



Preventing Chemical Accidents

The Risk Management Program



Course Objectives

- Discuss requirements of CAA 112(r)
- Provide information on common compliance pitfalls
- Help facilities prepare for CAA 112(r) inspections
- Help prevent accidents and minimize consequences of those that do occur



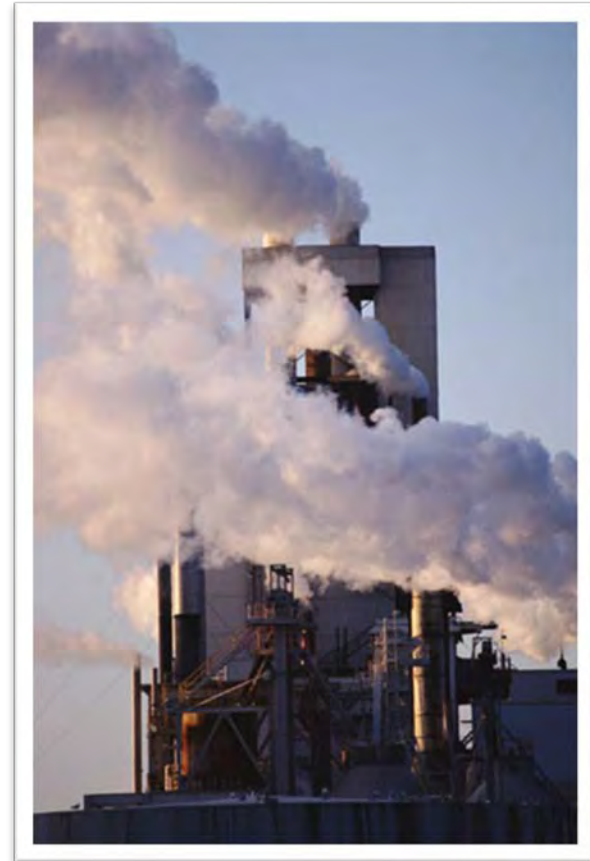
Chemical Accident Prevention Federal Regulations – 1990

- Clean Air Act Amendments of 1990
 - General Duty Clause
 - OSHA Process Safety Management (PSM) – 1992
 - EPA Risk Management Program (Section 112(r)) – 1999
 - U.S. Chemical Safety and Hazard Investigation Board (CSB) – 1998



General Duty Clause Clean Air Act 112(r)(1)

- No thresholds, no lists
- Facilities must
 - Identify hazards
 - Design and maintain facility to prevent releases in accordance with good engineering and industry practices
 - Minimize consequences of releases that do occur





Risk Management Program

Clean Air Act 112(r)(7)

40 CFR Part 68



Clean Air Act (CAA) 112(r) Purpose

- Prevent accidents from occurring
- Minimize consequences of accidents that do occur





Applicability

- Is the facility a stationary source?
- Does the facility have a regulated substance?
- Is the quantity of a regulated substance in any single process above the specified threshold?
- What Program Level is the process?



Definitions

- **Stationary Source:** any structures/equipment located on one or more contiguous properties under the control of the same person(s) from which an accidental release may occur
 - Properties shall not be considered contiguous solely because of a railroad or pipeline right-of-way



Definitions (cont.)

- **Process:** activity involving a regulated substance
 - Any group of vessels that are interconnected or separate vessels that are located such that a regulated substance could be involved in a potential release shall be considered a single process
- **Covered Process:** process that has a regulated substance present in more than a threshold quantity



Definitions (cont.)

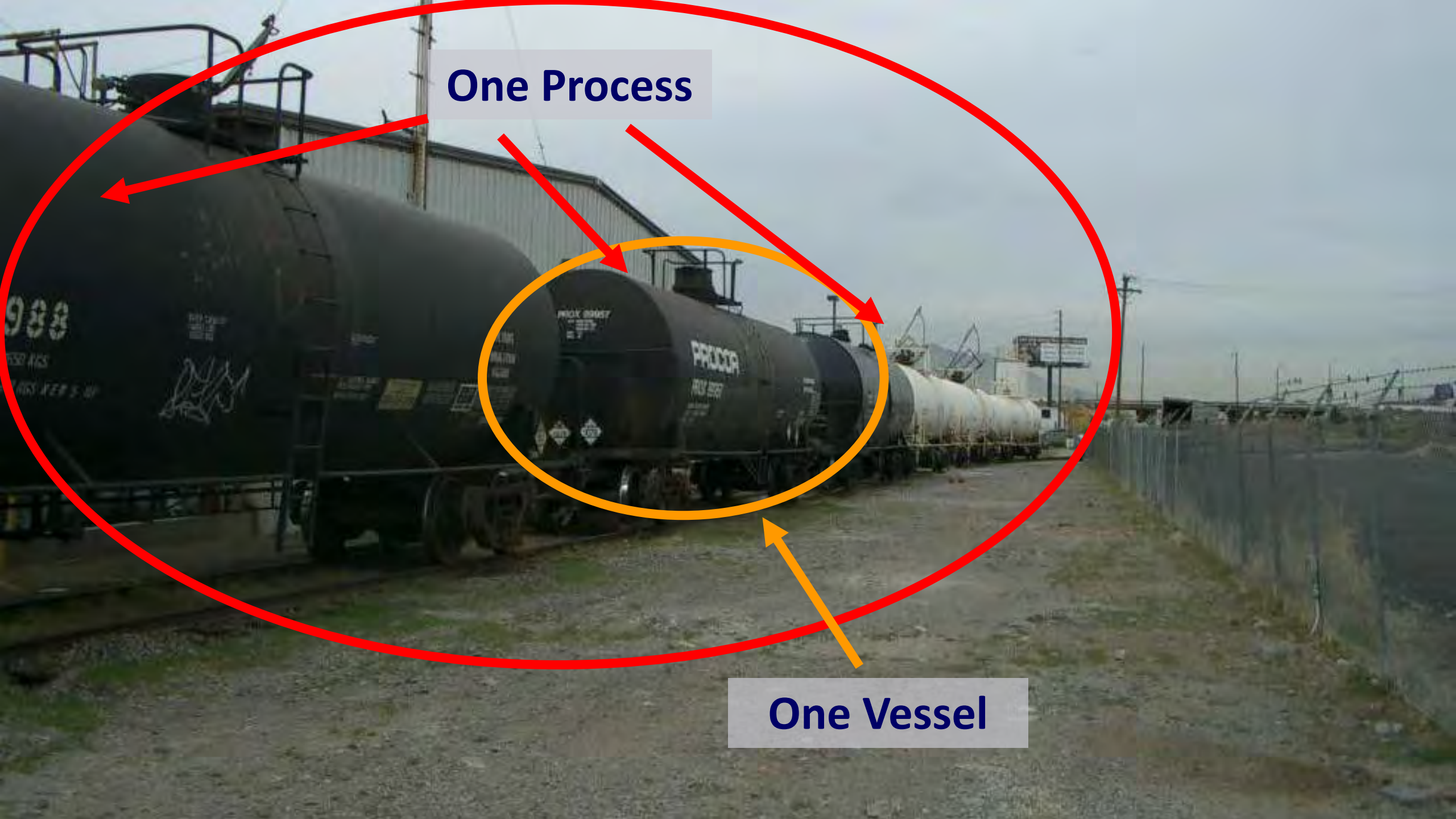
- **Vessel:** any reactor, tank, drum, barrel, cylinder, vat, kettle, boiler, pipe, hose, or other container
 - Includes transportation containers disconnected from mode of power

One Process



One Vessel





One Process

One Vessel



Definitions (cont.)

- **Regulated substance:** any substance listed in CAA 112(r)(3) in CFR 68.130
- **Threshold quantity:** quantity specified for a regulated substance present at a stationary source



Regulated Substances

- Currently 140 substances (63 flammable, 77 toxic)
- Listed based on
 - Toxicity
 - Ambient physical state
 - Gas
 - Liquid with vapor pressure > 10 mmHg
 - Flammability
 - NFPA 4 flammability (flash point < 73 °F; boiling point < 100 °F)



Mixtures and Solutions

- Listed **toxic** mixtures containing $\geq 1\%$ listed toxic substance with partial pressure ≥ 10 mmHg
- Listed **flammable** mixtures containing $\geq 1\%$ listed flammable substance with mixture exceeding NFPA 4 flammability criteria
- Substances with specified concentrations
 - Aqueous ammonia ($\geq 20\%$)
 - Nitric acid ($\geq 80\%$)
 - Hydrofluoric acid ($\geq 50\%$)
 - Hydrochloric acid ($\geq 37\%$)



Risk Management Program Exemptions

- Mixtures < 1% concentration (flammable & toxic)
- Naturally occurring hydrocarbon mixtures prior to processing
- “Articles”
- Flammables used as fuel or held for retail sale
- **Anhydrous ammonia held by farmer for own use as nutrient**
- Transportation



Risk Management Program Exemptions (cont.)

- Specified uses
 - Structural component of stationary source
 - Routine janitorial maintenance
 - Foods, drugs, cosmetics, or other personal items
 - In process water, non-contact cooling water, compressed air, or air used for combustion
- Laboratory activities
- Outer continental shelf sources
- Gasoline used as fuel in internal combustion engines



When is a Risk Management Program Required?

- A Risk Management Program is required as soon as a threshold quantity of any CAA 112(r) chemical is brought onsite
 - Even if the facility is not in operation or is only in its “shake down” period
 - The owner/operator of the chemical or process is the one responsible for having the program developed and plan submitted
 - Can do predictive filing



Program Level

- Determine Program 1, 2, or 3, and follow appropriate regulatory requirements
 - Program 1 40 CFR 68.10(b) and 68.12
 - Program 2 40 CFR 68 Subpart C
 - Program 3 40 CFR 68 Subpart D
- Ensure that individual chemical processes are subject to appropriate requirements based on the risks associated to that process



Key Points About Program Level

- Each process is assigned a program level, not the facility as a whole
- Any process that meets criteria for Program 1 can be assigned to Program 1, even if it is subject to OSHA Process Safety Management (PSM) or is in one of the North American Industry Classification System (NAICS) codes listed for Program 3
- Program 2 is the “default” program level
- Only one program level (Program 1 if eligible, or the higher of Program 2 or 3) applies to a process



Program 1 Eligibility Criteria

- No public receptors in worst-case scenario zone
and
- No accidents with a specified **OFF-SITE** consequence in the last five years
 - Death
 - Injury
 - Response or restoration activity for an exposure of an environmental receptorand
- Emergency response procedures coordinated between facility and local emergency planning and response organizations

Flammable Storage may commonly qualify for Program 1



Definitions

- **Injury:** any effect on a human that results either from direct exposure to toxic concentrations, radiant heat, or overpressures from accidental releases or from direct consequences of vapor cloud explosion (such as flying glass, debris, and other projectiles) from an accidental release
- **Medical Treatment:** treatment, other than first aid, administered by a physician or registered personnel under standing orders from a physician
- **Off-Site:** anything beyond the property boundaries



Program 1 Requirements

- Limited hazard assessment requirements
- Minimal prevention and emergency response requirements



Important Tips for Program 1 Processes

- Use the correct latitude and longitude coordinates for the largest vessel for the hazard assessment
- Consider not only residential, but also the nearest industrial neighbors
- Program 1 eligibility can change



Common Deficiencies

- **Program Level 1**

- Proper documentation not maintained for worst-case release scenarios
- Facilities claim to have Program 1 process(es), but in fact are not eligible



Program 2 Eligibility & Requirements

- Ineligible for Program 1 **and** not covered by Program 3
- Requirements
 - Streamlined prevention program requirements (as compared to Program 3)
 - Safety information, hazard review, operating procedures, training, maintenance, compliance audits, incident investigations
 - Requires a management system, hazard assessment, prevention program, and emergency response requirements (as compared to Program 1)

Common program level for agricultural ammonia processes (as of Sept. 2016)



Program 3 Eligibility

- Ineligible for Program 1
- Either ***subject to OSHA PSM*** (federal or state) or one of the North American Industry Classification System (NAICS) codes specified in 40 CFR Part 68

Usually more complex chemical processes (refining, manufacturing) versus storage or warehousing



CAA 112(r)(7) Program 3 NAICS Codes

32211 Pulp Mills

32411 Petroleum Refineries

32511 Petrochemical
Manufacturing

325181 Alkalies & Chlorine
Manufacturing

325188 All Other Basic Inorganic
Chemical Manufacturing

325192 Cyclic Crude & Intermediate
Manufacturing

325199 All Other Basic Organic Chemical
Manufacturing

325211 Plastics Material & Resin
Manufacturing

325311 Nitrogenous Fertilizer Manufacturing

32532 Pesticide & Other Agricultural
Chemical Manufacturing



Program 3 Requirements

- Requires a management system, hazard assessment, and emergency response requirements
- Full prevention program (similar to OSHA's PSM Standard)
 - Process safety information
 - Process hazard analysis
 - Operating procedures
 - Training
 - Mechanical integrity
 - Management of change
 - Pre-startup review
 - Compliance audits
 - Incident investigation
 - Employee participation
 - Hot work permit
 - Contractors



Common Deficiency

- **All Program Levels**

- Wrong program level determination
 - Especially Program 2 versus Program 3 in states with delegated OSHA programs



Five Elements of a Risk Management Program

- Written management system - Program 2 & 3
- Written hazard assessment - all program levels
- Written and implemented accident prevention program - Program 2 & 3
- Emergency response requirements - Program 2 & 3
 - Coordinate with Emergency Response Agencies - all program levels
- Submit a Risk Management Plan (RMP) - all program levels



Written Management System

Documenting who is responsible for what



Written Management System

- Owner or operator of a stationary source with processes subject to Program 2 or Program 3 shall develop a management system to oversee the implementation of the Risk Management Program elements (40 CFR 68.15(a))
- Owner or operator shall assign a qualified person or position that has the overall responsibility for the development, implementation, and integration of the Risk Management Program elements (40 CFR 68.15(b))



Written Management System (cont.)

- When responsibility for implementing individual requirements of this part is assigned to persons other than the person identified under paragraph (b) of this section, the names or positions of these people shall be documented and the lines of authority defined through an organization chart or similar document. (40 CFR 68.15(c))

Common Deficiency



Common Management System Deficiencies

- No management system exists
- Management system is not accurate or effective
- Management system does not include all 5 Risk Management Program elements
- How management system deficiencies are detected
 - Hazard assessment identical in two RMP resubmissions
 - Required corrections or resubmissions of the RMP are missed



Hazard Assessment

What are the potential impacts to the community if the facility has a release?



Has the Hazard Assessment Been Updated?

- Do NOT assume that 5+ year old information is still accurate
 - 2010 Census data (most recent)
 - New or change in receptors
 - Process changes
 - More accurate methods to determine latitude/longitude



Hazard Assessment – Red Flags

- Latitude/longitude in the RMP is nowhere near the facility
 - Do not assume that latitude/longitude determined in the 1990s are still accurate
 - Technology has improved
- Facility uses the same latitude/longitude for all scenarios
 - Must use the latitude/longitude for the actual vessel
 - This could affect Program Level eligibility



Tips for Completing Flammable Mixture Scenario

- Each flammable scenario must use the weight of all of the Risk Management Program components present in the mixture
 - Not a separate calculation for each component
- It is possible to have more than one flammable worst case scenario
 - If vessels are not located near each other evaluate each vessel to see if they impact different receptors



Off-Site Consequence Analysis

Determine worst-case and alternative release scenarios



Definitions

- **Off-site:** areas beyond property boundary of stationary source, and areas within property boundary to which public has routine and unrestricted access during or outside of business hours
- **Public:** any person except employees or contractors of the stationary source



Definitions (cont.)

- **Worst-Case Release Scenario:** release of largest quantity of regulated substance from vessel or process line failure that results in greatest distance to endpoint
- **Alternative Release Scenario:** scenarios more likely to occur than worst-case scenario that will reach off-site endpoint, unless no such scenario exists



Definitions (cont.)

- **Distance to an endpoint:** distance toxic vapor cloud, fire, or explosion from accidental release will travel before dissipating to the point that serious injuries from short-term exposures will no longer occur
- **Environmental receptor:** natural areas such as national or state parks, forests, or monuments; officially designated wildlife sanctuaries, preserves, refuges, or areas; and Federal wilderness areas



Definitions (cont.)

- **Public receptor:** offsite residences; institutions (e.g., hospitals, schools); industrial, commercial, and office buildings; parks; or recreational areas inhabited or occupied by the public at any time ***without restriction*** by stationary source where members of the public could be exposed to toxic concentrations, radiant heat, or overpressure as a result of an accidental release



Required OCA Scenarios

- For each Program 1 process
 - One worst-case scenario
 - No alternative scenarios required
- For each Program 2 and Program 3 process
 - Worst-Case Scenarios
 - One worst-case scenario for all toxics
 - One worst-case scenario for all flammables
 - Additional worst-case scenarios if different public receptors could be affected (more common for flammables)
 - Alternative Scenarios
 - At least one alternative scenario for each toxic
 - At least one alternative scenario for all flammables



Mitigation Systems

- Activities or equipment designed to contain released substances to minimize exposure
- Passive mitigation
 - Function without human, mechanical, or other energy input
 - Examples: building enclosures, dikes, blast walls
- Active mitigation
 - Need human, mechanical, or other energy input to function
 - Examples: interlocks, shutdown systems, pressure relieving devices, flares, emergency isolation systems, water cannons



Worst-Case Scenario Selection

MUST be the scenario with greatest off-site distance to endpoint

- Typically the single vessel/pipe containing the largest amount of chemical
 - Account for administrative controls that limit inventory and passive mitigation
- May not be the vessel/pipe with the largest amount of chemical if
 - Smaller quantities are present at a higher temperature or pressure
 - Closer to stationary source boundary



Alternative Scenario Selection

- Must reach off-site endpoint, unless no such scenario exists
- Must be more likely than worst-case scenario
- Can consider active mitigation
- Should consider 5-year release history and failure scenarios identified in hazard review



Required OCA Endpoints

- Toxic substances
 - Must use endpoints provided in Appendix A of the rule
- Flammable substances
 - Worst case – 1 pound per square inch (psi) overpressure
 - Possible alternative case scenarios include:
 - 1 psi overpressure for explosions
 - The lower flammability limit (LFL) for flash fires
 - 5 kW/m² for 40 seconds (or equivalent) for pool or jet fires and fireballs



Review and Update

- Reevaluate if the worst-case vessel conditions change
 - If distance to endpoint changes by a factor of 2 or more, update the RMP within 6 months
- Review and update all OCA elements every 5 years
 - Ensure process conditions have not changed
 - Ensure public and environmental receptors have not changed
 - Update population numbers based on most recent Census
- Make sure to document that the review occurred
 - If no changes, at minimum have a signed “memo to file” indicating what information was reviewed



One Possible Way to Conduct Release Scenarios

RMP*Comp

Summary of Scenario

CHEMICAL NAME	CAS #	WEIGHT (lbs)
1-Butene	106-98-9	500000
1-Pentene	109-67-1	500000
2-Butene	107-01-7	500000

Category: Flammable

Estimated Distance to 1 psi overpressure:
..... 9 miles
..... 1.5 kilometers

This is the distance to the overpressure endpoint of 1 pound per square inch specified for this regulated substance under the RMP Rule.

Start Over Tips < Back Next >



Use Mapping Program for Lat/Long

- Examples include Google Earth, Bing Maps, etc.
- Can use these tools to draw circle and visually see if there are houses or other businesses within the circle
- May need to use other information sources to determine if there are applicable environmental receptors



Finding Population

- Use lat/long and radius and put them into a program that uses current Census data
- Example: Missouri Census Data Center

<http://mcdc.missouri.edu/websas/caps10c.html>

2-mile radius of specified point

Subject	Number	Percent
<u>1. Total Population Trends, Etc.</u>		
Universe: Total Population		
Total Population	21,759	
Total Population 2000	22,227	
Change in Population 2000-2010	-468	-2.4



OCA Common Deficiencies

- Wrong latitude/longitude
- Wrong release quantity
- Inconsistencies between release quantity and endpoint distance (e.g., very large release quantity with very short endpoint distance)



OCA Common Deficiencies

- No documentation corresponding to information provided in RMP
- No documentation that information is reviewed every five years
- Worst Case Vessel
 - Rationale for selection not documented
 - Wrong vessel identified



Five Year Accident History

What accidents have happened recently?



Five Year Accident History Criteria

- Occurred within the last five years
- Unanticipated emission of a regulated substance
- From a covered process
- Had specific consequences
 - On-Site: death(s), injuries, significant property damage
 - Off-Site: death(s), injuries, evacuations, shelter in place, property damage, environmental damage



Key Points

- Accidental releases documented in the five-year accident history may be candidates to use as alternate release scenarios
- There are no minimum thresholds for the quantity of chemical released. It only considers the consequences.



Common Deficiencies

- Failure to report releases
 - Especially if people are admitted to the hospital for observation or are treated and released
 - Confusion over reporting trigger – it is not based on quantity released
 - Consequences to public receptors may require a little research; failure to do due diligence does not absolve the requirement to report