



# U. S. Nuclear Regulatory Commission

Augmented Inspection Team

Inspection of Honeywell Uranium  
Hexafluoride (UF<sub>6</sub>) Release

December 22, 2003

D-11



# U.S. Nuclear Regulatory Commission

- NRC's primary mission is to protect public health and safety, and the environment from the effects of radiation from nuclear reactors, materials, and waste facilities
- This is accomplished through licensing, inspection and enforcement of requirements
- Headquarters in Rockville, Maryland
- Four regional offices



## U.S. Nuclear Regulatory Commission

- Honeywell International, Inc. holds NRC License No. SUB-526
- The primary authorized activity is the chemical conversion of uranium ore concentrates into uranium hexafluoride ( $\text{UF}_6$ )



# U.S. Nuclear Regulatory Commission

- $\text{UF}_6$  is used to make the uranium fuel pellets contained in nuclear reactor fuel rods
- When  $\text{UF}_6$  is released to the atmosphere, it forms uranyl fluoride and hydrofluoric acid
- The hydrofluoric acid presents the greatest hazard



# U.S. Nuclear Regulatory Commission

- On December 22, 2003,  $\text{UF}_6$  was released from the Honeywell Plant in Metropolis, IL and went beyond the site boundary
- The NRC established an Augmented Inspection Team (AIT) to inspect and assess the release



# U.S. Nuclear Regulatory Commission

- AIT Inspection Objectives
  - determine facts surrounding event
  - assess the licensee's response to event
  - assess the licensee's activities during their event review and recovery
  - identify root causes
  - assess the public health and safety impact



# U.S. Nuclear Regulatory Commission

- AIT Team Members
  - Jay Henson, Chief, Fuel Facility Inspection Br 2
  - David Hartland, Senior Fuel Facility Inspector, RII
  - Merritt Baker, Senior Fuel Facility Inspector, NRC Headquarters
  - Manuel Crespo, Fuel Facility Inspector, RII
  - Richard Gibson, Health Physicist, RII



## U.S. Nuclear Regulatory Commission Event Description

- 11:00 pm 12/21 Begin effort to bring two of three fluorinator trains on line
- Two fluorinator trains (A & C) to be brought on line were on hot stand-by; purging with 90 psi nitrogen gas
- Reconfiguration of some fluorine pipes required that the dust collector valves be closed and the system valves opened on all three trains; this activity performed by Assistant Fluorine Operator (AFO)





# U.S. Nuclear Regulatory Commission

## Event Description

- Reconfiguration of piping associated with pumps that provide the negative pressure to entire system also required after fluorine pipes reconfigured
- This reconfiguration of piping required that the AFO first open the dust collector valves and close the system valves; the AFO did not perform this step



## U.S. Nuclear Regulatory Commission Event Description

- The AFO proceeded with the reconfiguration of the downstream pipes which isolated a section of process equipment and piping from the fluorinators to  $\text{UF}_6$  storage tanks called cold traps
- This isolated section began to pressurize from the 90 psi nitrogen gas and from 70 psi of  $\text{UF}_6$  entering from the recycling boilers



## U.S. Nuclear Regulatory Commission Event Description

- The isolated section began pressurizing around 12:50 am on 12/22/03
- At 2:15 am, a foreman noticed evidence of a leak in the Feed Materials Building
- 90 psi purging gas turned off
- Radiological Contingency Plan initiated
- At 2:28 am, the first response team opened the dust collector valves and closed system valves



## U.S. Nuclear Regulatory Commission Event Description

- The initial UF<sub>6</sub> leak was from the C-minus control valve
- The release to the environment occurred when the dust collector valves were opened and the UF<sub>6</sub> under pressure in the system exited through the dust collectors and out a horizontal exhaust stack on the southwest side of the Feed Materials Building (86 ft above ground level)

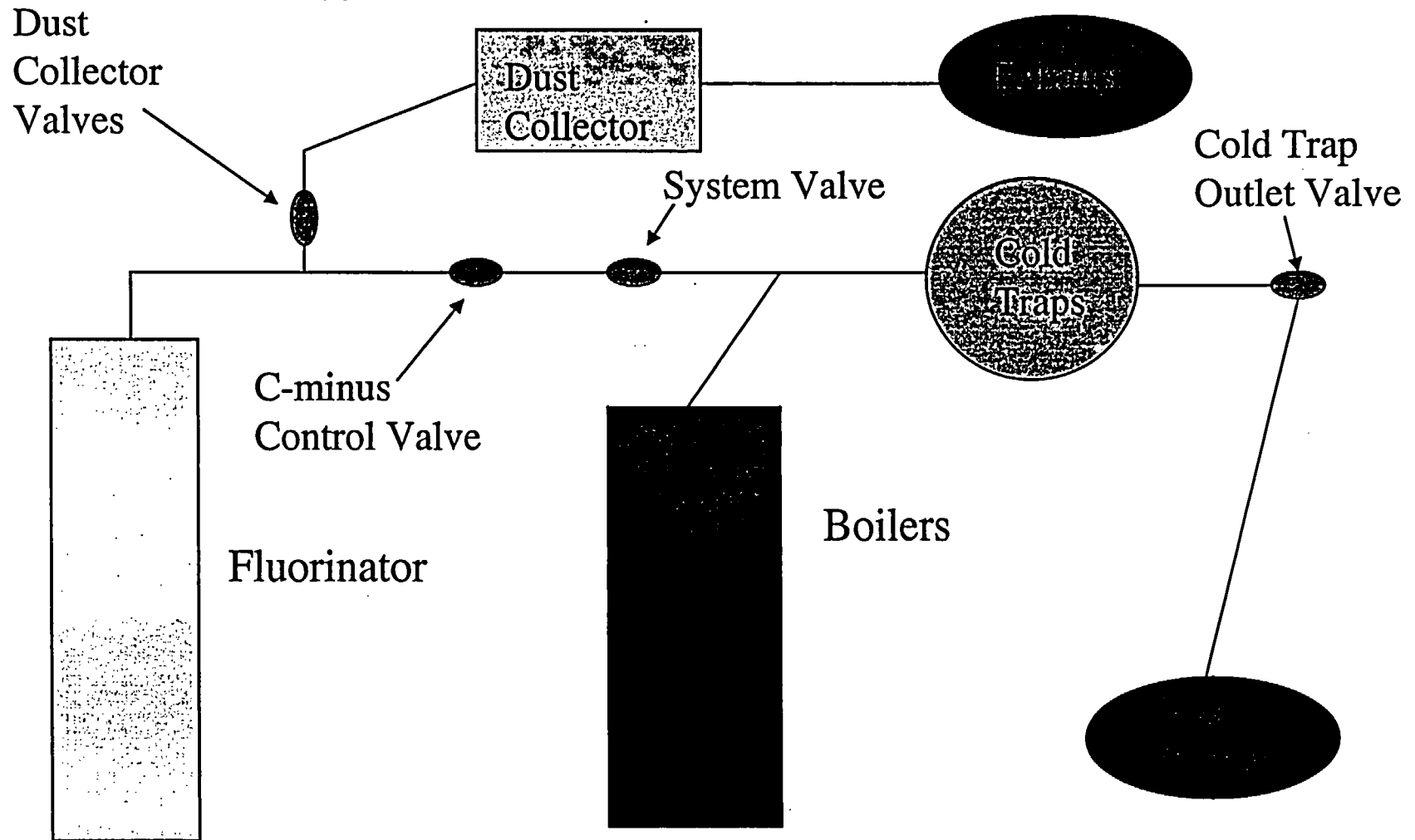


# U.S. Nuclear Regulatory Commission

## Event Description

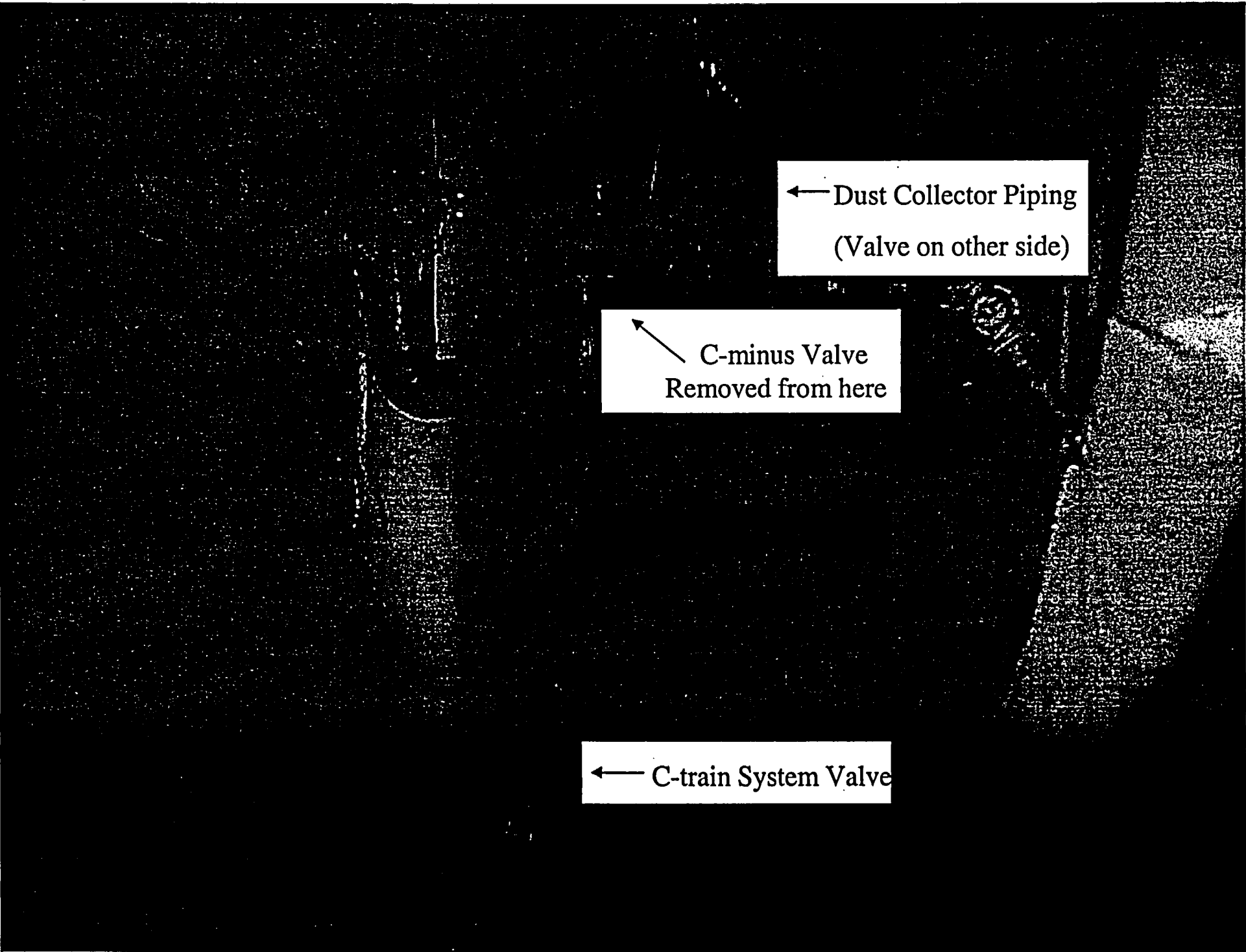
- At 2:34 am, Honeywell security called 911 and informed the Sheriff's office of the release and notified them to evacuate the public around the facility
- At 2:40 am, a response team tried to restart the Nash pump system but due to the failure of a component, it was not started until 3:15 am
- At 4:05 am, Honeywell staff confirmed the release had ended and the all clear was announced at 4:15 am

# Simplified Process Drawing





C-minus control valve that  
began to leak  $\text{UF}_6$



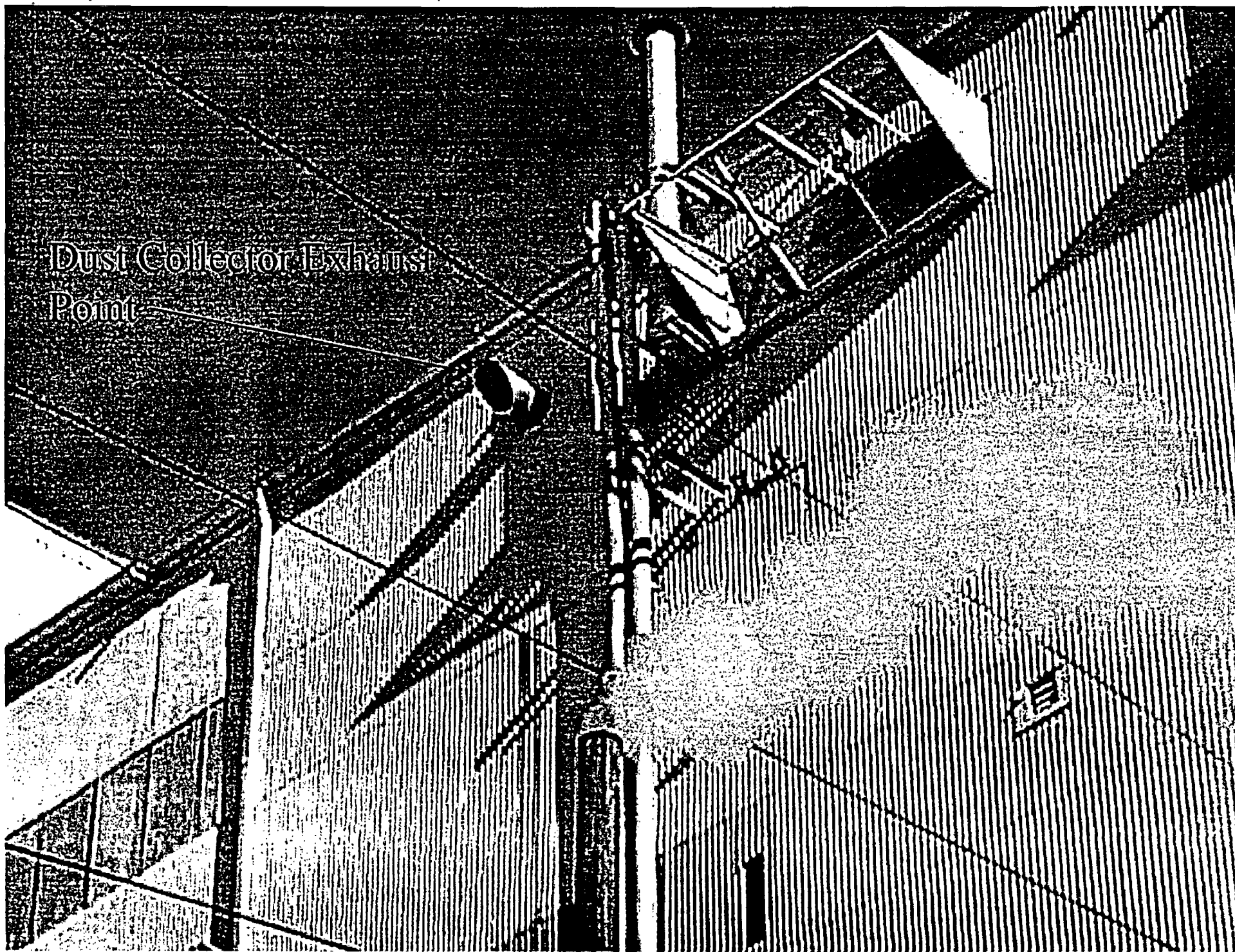
← Dust Collector Piping  
(Valve on other side)

↙ C-minus Valve  
Removed from here

← C-train System Valve



Dust Collector Exhaust  
Point





# U.S. Nuclear Regulatory Commission Event Response

- Licensee initial response actions were in accordance with emergency response plan
- Declaration of Site Area Emergency done in timely fashion
- Room for some improvement in some emergency response positions and implementation



## U.S. Nuclear Regulatory Commission Root Causes/Contributing Factors

- The AFO did not place the dust collector valves and the system valves in the correct positions
- The AFO had no procedure or checklist that designated the proper valve positions for the reconfiguration
- No management oversight/review to ensure valves were in correct positions
- Reconfiguration from one to two fluorinator lines performed infrequently
- AFO was working a double shift



# U.S. Nuclear Regulatory Commission

## Root Causes/Contributing Factors

- The system pressure indicators do not have a visible or audible alarm to indicate when system pressure is approaching positive
- The boiler/distillation operator was not informed that the negative pressure system would be taken off line during the shift
- The failure of a pump/motor coupling which was needed to start the Nash pumps contributed to the duration of the release



## U.S. Nuclear Regulatory Commission Public Health and Safety Impacts

- Licensee and State of Illinois air samples indicated that levels of uranium offsite were up to 100 times normal but at or below NRC regulatory annual average effluent concentration limits
- Urine bioassays taken from five members of the public indicate that levels for four individuals below minimum detectable activity (MDA) and level for one individual up to two times the MDA and therefore well below public dose limits



## U.S. Nuclear Regulatory Commission Public Health and Safety Impacts

- Four members of the public reported to hospital
- Three were examined and released
- One individual showed some symptoms of exposure to low levels of hydrofluoric acid, received precautionary treatment for skin reddening and potential lung exposure, and was released after 24 hours



## U.S. Nuclear Regulatory Commission Public Health and Safety Impacts

- The licensee has estimated that approximately 7 pounds of  $\text{UF}_6$  was released
- Based upon this preliminary information, it appears that the release had minimal impact on worker or public health and safety