

**USNRC/PPL Susquehanna, LLC
Regulatory Conference:
Potential White Finding Regarding
Radioactive Particles**

USNRC Region I Offices

King of Prussia, PA

March 1, 2001

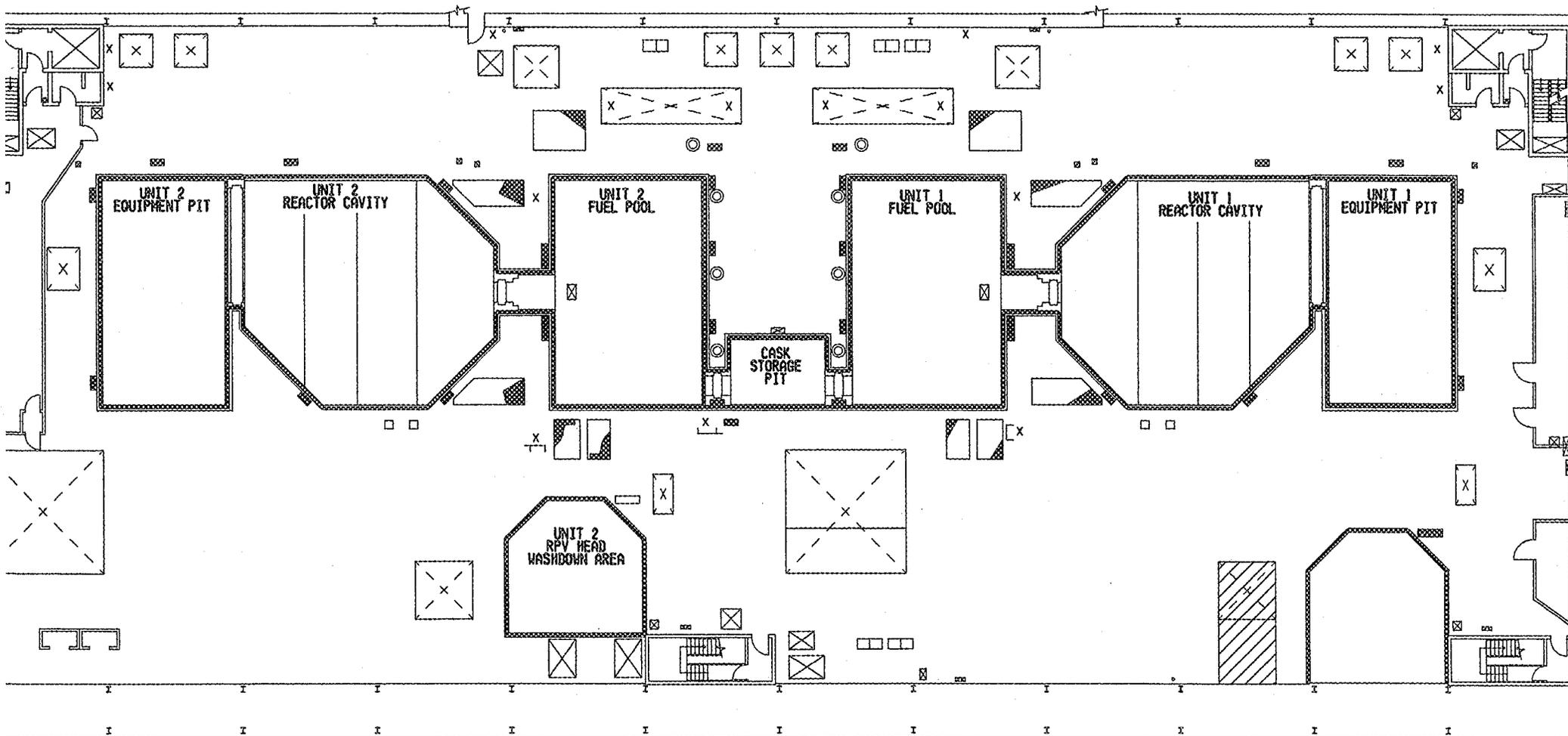


Agenda

- Introduction Bryce Shriver
- Background Duane Karchner
- Radiological Controls Myra McCarthy
- Root Causes &
Corrective Actions Rich Anderson
- Conclusion Bryce Shriver

Overview of 2000 Fuel Pool Cleanout Project

- Overview of SSES Refueling Floor
- Principal Locations of Project Work
- Cleanout of Unit 1 and 2 Fuel Pools



FLOOR PLAN - ELEV. 818'-1"

Fuel Pool Cleanout Project Scope

1991

- 98 CR BLADES
- 72 LPRM STRINGS
- 4 IRM STRINGS
- 9 TIPS/ 4 EX-CORE
- 100 FILTERS

2000

- 136 CR BLADES
- 75 LPRM STRINGS
- 10 IRM STRINGS
- 5 TIPS
- 84 FILTERS

2000: ~40% Scope Increase

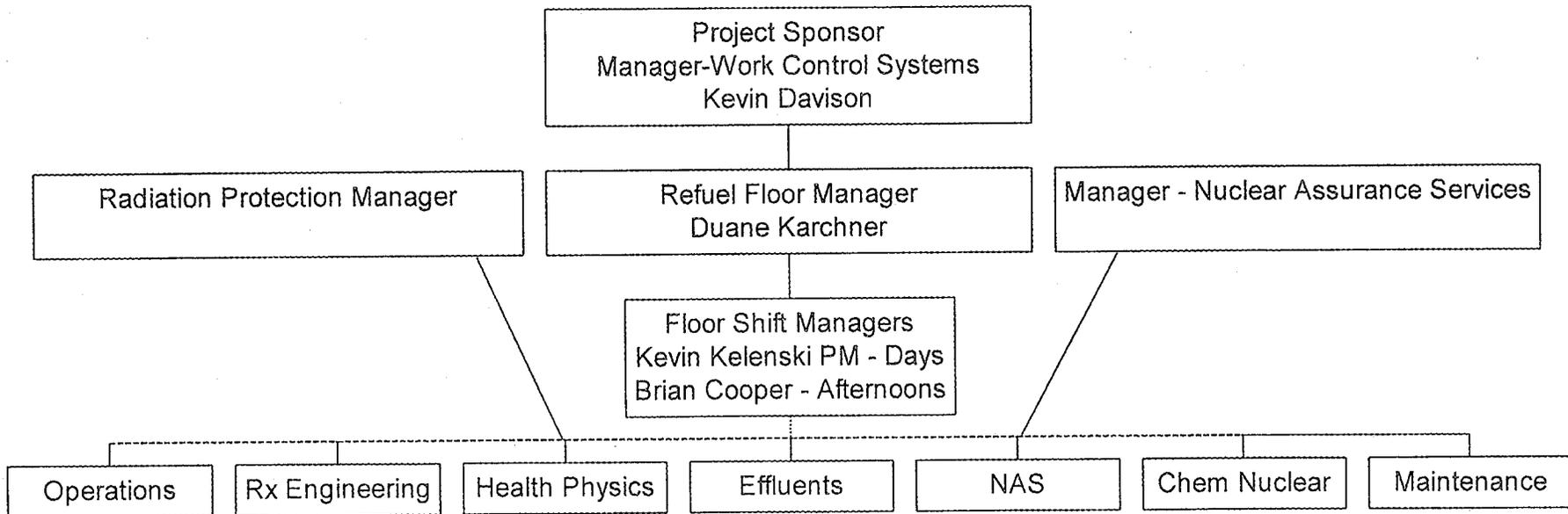
Lessons Learned From 1991

- Use of remote cameras
- Remote dose monitoring
- Use of shield walls for crane operator
- Cask pit gates open
- ALARA Results
 - 1991: 23.2 person-rem
 - 2000: 14 person-rem

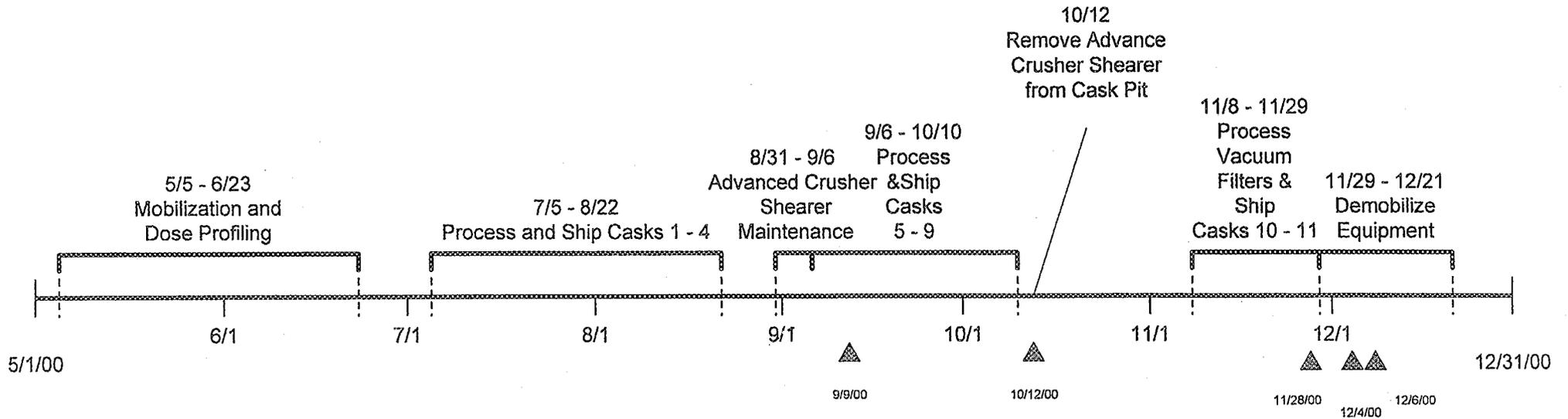
2000 Project Planning

- Detailed project planning began in March 2000
- 2000 Project Plan included lessons learned
- Project plan and procedures were reviewed for personnel and radiation safety issues by:
 - Station ALARA Committee
 - Plant Operations Review Committee
 - Project kick-off meetings

Fuel Pool Cleanout Project 2000



2000 FUEL POOL CLEANOUT PROJECT TIMELINE



▲ Significant particle (as identified in NRC report)

Radiological Controls on Refuel Floor

- Initial Controls
- Timeline of Events
- Assessment of Significance

Initial Radiological Controls

- Based on internal experience and industry guidelines
 - Job specific Radiation Work Permits (RWPs)
 - Constant Health Physics coverage when withdrawing items from the water
 - Rinse of items pulled from water
 - Establish radioactive particle control zones
 - Monitor workers for radioactive particles every 4 hours and when exiting control zone
 - Survey equipment for radioactive particles when exiting control zone

Timeline of Events

- 6/12 - Project begins
- 9/09 - Radioactive particle detected on worker's forearm when exiting refuel floor
 - 12 Rem SDE
 - Protective Actions
 - Revised RWP to require immediate frisks of personnel after removing equipment from the pool
 - Required hoods and plastic aprons when handling equipment that had been in pool

Timeline of Events

- 10/12 - Identified a highly radioactive particle during movement of crusher-shearer.
- Immediate Response:
 - STOP WORK** - evacuated local area and refueling floor
 - shielded particle
 - treated entire refuel floor as radioactive particle control zone and high radiation area
- Subsequent Actions
 - initiated root cause event review team
 - assembled recovery team
 - additional surveys
 - determined particle dose rate of 800 Rem/hour

Timeline of Events

- Corrective Actions from Root Cause Analysis
 - RWPs revised to require enhanced radioactive particle controls
 - Initiated radioactive particle tracking process
 - Enhanced management oversight
 - More detailed evolution planning
- 11/28 - 220 Rem/hour particle found on cask on refuel floor (no dose)
- 12/04 - 200 Rem/hour particle found in crusher-shearer tent (no dose)

Timeline of Events

- 12/6 - Radioactive particle found on worker's protective shoe cover during radioactive particle frisk
 - 17 Rem SDE
- Protective Actions
 - STOP WORK** : Terminated all high-risk evolutions
 - Initiated comprehensive re-evaluation of events
 - Conducted benchmarking phone survey
 - INPO assist visit
 - Remote imaging of refuel floor
 - Communicated to workers

Significance of Events

- Actual: No regulatory limits were exceeded.
 - 9/9/00 - 12 Rem SDE
 - 12/6/00 - 17 Rem SDE
- Potential: Highly radioactive particles identified during the 2000 fuel pool cleanout project could have resulted in significant doses.

Root Causes

- Lack of sensitivity by radiological protection and station management to radiation risks posed by radioactive particles
- Radiological controls did not adequately mitigate the risks associated with radioactive particles
 - in the pool
 - on the refueling floor
- Insufficient management and independent oversight of high risk project evolutions

Station Sensitivity to Radioactive Particle Risk

- Contributing factors:
 - Treatment of events as accepted occurrences
 - General perception that controls were adequate
 - Industry documentation that characterizes these events as skin dose concerns
 - Station focus on dose and dose limits rather than near misses or adverse trends
 - Inconsistent tracking of radioactive particle events

Effectiveness of Controls

- Contributing factors:
 - Inadequate review of peer experience
 - Unfamiliarity with geometry of equipment
 - In-pool and refuel floor particle control efforts were not state-of-the-art
 - RWPs did not provide strict requirements for particle control
 - No project-specific goal for particles
 - Perception that more strict controls could result in unproductive dose

Management and Independent Oversight

- Contributing factors
 - No regularly scheduled update meetings with senior management
 - Daily management meetings did not consistently report on the project
 - Reports to management focused on successes rather than challenges
 - Minimal management presence on refuel floor
 - Missed opportunities for use of independent oversight

Corrective Actions

- Established a defense-in-depth approach to control of radioactive particles
 - Enhanced site sensitivity to radiation risks
 - Established better control of particles at source
 - Implemented enhanced radiological monitoring
 - Improved management oversight of high risk evolutions
 - Improvements to independent oversight

Corrective Actions

- Enhanced sensitivity to radioactive particle issues
 - Developed communication plan
 - Revised procedures to highlight potential risk
 - Better use of corrective action program
 - Engage industry in evaluation of risk
 - Incorporate lessons learned into Training

Corrective Actions

- Established better control of particles at the source
 - Use of operating experience/benchmarking/self-assessment
 - Identification of potentially affected systems
 - Developed a particle pre-job checklist
 - Evaluate other sources of Co-60
 - Chemical decon of fuel pool cooling systems
 - Evaluating equipment wash-down/vacuuming techniques

Corrective Actions

- Implemented enhanced radiological monitoring
 - Evaluated health physics survey techniques
 - More frequent cleaning of refueling floor
 - Initiated use of remote survey tools
 - Evaluate use of telemetry and area radiation monitors

Corrective Actions

- Improved management oversight of high risk evolutions
 - Improving work standards for radiation area work
 - Incorporation of radiation protection considerations into work plans
 - Increase management presence in the plant
 - Radiation protection management
 - Two refuel floor supervisor positions created

Corrective Actions

- Improvements to independent oversight
 - Revise nuclear assurance oversight activities to specifically include radioactive particle controls
 - Improve line organization response to findings and recommendations

Summary of Present Status

- Station sensitivity to risks posed by radioactive particles has increased
- Radiological controls have been enhanced and reflect SSES and industry experience
- Radiological management has been improved - further changes are ongoing

Conclusion

- Worker safety is our priority
- Actual events did not result in dose in excess of regulatory limits
- We recognize our controls were inadequate
- Station Response has been broad and comprehensive