptors** resulting from **exposure to chemicals**.

Risk Based Approach – Acute HHRA

Four Steps of Risk Assessment



Risk Based Approach – Acute HHRA

Step 1. Problem Formulation

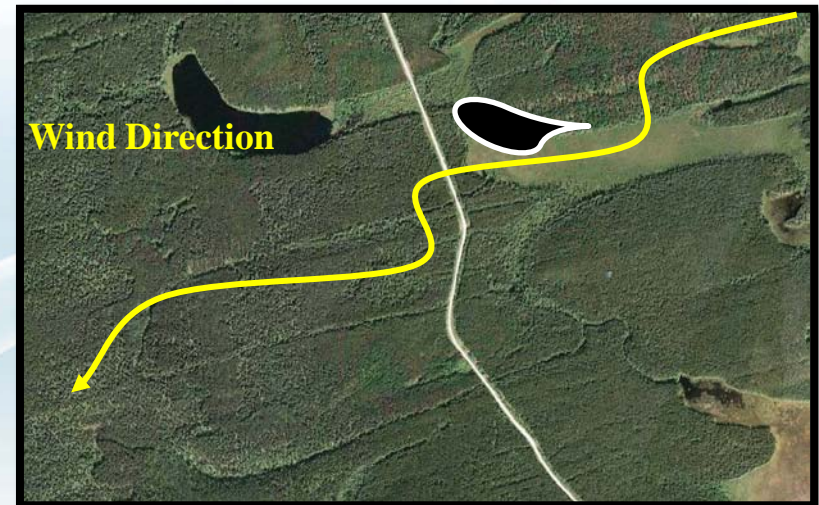
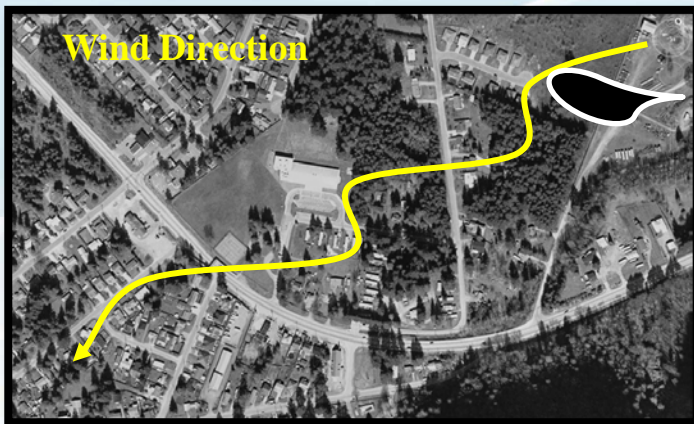
- **Where** is the spill event
- **Where** are the chemicals → in the ambient air
- **What** type of chemicals are being released
- **Who** lives in the spill impacted area
- **How** are the Public exposed to contamination -> inhalation
- **How long** is the Public exposed



Components of Problem Formulation

Context:

- Exposure that may occur during a Petroleum Spill Event not during a long clean up period
- Urban or Remote Environments
- Wind Direction and Weather



Components of Problem Formulation

Receptors:

- Humans – who is in area of impact
 - All ages - birth to elderly
 - Sensitive populations – sick, elderly
 - Daycares, care homes, hospitals, schools, residential area, parks, industrial areas, etc



Components of Problem Formulation

Chemicals: Related to Petroleum Products

- General Physical Properties
 - Product vapors generally sink towards ground
 - Product constituent floats and/or sinks in water
- Chemical Properties
- Toxicology
- Where is this information found
 - MSDS Sheets
 - Specific chemical Analysis



Components of Problem Formulation

Chemicals of Potential Concern

Product Type: Crude Oil and Gasoline		Product Type: Added to List for Only Gasoline	
• Benzene	• Isopropylbenzene	• 1,2-dibromoethane	
• Toluene	• N-decane	• 1,2-dichloroethane	
• Ethylbenzene	• N-hexane	• MTBE	
• Xylenes	• Methylcyclohexane	• Ethanol	
• Naphthalene	• Methanethiol		
• 1,3-butadiene	• Ethanethiol		
• 1,2,4-trimethylbenzene	• Sec-butyl mercaptan		
• 1,3,5-trimethylbenzene	• Hydrogen sulfide		
	• VPHv		

Components of Problem Formulation

Chemicals Screening

Criteria: Acute not Chronic

- Chemical specific to protect human health
- Select short term exposure times with durations ranging from 10 minutes to 14 days

Screening: Acute not Chronic

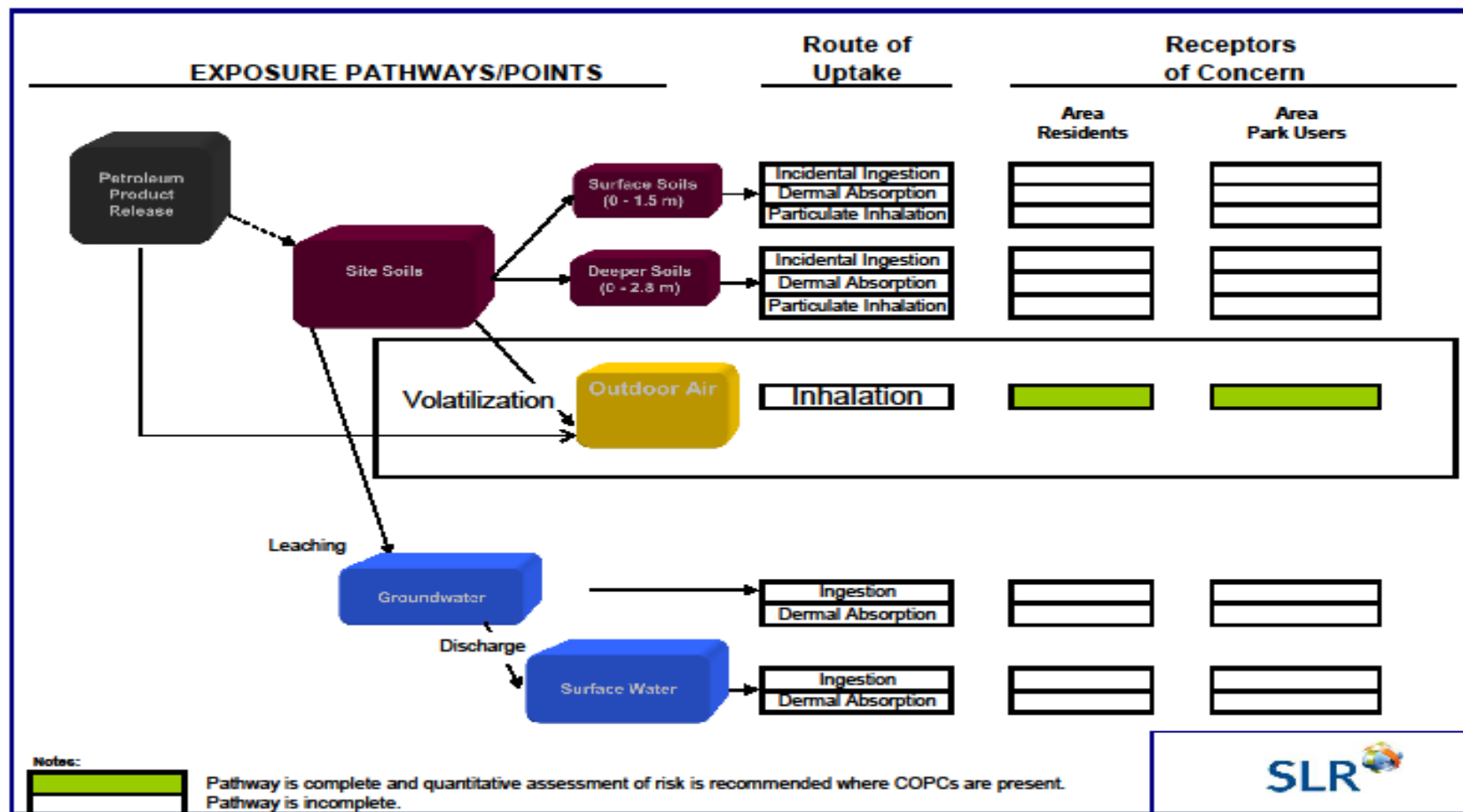
- Criteria used to screen air monitoring results to determine which chemicals should be included in Acute RA
- If chemical's maximum concentration is less than the Air Screening Criteria it will be deemed to be of no potential public health concern and will not be included in Acute RA

Components of Problem Formulation

Screening Criteria

Reference Value	Organization	Type Value	Exposure Duration
AEGL - Acute Exposure Guideline Level	NAC/AEGL; COT/AEGL	Emergency Response	10- and 30-min; 1-, 4- and 8-h
ERPG - Emergency Response Planning Guideline	AIHA	Emergency Response	1-h
TEEL - Temporary Emergency Exposure Level	DOE	Emergency Response	1-h
ERG - Emergency Response Guidebook	DOT	Emergency Response	Specialized application to determine evacuation zones
MRL - Minimal Risk Level	ATSDR	Public Health	1-14 days (acute); 15-364 days (intermediate); >365 days (chronic)
REL - Reference Exposure Level	OEHHA	Public Health	1-h, 8-h, and chronic
ARfC - Acute Reference Concentration	OECD	Public Health	Less than 24-h
AMCVs - Acute Monitoring Comparison Values	Texas	Public Health	24-h or less

Components of Problem Formulation



Risk Based Approach - Acute HHRA

Step 2. Exposure Assessment

Provides estimates of from **short term** exposure:

- ***What is the chemical concentration(s) measured during the Spill Event*** that the Public may inhaled
- ***How long is the Exposure: Daily intake (dose)*** of chemical(s) by Public

Human intake factors include:

- Age
- Hours per day exposed;
- Breathing Rate



Components of Exposure Assessment

Exposure: Inhalation

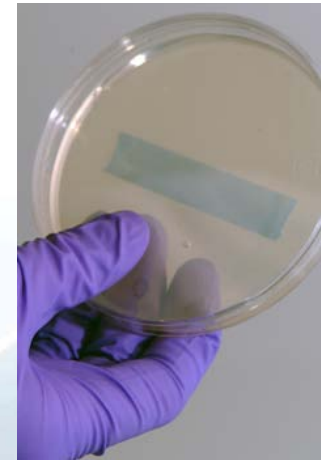
- Consider exposure period
 - Highest concentrations occur at beginning of event
 - Ambient air data considered representative of 1-hour, 8-hour and 14-day exposure periods following spill event
 - Fluctuations can occur due to dispersant usage during spill response

Risk Based Approach - Acute HHRA

Step 3. Toxicity Assessment

Gather information on:

- ***Acute Adverse Health Effects*** the chemical(s) may cause
- ***Concentrations*** that cause these adverse effects
- Short term exposure criteria



Components of Toxicity Assessment

Adverse Effects:

- Acute and Subchronic Effects not Chronic Effects
- Need **acute and/or subchronic** effects toxicological data, when available, such as:
 - Decreased lymphocyte count
 - Developmental toxicity
 - Motor function
 - Nasal lesions

Risk Based Approach - Acute HHRA

Step 4. Risk Characterization

Combines results of Step 2 and 3 to :

- **Estimate probability and severity of potential risks to Public**
 - **Compare** the estimated site-specific **doses** for each site user to **Acute TRVs**
 - **Calculate risks**
 - **Uncertainties evaluated**
 - **Discuss meaning** of results



Challenges of Acute HHRA

- Dynamic environment during event
- Lack of air monitoring plans specific for public health during spill event
- Acquiring useful data at low detection limits in real time
- Acute criteria selection
- Transfer from acute to chronic conditions when longer term impacts are occurring

Lessons Learned

- Monitoring plans need to be proactive not reactive
- Risk assessments need to be tailored to short term exposure scenarios
- Chemicals monitored need to be specific to product spilled – a long list is not better than short list with actual criteria
- Monitoring instruments need to be sensitive

Components of World Class RA

- Comprehensive Air Monitoring Plans that allow collection of accurate and reliable data
- Measurement of chemicals at low detection limits in real time
- Screening level and toxicity reference sources are respected and recognized organization
- RA is proven method to assess human impacts during and after exposure to chemicals

Thank you!

Questions??