

DC Cook Baffle Bolt Inspection and Repair

Follow Written Instructions



Support Your Peers



Recognize and Mitigate Risks



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Preparations

- Special thanks to the RP staff at Indian Point and Salem for allowing us to benchmark and learn from them



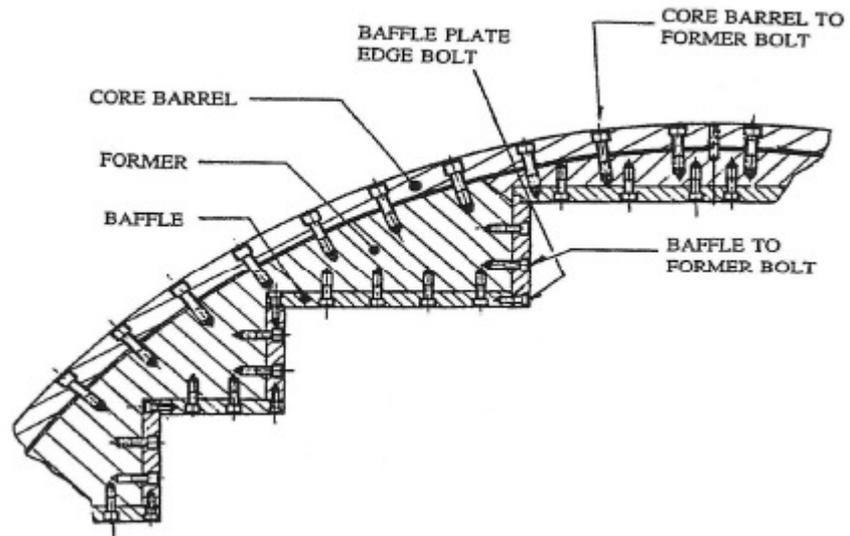


Scope of Issue

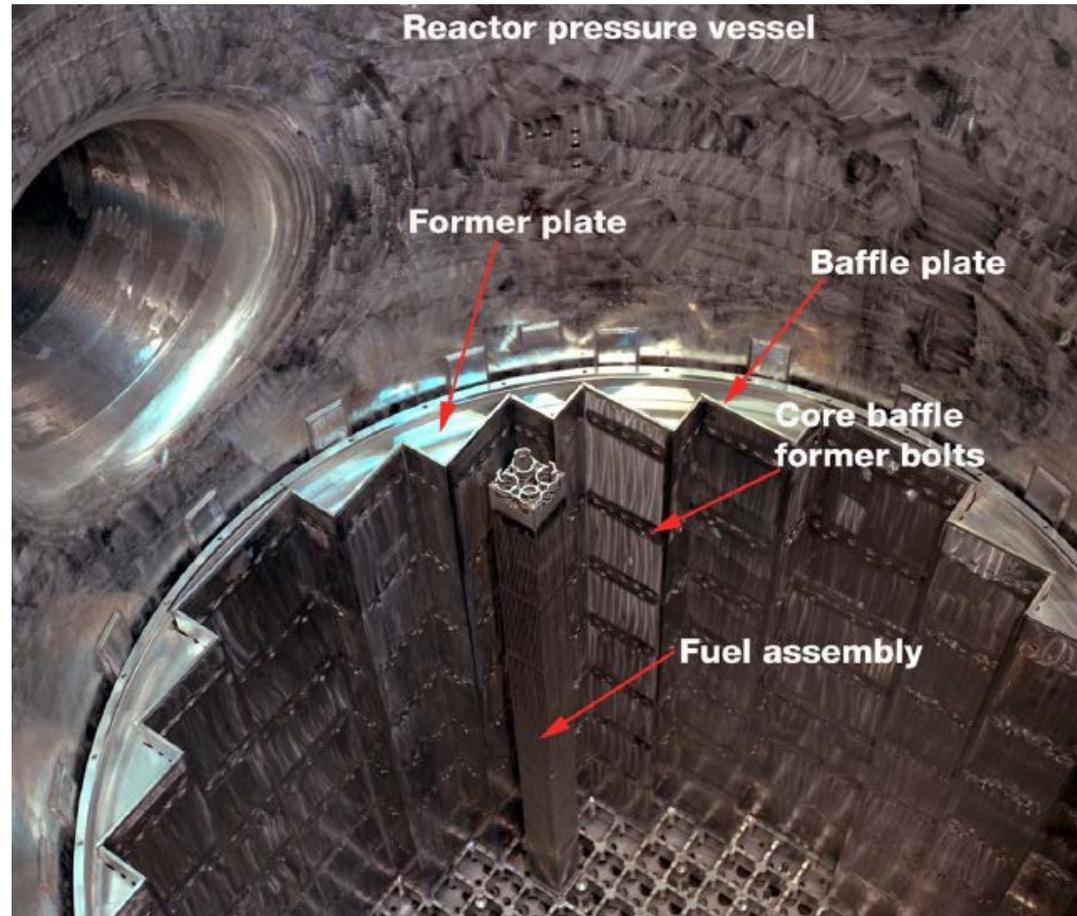
- Baffle bolt degradation was found at the Indian Point and Salem Plants in March and April 2016
- Industry response guidance, endorsed by the NRC, has been issued
- Both units of Cook, along with both units of Indian Point, both units of Salem, and one unit of Diablo Canyon fall into the most urgent category of response
- Cook's current strategy is to replace at least 200 bolts during each of the next two refueling outages on each unit



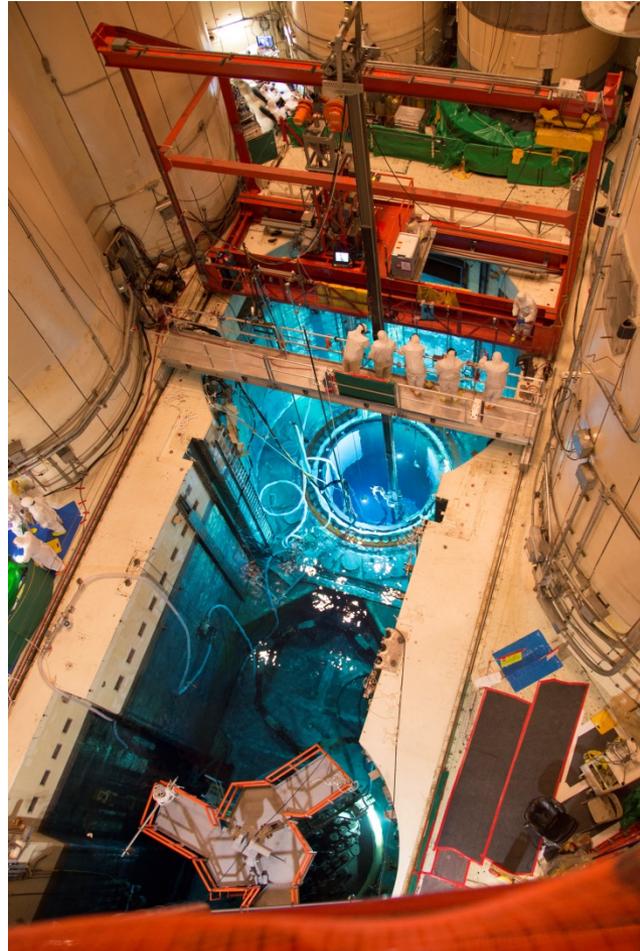
So, What's a Baffle Bolt?



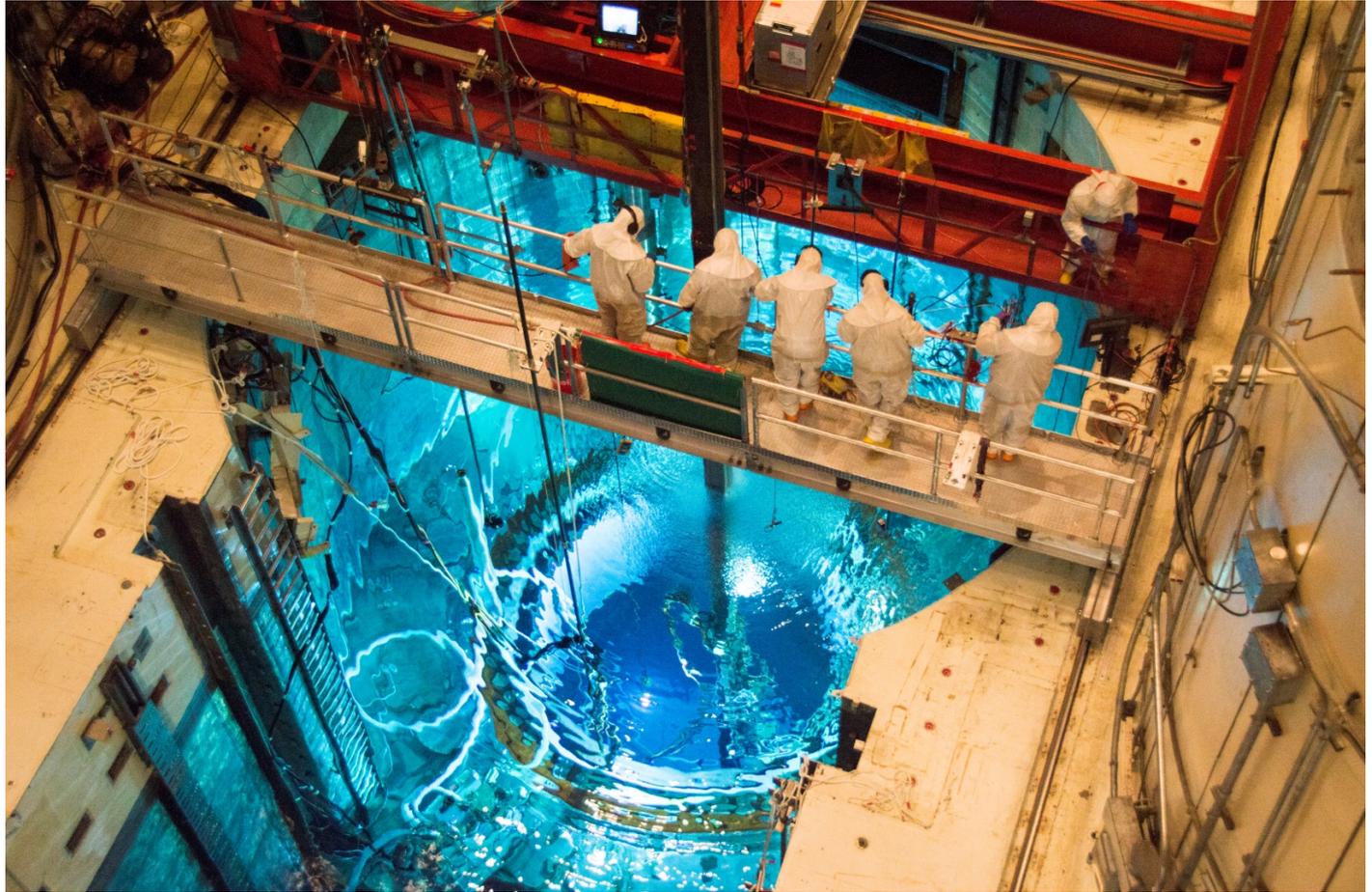
How to put a Square Peg in a Round Hole



Bird's Eye View of Set Up



(Men at Work)



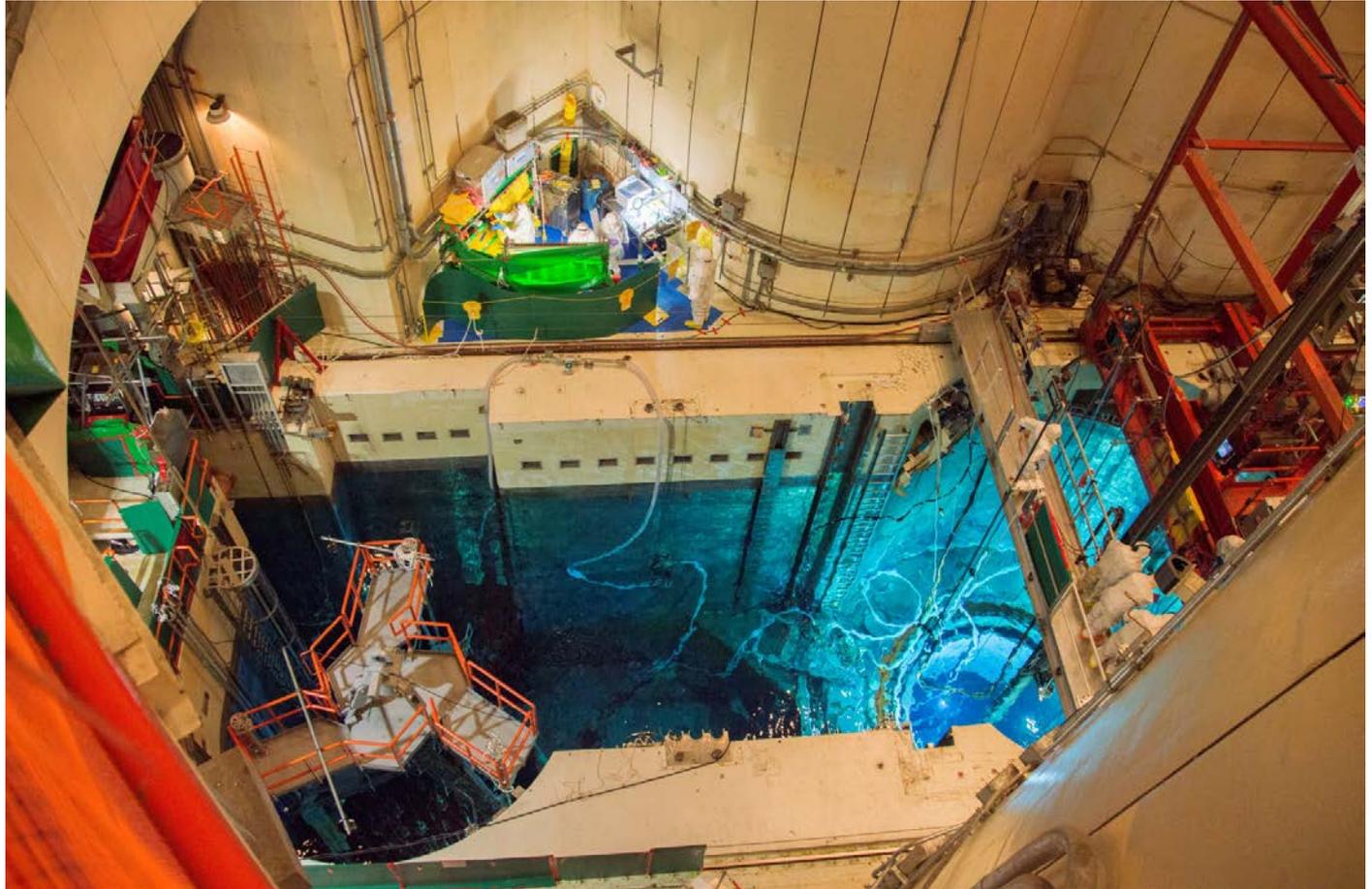
Tool Head Repair Area





EXCELLENCE - by choice

Overhead View of Tool Head Repair Area



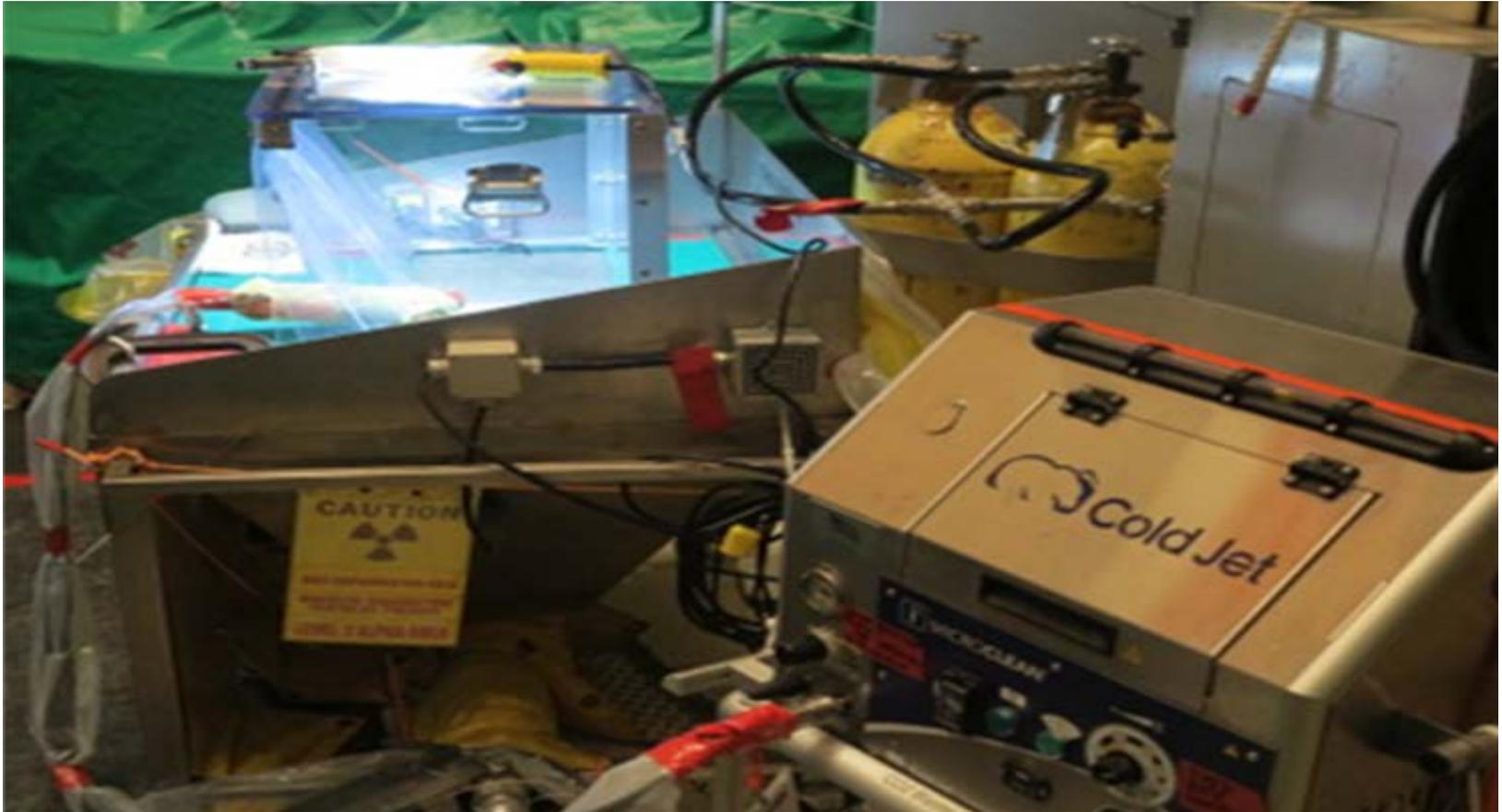
Tool Repair



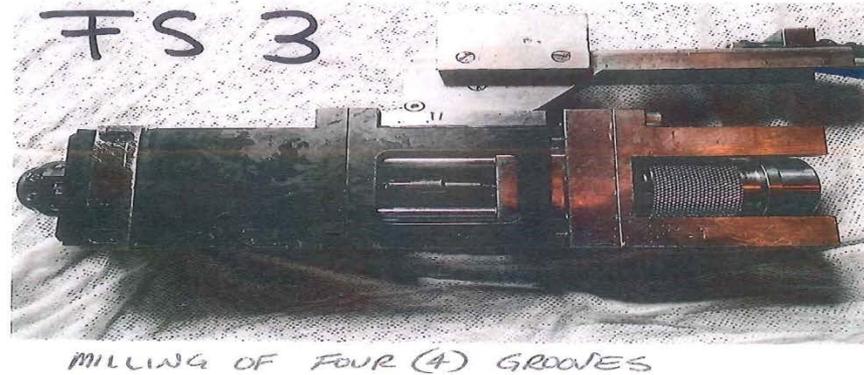


EXCELLENCE - by choice

Tool Maintenance



The Usual Suspects



FME Controls





Overall Results

- 6.833 rem, 21,000 person hours (32.2 ~32.2 mRem/bolt) includes waste disposal, demob, etc.
- Extensive planning (to the extent practical); rigorous tool handling/removal process
- JIT training developed (by RPT) and delivered to all personnel supporting baffle bolts
- Solid ALARA plan with clear hold points and stop work criteria
- Shiftly pre-job briefs/vendor engagement/teamwork
- Dedicated RP support, strong AEP and contractor ownership, strong technician ownership and engagement



Lower Internals Results

- The total dose to remove and reinstall the Lower Internals to include the setup, dry runs and support activities was estimated at 0.381 person rem and 452 person hours
- The actual dose received was 0.133 person rem and 514 person hours
- The dose delta is attributed to the water level being at the maximum level of the elevation of 645' & 10.5" and the height of Lower Internals was only raised to the level required to clear the bottom obstacles





Improved Equipment Performance

- Move in and set up of the Westinghouse equipment was estimated for 0.771 person rem and received 0.307 person rem
- The radioactive material shipped to Cook was decontaminated and refurbished prior to arriving at Cook
- The Westinghouse mast and filtration systems equipment had lower dose rates and contamination levels than encountered during previous outages due to only being used for one campaign (Diablo Canyon) prior to being shipped to D.C. Cook.





Expertise/ Use of Experienced Craft

- Westinghouse provided a crew of trained technicians & baffle bolt tool operators with a US citizenship to minimize the language barrier and have the ability to make repairs and adjustments as needed.
- Other crafts are skill of the trade and had previous Cook experience.
- The craft experience went a long way in achieving the Cook ALARA Committee's goals for the Unit 1 baffle bolt replacement project





Flusing Hydro-Lazing/System Employed with Excellent Results

- A pressure washer was used to wash tooling and equipment prior to breaching the surface of the water. This has proven to be effective in reducing the dose rates after coming into contact with the irradiated components
- A CO₂ (dry ice) blaster was purchased and has proven very effective in reducing the contamination and the radiation levels to a more manageable level reducing the need for additional engineering controls



Engineering Controls

- An underwater vacuum/filter skid was provided with a removable pump impeller to allow it to be disposed of with the other highly radioactive materials in the Spent Fuel Pool
- A down draft table with a HEPA was used in the tool refurbishment area





Baffle Bolt Project RWP Summary

- The dose estimate for the project was based on similar work being performed in Cook Unit 2 during the fall of 2016 refueling outage
- Several factors that attributed to the successful completion of the Baffle Bolt Project below the estimated dose:
- The dose rates of the lower internals were lower than anticipated from what were recorded during the U1C25 Lower Radial Support Structure Bolt Replacement Project (LRSS).



RWP Summary (continued)

- The vacuum skid was redesigned to allow the pump portion to be removed underwater and disposed in a trash can stored in the spent fuel pool
- A camera was set up to view the crane match mark location so the crane operator could remain inside of the 701' shield hut
- The reactor cavity water levels were maintained at an elevation of 645' 10.5" during the project
- RP Coverage was reduced from 3 technicians during U2C23 performing surveys for items being removed from the water to 1 technician on the bridge to dose rate tools during manipulations
- Chairs were set up in a Lower Dose Waiting Area on the #12 RCP hatch to encourage workers to move off of the bridges and sit in the LDWA



RWP Summary (continued)

- The new US manufactured baffle bolt machinery worked more efficiently than the previous equipment used at Cook from Germany
- With the Lower Internals placed in the storage stand versus the vessel the travel time for the tool carriage to reach the surface and return to the bolt location was reduced by approximately 1 minute per tool swap
- A new style of see through shield by ClearView® Shield that is being used for tool refurbishment after it has gone through the decontamination process. Dose rates were reduced to the workers whole body approximately 50% as expected
- New decontamination equipment was purchased that uses dry ice as a blast agent to remove contamination and dose rates from the tools used to mill and bore into the lower internals and has reduced the dose rates by a factor of 3 to 5 times



Shielding Design & ALARA Evaluations

- Additional shielding was requested for the manipulator bridge but was not utilized; the location for tool removal was changed to the Master-Lee mobile bridge which was not rated for the additional weight of shielding. (no impact on the total dose received)
- A shield was requested for the operator station on the #1 RCP hatch and was not utilized due to the dose rates where the operator were sitting did not justify the shielding installation
- The down draft table was shielded around the bottom to lower the decontamination area dose rates





Learning Organization

- Fall 2010 (first time) 149.4 mrem/bolt
- Fall 2016 63.4 mrem/bolt
- Fall 2017 32.2 mrem/bolt

- 6 Level 1 Percons
- 0 Dose/Unanticipated Dose Rate Alarms





Lessons Learned

- Receipt of material – anticipate potentially higher dose rates and contamination levels
- Additional cavity cleanup through SFP demin not necessary
- Ensure accountability for tethered tools
- Monitor downdraft table and ultrasonic sink to maintain dose rates low
- Clear hold points identified at beginning of project
- Complete overhaul of FS 3 tool was very beneficial
- Demobilization plan needs to be thorough and must be adhered to
- If EDM is necessary, ensure capture of all debris and anticipate much higher dose rates on vacuum hoses during demobilization (2010 40 R/hr vs. 2016 200-400 mR/hr)
- Utilize a “tool pool” to hydrolaze tools underwater in parallel with other activities
- Lifting hook bent when demobilizing core plate FME cover





Thank You

Questions?

