

A vertical strip of seven small images on the left side of the slide, depicting various space-related scenes: a space shuttle on the launch pad, a rocket launch with a large plume of fire, a view of the Earth from space, a close-up of a spacecraft component, a view of a spacecraft in space, a view of a spacecraft's interior, and a view of a spacecraft's exterior.

# Triple Threat: Industrial Chemical Releases

## Leadership ViTS Meeting

June 2009

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*Deputy Chief, Safety and Mission Assurance*

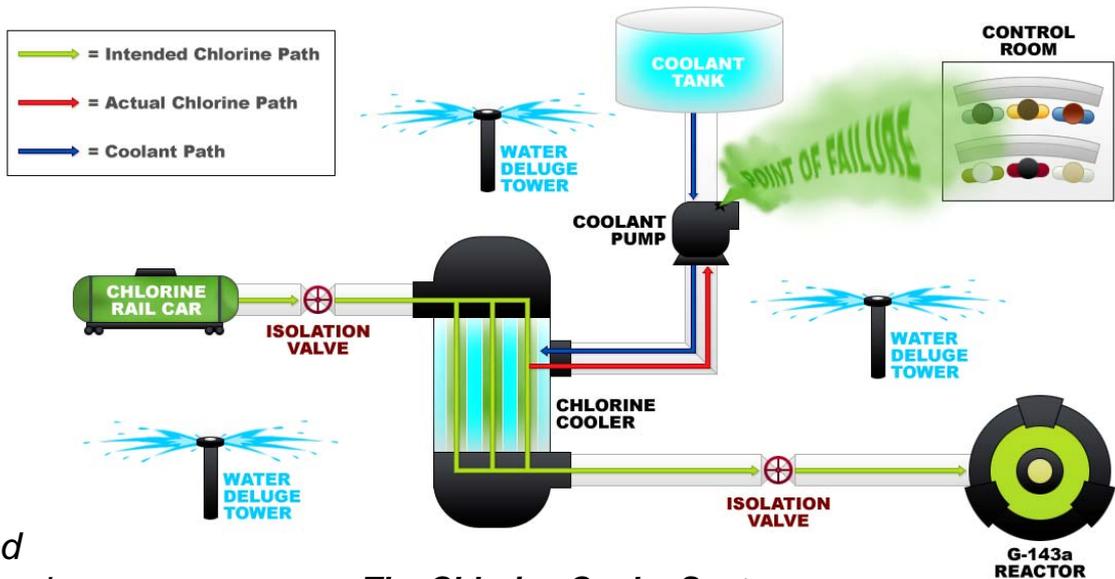
# THE MISHAPS

During the summer of 2003, the Honeywell International, Inc. plant in Baton Rouge, Louisiana experienced three safety incidents. The incidents injured 8, killed 1, and exposed the surrounding community to toxic chemicals. A Chemical Safety Board investigation of all three incidents found common underlying issues.

## First Incident: July 20th Chlorine Release

*Chlorine escaped through holes in the cooler tubes, disabled the coolant pump and sprayed into the atmosphere. The gas entered the control room through unplugged holes and joint gaps in the HVAC system.*

*Operators were overwhelmed by the chlorine and evacuated without shutting down the cooling system. Honeywell shut down the plant and notified authorities who issued a "shelter-in-place" advisory for the surrounding community. Meanwhile, the chlorine corroded the control system that would have shut the cooling process down. An emergency response team stopped the leak 3 ½ hours after it began by manually closing the rail car isolation valve.*



**The Chlorine Cooler System**

# THE MISHAPS (cont.)

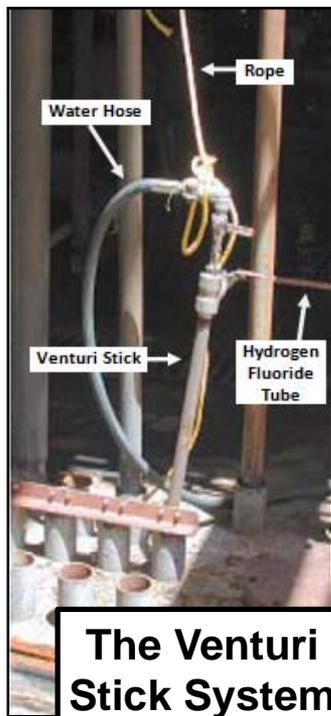
## Second Incident: July 29th Antimony Pentachloride Release

*A vendor sent a one-ton cylinder of contaminated\* antimony pentachloride (CAP) mislabeled as R-22 refrigerant to the Baton Rouge plant. A worker in the refrigerant cylinder recycling area tried to vent the cylinder. The contents spewed out and engulfed the worker in a cloud of CAP. Employees sounded the plant alarm, helped the worker to an emergency shower and transported him to the hospital where he died the next day.*



**One-Ton  
Cylinders**

## Third Incident: August 13<sup>th</sup> Hydrogen Fluoride Release



**The Venturi  
Stick System**

*After the July 20<sup>th</sup> emergency shutdown, liquid remained in a hydrogen fluoride vaporizer. The operations department used a Venturi stick system to suck the liquid into a sewer. The Venturi stick was secured with a rope and used a flow of water to create a vacuum. Once the system was in place, operators removed their acid suits and respiratory protection.*

*The next day, an operator noticed a block in the system and opened and closed some valves, creating a pressure surge that lifted the Venturi stick and sprayed the worker. The worker went to the emergency shower. The worker and a supervisor were transported to the hospital, but had no major complications.*

*\* Antimony pentachloride is a catalyst for the reaction that creates refrigerant. The reaction contaminates the antimony pentachloride which Honeywell sends offsite for cleaning before it can be reused.*



# PROXIMATE CAUSES

- **First incident:** Holes in the chlorine cooler leaked chlorine into the coolant system.
  - **Second incident:** A worker opened a mislabeled cylinder of contaminated antimony pentachloride.
  - **Third incident:** Inadvertent hydrogen fluoride discharge into the atmosphere.
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# UNDERLYING ISSUES



## Incomplete Hazard Analysis

- **First incident:** Unforeseen but not impossible consequences of chlorine entering the coolant system.
  - **Second incident:** No hazard analysis for the refrigerant cylinder recycling process. The possibility that non-refrigerant cylinders could enter the area was not addressed.
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## Inability to Recognize Non-Routine Situations

- **First incident:** Previous chlorine vapors in the control room were not fully investigated because operators did not recognize them as non-routine.
  - **Second incident:** Employees in the refrigerant cylinder recycling area were not trained to identify suspect or questionable cylinders.
  - **Third incident:** Operators did not consider the use of a Venturi stick with a hazardous chemical, hydrogen fluoride, as non-routine.
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## Disregard for Written Operating Procedures

- **Second incident:** Despite official regulations to the contrary, workers in the refrigerant cylinder recycling area regularly vented R-22 refrigerant.
  - **Third incident:** The Venturi stick operator removed some PPE once the system was set up despite a company-mandated PPE requirement for workers to continue to wear PPE throughout the process.
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## Hazard Analysis

- Conduct hazard analyses that identify system failure scenarios and provide strong, timely engineering defenses (barriers and controls).
- Encourage a 'reporting culture' that rewards and responds to timely hazard identification throughout a system lifecycle. Update hazard analysis as the system changes.

## Normalization of Deviance: off-nominal conditions accepted as normal

- Understand the rationale behind applicable procedures; question deviations and involve those exposed to risk in the discussion.
- Train workers to recognize and respond appropriately to non-routine situations.

## Written Operating Procedures

- Review written requirements or operating procedures often to ensure that actual practice conforms to recommendations.
- If employees are working around procedures instead of following them, find out why and correct the situation.