Industrial Facility Response Command and Control

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Are You Ready to Handle the Response to this Type of Fire?

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Facts About Fixed Industrial Facilities

- 75% of reported haz mat release occur at fixed sites
- Largest dollar loss fires occur at fixed sites
- 60% of confined space fatalities occur at fixed sites
- Most municipal fire service agencies have minimal info on the fixed sites in their area

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Typical Industrial Facilities

- Refineries or Chemical Processing Plants
- Manufacturing Sites – Steel Mills, Vehicle Assembly, etc.
- Loading Terminals or Bulk Storage Plants
- Storage/Warehouse Sites
- Power Plants

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Facility Risk Analysis

Facility Hazards and Response Planning Characteristics

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Fixed Facility Response vs. Municipal Response

- Many incidents witnessed or discovered by employees
- Pre-plan information available
- Important facility features may be available
- Type of involved chemicals usually easily determined

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Uniqueness of Fixed Sites

- Everything is big
- Complexes are complex
- Hazards never go away
- Industrial terminology
- You can't just shut the plant down
- Livelihoods are at stake
- Everything is regulated

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Industrial Facility Hazards

- High Noise
- Elevations
- Narrow/congested areas
- High pressure systems
- Slippery surfaces
- High voltage electrical
- Many different types of equipment
- Large inventories of multiple products
- Interconnected processes
- Extremely hot equipment/lines
- Heavy construction and maintenance activities

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On-site Response Programs At Industrial Facilities

- No Response - Reliant on Area Municipal Emergency Services
- Limited Response - Usually small number of on-shift responders
- Response Teams - On-shift responders supplemented by call back teams

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Potential Facility Fixed Emergency Response Equipment

- Fire Water System
  - Municipal
  - Facility
- Fixed Extinguishing Systems
  - Dry Chemical
  - Halon
  - Carbon Dioxide
  - Sprinklers
  - Steam
- Alarm Systems
  - Fire / Smoke
  - Gas
  - Facility/Community Alerting
- Deluge/Spray Systems
- Foam Delivery Systems
- Standpipes/Fixed Hose Reels
- Fixed Turret Monitors

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Management of Industrial Facility Responses

General Considerations For Incident Response

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General Considerations For Fixed Facility Response

- Well defined incident command systems
  - Strong command presence
  - Expanded ICS structure
  - Staff key roles
    - Incident Commander
    - Safety Officer
    - Process Liaison
    - Agency Liaison
    - Public Information Officer

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General Considerations For Fixed Facility Response

- Process Liaison Role / Process Tech Specialist
  - Facility representative who is highly familiar with the affected area of the facility
  - Will provide technical expertise from a “process / manufacturing” standpoint
  - Is the interface between emergency response operations and the facility operations
  - Normally work between the incident commander/command post and the facility operators/control center

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General Considerations For Fixed Facility Response

- Liaison Officer / Agency Liaison Role
  - Consider a facility representative who is highly familiar with area regulatory agencies teamed with a municipal responder
  - Will provide link to regulatory agencies as well as municipal agencies
  - Dependent on locale, can be very “politically” motivated operation

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General Considerations For Fixed Facility Response

- Public Information Officer Role
  - Consider a facility representative who is highly familiar with area media teamed with a municipal public information officer
  - Many times industry will request taking the lead on media releases.
  - Depending on the size of the incident, media circuses can develop very quickly.

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General Considerations For Fixed Facility Response

- Other Command Staff Roles
  - Logistics Chief
  - Planning Chief
  - Finance Chief
  - Legal Officer – Industry Driven
  - Business Continuity – Industry Driven
  - Technical Specialists

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Incident Size Up

- Incident size up starts at the receipt of the incident.
- Get a 360 survey done as soon as possible.
  - Consider the 7 sided survey
- Get everyone is involved in incident size up.
  - Responders
  - Facility Personnel
- Size up from both a fire standpoint and a facility / process standpoint.
- Incident size up never ends.

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Size-up Resources

- Witnesses – facility reps are priority
- Pre-plans / Maps / Aerial Photos
- Reference materials / Tactical Worksheets
- Binoculars / Drones
- Security / Process Cameras
- TIC / Infrared Thermometers
- Air Monitors / pH Paper

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Industrial Incident Size-Up Priorities

- Life safety status
- Fire source
- Process control status
- Hazard identification
- Immediate exposures
- Fixed system activation / availability
- Water / foam supplies

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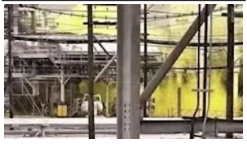
Industrial Incident Size-Up Priorities

- Facility concerns
- Resource availability
- Potential community impact
- Regulatory agency concerns
- Estimated incident length



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Top 10 Questions For Industrial Response Size Up

- What happened? (In common terms)
- Are people injured? How many?
- What is the operational status of the involved equipment?
- What has already been or is being done?
- If chemicals are involved, what information can you give me about the chemicals?

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Top 10 Questions For Industrial Response Size Up

- What are the most concerning hazards?
- What are the biggest exposures?
- How will this incident affect other operations in the facility?
- What assistance can the facility provide to help mitigate the incident?
- From a facility perspective, what is the most urgent issue?

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Define Incident Priorities

- Life Safety
  - Protection and safety of responders including operators
  - Rescue of personnel from affected area
  - Protection of personnel adjacent to the incident
  - Evacuation or shelter-in-place of nearby areas
- Incident Stabilization
  - Isolation of affected process equipment
  - Exposure protection of non-affected equipment
  - Containment of released materials
  - Fire extinguishment
- Property / Environmental Conservation
- Business Restoration

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Accountability Operations

- Response Personnel Accountability
  - Assign site staging officer
  - Account for personnel by work assignment
  - Routinely re-evaluate accountability
- Facility Personnel Accountability
  - Evacuation Sites / Shelter-in-place locations
  - Contract employee and visitors
- Identify any evacuation / shelter-in-place needs
  - Internal to facility
  - External to facility

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Community Impact Considerations

- What can be seen or heard in the community?
- Are detectable chemical levels present?
- Have materials been released into the community?
- Have excessive resources be sent to the plant?
- Can the situation get worse?
- Have informational messages be sent out?
- Is evacuation/shelter-in-place operations required?

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General Considerations For Fixed Facility Response

- Request Technical Resources
  - Safety/IH Personnel
  - Process Personnel
  - Maintenance/Engineering Personnel
- Conduct Appropriate IH Monitoring
  - Hot Zone
  - Fenceline
  - Community
  - Document all monitoring results

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General Considerations For Fixed Facility Response

- Identify and control hazard control zones
- Ensure proper agency contacts are made
- Consider impact to other portions of the facility
- Consider environmental impact
- Consider community impact
- Acquire special resources – specialized responders, foam, etc.

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Response To Industrial Facility Fires

Specific Tactics For Industrial Facility Fires

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Tactical Operations

- Critical tactical operations during initial response
  - Rescue
  - Rapid Intervention
  - Exposure protection
  - Water / foam supply
  - Confinement or containment
  - Extinguishment
  - Overhaul / Salvage
  - Decontamination

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Key Initial Tactical Operation Considerations

- Rescue Operations
  - Accountability of personnel is priority
  - Initial rapid search from perimeter
  - Building search vs. external process area search
  - Possible multiple patients / possible contamination
- Rapid Intervention Operations
  - Can be a forgotten process for this type incident
  - May require multiple teams

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Key Initial Tactical Operation Considerations

- Exposure protection
  - Consider status of process equipment on exposure protection needs – tank levels / flow through pipe
  - 5/10/15 Minute Rule
    - Electrical / control system impact
    - Pressure vessels impact – potential BLEVE
    - Structural steel impact

  - "Capture" of fire source provides exposure protection
  - Consider high volume streams

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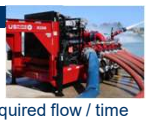
Key Initial Tactical Operation Considerations



- Water / Foam Supply
  - Water Supply
    - Define potential water supply needs – required flow / time
    - Available pressurized water – facility vs. municipal
    - Available static water supply – distance / accessibility
    - Available equipment – apparatus / portable pumps / LDH
  - Foam Supply
    - Define foam supply needs – process unit vs. storage tanks
    - Available supply – facility / mutual aid / distributor
    - Proportioning capabilities – apparatus / high volume

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Key Initial Tactical Operation Considerations

- Confinement / Containment Operations
  - Remote isolation is preferred - Plot edge valve manifolds vs. entering the hot zone
  - Eliminate source of pressure – pumps / compressors
  - Clearly define all potential release sources
  - Use facility expertise when/if possible
  - Limit time and people in the hot zone it entry is needed
  - Over isolation is typically preferred
  - Maintaining contaminated water/foam runoff on-site is a priority
  - Define impact from released materials

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Key Initial Tactical Operation Considerations

- Extinguishment
  - Use high volume water/foam streams to take the heat out of the fire to determine source of fire(s).
  - “Capture” pressure fed and running fuel fires
  - Don’t fight fair – initiate high-volume streams to overcome BTUs and loss to thermal updraft
  - If using foam, ensure sufficient foam is on-scene prior to starting extinguishment
  - Consider specialty extinguishment – dry chemical, inerting, water injection, capture with burnout

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Key Initial Tactical Operation Considerations

- Overhaul / Salvage
  - Overhaul will typically be continued water flow until all materials / equipment are completely cool
  - Facility representatives will typically define salvage priorities
- Decontamination
  - Process area fire are haz mat incidents
  - Decon everything – personnel, PPE, apparatus, equipment
  - Don’t take contaminated materials off-site

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Industrial Facility Fire Considerations

- Limit personnel required to enter the hot zone
- Always know who is working in the hot zone – process operations and responders
- Special fire considerations
  - Storage Tanks
  - Pressure Vessels - BLEVEs
  - Electrical System – High Voltage / Battery / Solar
  - Structures – haz mat fires in a box

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Industrial Facility Haz Mat Response

Industrial Strength Problems

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Typical Industrial Haz Mat Situations

- Piping Leaks - flanges, weak links, welds
- Valve Leaks - packing, housing, cover, bleeder valves, leak throughs
- Storage Vessels - ruptures, welds, floating roof sinks
- Pumps - casing, packing
- Vessels - rupture, manway, nozzle, channel heads
- Special Situations - PRV release, overfills
- Transportation Related – tank truck, tank car, pipeline system

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Haz Mat Management

- Site management and control
- Identify the problem
- Hazard and risk evaluation
- Select PPE and equipment
- Information management and resource coordination
- Implement response objectives
- Decontamination
- Termination

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Industrial Haz Mat Considerations

- Large quantities
- May be difficult finding the leak
- Difficult getting to the leak
  - Elevated locations
  - Congested areas
- Unfamiliar equipment
- Mixed chemicals
- Facilities may work to your advantage
- On-site experts may be available
- Industry may not see it as emergency
- Regulatory pressure

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Industrial Haz Mat Considerations

- Haz mat problems within buildings
  - Ventilation
  - Difficult to access
- Lab or Research facilities will pose special problems
- Large scale evacuations
- Patching/Plugging Problems
  - High pressure
  - Extreme temperature
  - Special metallurgy
  - Clamps may have to hold till unit can be shutdown
  - Special equipment requirements

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Industrial Haz Mat Considerations

- Possibility of all types of transportation related emergencies
  - Tank truck
  - Tank Car
  - Intermodal
  - Barrels
  - Totes
  - Pipeline
- Response phase vs. Clean up phase
- Extremely manpower intensive
- Haz mat waste storage facilities may be present

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Industrial Haz Mat Considerations

- Marine spill response operations are extremely resource intensive
  - Specialized equipment
  - Large geographic areas can be affected
  - Highly regulated responses
- Possible contamination of sewer systems and ground water has to be considered
- Consider long term effects of haz mat incidents

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Industrial Facility EMS/Rescue

More than your routine sick call

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Typical Petro-Chemical EMS/Rescue Responses

- Routine EMS
- High Angle Rescue
- Confined Space
- Trench Rescue
- Collapse Rescue
- Machinery Rescue
- Haz Mat Exposure

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Industrial EMS

- Common patients in uncommon surroundings
- Don't be lulled to sleep
- Beware of surroundings
- Move patients from field ASAP
- Back to basics
- ALS has its place and time

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Industrial Rescue Operations

- High Angle
  - Fall protection rescue
  - Equipment
  - Use of cranes
- Confined Space
  - Who is the rescue team?
  - Haz Mat in a hole
  - Rescue vs. recovery
- Trench
  - Shoring systems
  - Haz mat potential
- Collapse
  - Why did it collapse
  - Shoring sytems
- Machinery
  - LOTO
  - Technical expertise

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Special Considerations for Industrial Facility Response

Other Issues to Consider

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Facility Security

- How accessible is the facility?
- What type of security systems are present?
- Are there special identification requirements for responders?
- What special security requirements will be instituted during a facility emergency?
- Who is responsible for security operations?

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Evacuation and Shelter-in-Place Operations

- What is the potential for evacuation or shelter-in-place operations based on facility operations?
- Who will make the decision to evacuate or shelter-in-place?
- How will evacuation or shelter-in-place requests be communicated?
- Where will personnel be evacuated to?

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Emergency Incident Communications

- What radio frequencies will be used during emergency incidents – facility radios or agency radios?
- Are radio frequency uses pre-defined?
- Can all facility phones be used to dial the outside world?
- Are plans in place if the primary communication systems fail?

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Termination Activities

- Making the scene safe
- Turning over control of the scene
- Incident investigation – who is in charge
- On-site debriefing
- Formal post incident analysis / critique
- After action report
- Financial reimbursement issues

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Common Industrial Facility Tactical Errors

- Using habits developed during routine municipal fire department operations
- Failure to clearly define source of the fire / leak(s) and capture/control them promptly
- Failure to use big flows for big fires soon enough
- Failure to establish high volume water and foam supply operations
- Failure to call for assistance soon enough
- Failure to maintain personnel accountability and deployment location

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Common Industrial Incident Tactivcal Errors

- Failure to obtain technical/facility support and process firefighting expertise
- Failure to prioritize objectives – Think RECEO
- Failure to consider and address cascading facility impact
- Failure consider haz mat impacts
- Failure to consider and address community impacts
- Failure to start planning to support longer term operations

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Special Considerations for Successful Operations

- Developing strong facility / response agency working relationship
- Pre-planning
- Learning from other incidents
- Obtaining necessary resources to “go to work” on facility response incidents

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Lessons Learned from Industrial Incident Response

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Double Tank Fire Incident

A process line up error fills two heavy oil cone roof tanks with naphtha grade materials. The tank heat system rapidly heats the naphtha and fills the tanks with vapors. Pyrophoric materials on the interior roof of one tank causes ignition and blows the roof off of the tank. The resulting explosion lights the vapors being emitted from the second tank to ignite and blows the roof off the second tank onto a public roadway.

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Lessons Learned

- Incident size up
- Storage tank triage – extinguishment priority
- Foam application around and under obstacles
- Cold weather firefighting operations
- Community impact

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Exothermic Spent Sulfuric Acid Reaction in Multiple Railcars

Multiple railcars (11) located on railroad siding between three different industrial facilities begin an exothermic reaction which emits high levels of sulfur dioxide. Reactions continue for over 10 days. Large-scale response of municipal and industry resources activated to manage the incident. Over 75 haz mat entry operations conducted during the response.

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Lesson Learned

- Long term unified command operations
- Air monitoring operations
- UAV/Drone operations
- High volume water supply operations
- Technical specialists
- Historical experience

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Crane Failure Into Operating Process Area

While lifting a new reactor into place on the edge of an operating process unit, the boom on the crane fails and causes the crane to drop the reactor onto a live pipe rack. The incident kills one worker and severely injures the crane operator. Multiple process leaks and a small fire occurs in the damaged pipe rack area.

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Lessons Learned

- Pre-planning critical crane lifts
- Defining and managing multiple incident priorities
- Importance of process liaison / technical specialists
- Process operations support and emergency training

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Major Process Unit Fire

A 16” bottom outlet flange on a 175’ distillation column fails and the resulting release immediately ignites. The heat from the initial fire causes several other flanges in an adjacent pipe rack to fail and cause additional fires. The large fire burns for over 15 hours.

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Lessons Learned

- Ability to identify source of fires
- Importance of ability to use high volume water streams to capture and control source fires
- High volume water supply operations
- Control of running fuel fires
- Long term firefighting operations

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Straight Line Wind Facility Impact

A straight line wind incident damages 5 of the 6 incoming power lines to a large refinery. The damage shuts down the operations of the entire facility. The incident causes several small fires, a small chlorine release, a propane release and structural damage to 4 large cooling water towers. Heavy flaring occurs for 5 days. The entire facility is shut down for over 3 weeks due to the damage.

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Lessons Learned

- Importance of the ability to conduct facility triage after a major natural disaster
- Ability to manage multiple incidents
- Ability to obtain resources to manage incident operations for long term operations
- Importance of community relations.

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Industrial MCI Incident

During a facility maintenance turnaround, the facility response is dispatched to an EMS response for a person with difficulty breathing. Initial responders arrive on scene to find 11 contractors complaining of difficulty breathing. During the investigation to find the source, a dust explosion cause a fire in a process vessel and a vacuum truck.

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Lessons Learned

- Ability to manage a multiple injury incident
- Multiple hospital interface
- Firefighting a dust fire type incident
- Importance of air monitoring during all incidents

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Questions?

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