ALARA Aspects of the DC Cook Baffle Bolt/Upflow Modifications

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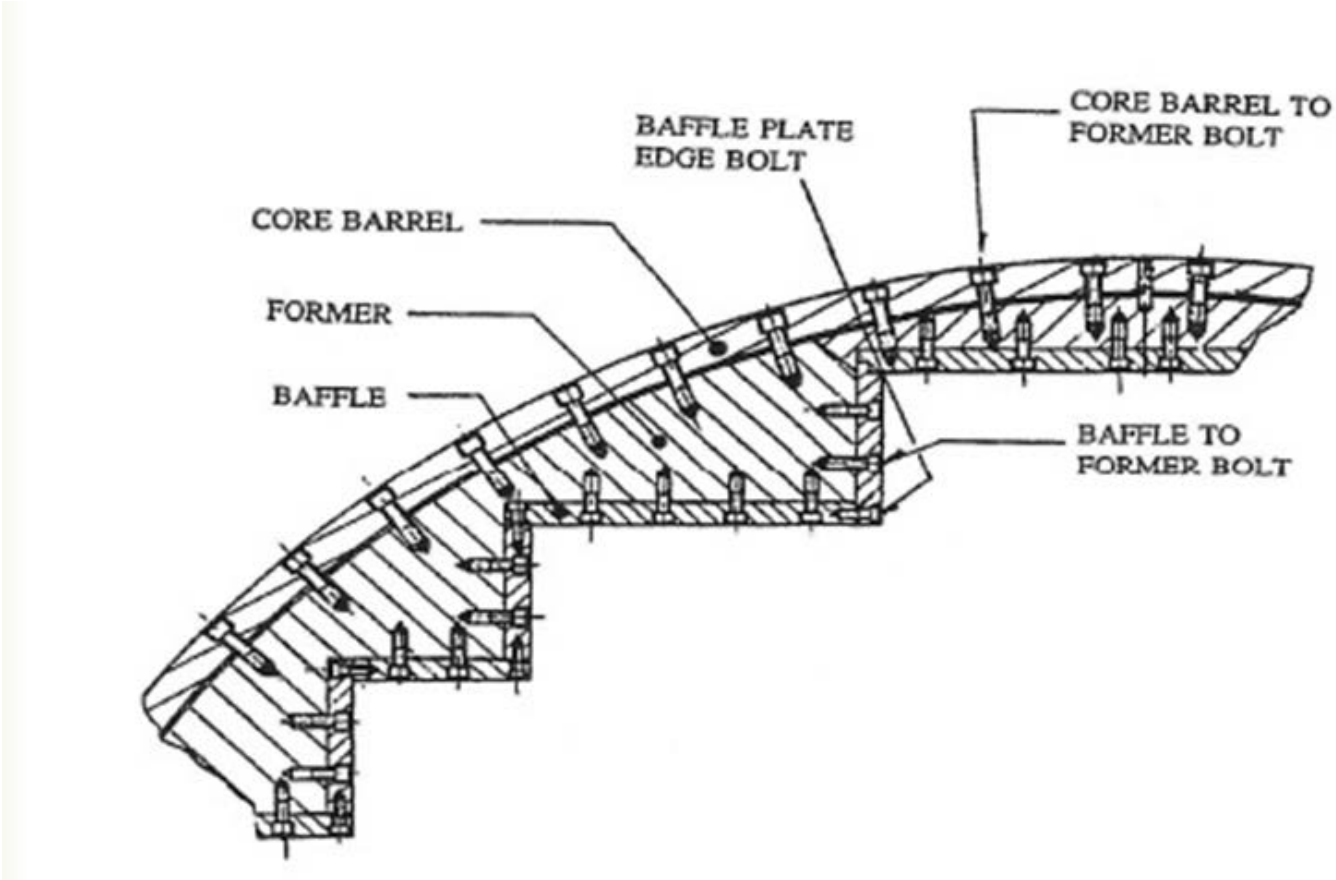
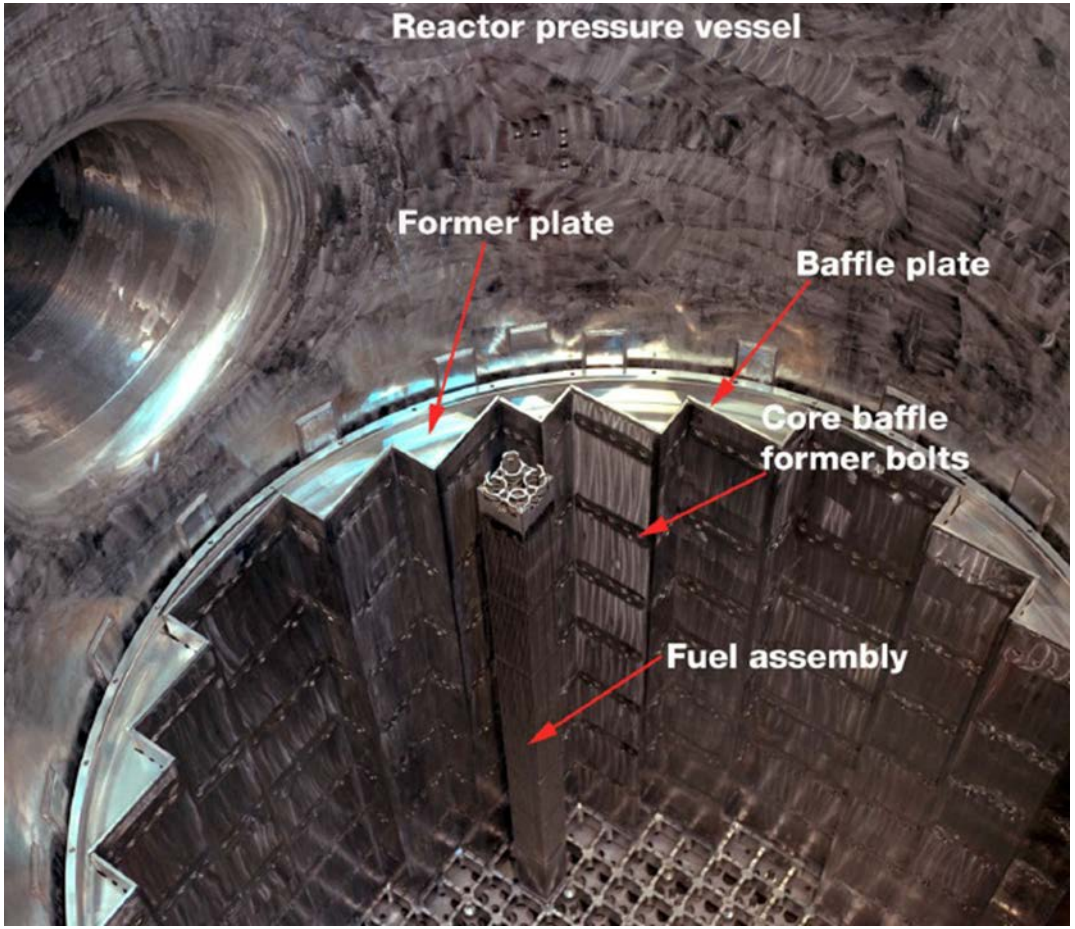
2018 ISOE International ALARA Symposium
Kyoto, JAPAN, October 25, 2018

DC Cook NPP

Question: So, What's a Baffle Bolt?



Answer: How to Put a Square Peg Into a Round Hole

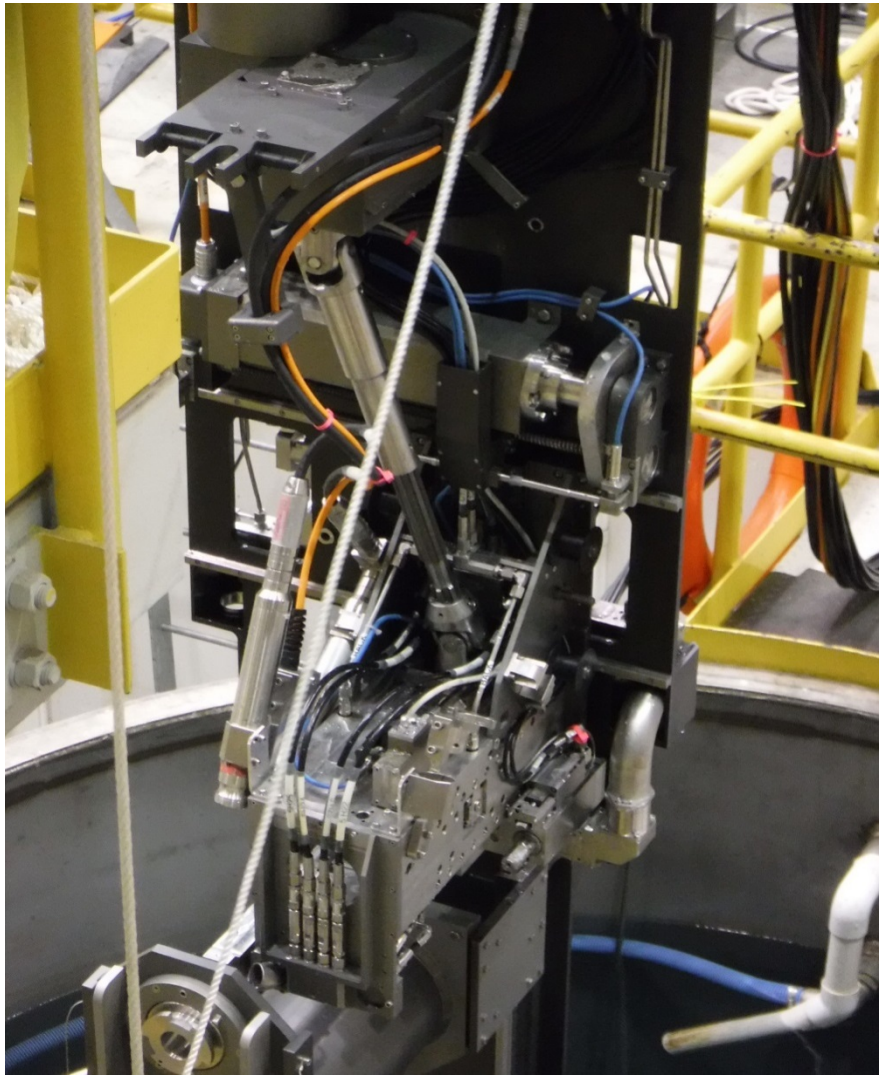


Baffle Bolt Scope

- Baffle bolt degradation was found at the Indian Point and Salem Plants in March and April 2016
- Industry response guidance, endorsed by the USNRC, has been issued
- Both units at Cook, both units at Indian Point, both units at Salem and one unit of Diablo Canyon all 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

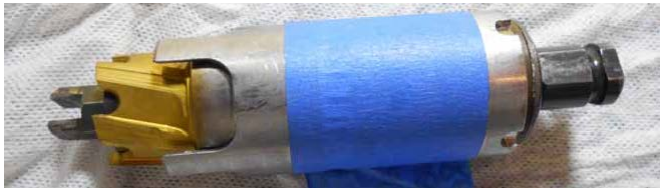
Tool Carriage

- Moves the underwater tools up and down the core barrel
- Has potential for core barrel millings (up to 10s of R/hr)



Baffle Bolt Tools

FB-9 Bolt Removal



Drills FB-1 Drill for EZ out

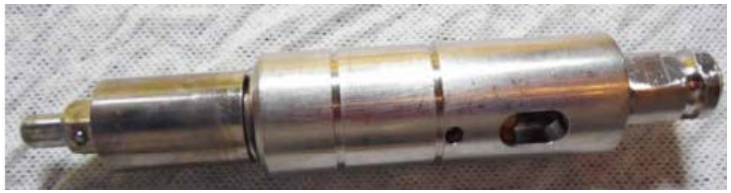
FB-4 EZ Out External

Drills FB-2 Drill shank

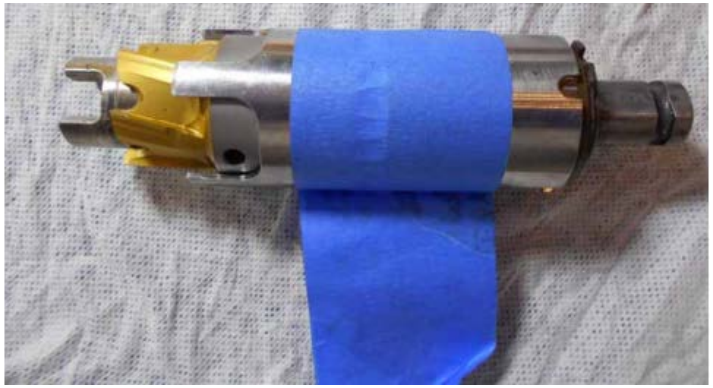
FB-4 EZ Out Internal

Baffle Bolt Tools, cont.

FB-11 Install Guide Pin

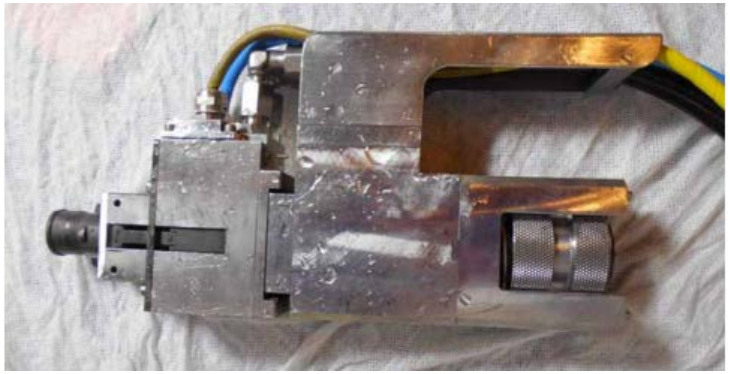


FS-1 Mill Counterbore and Remove Guide Pin



FS-3 Mill grooves

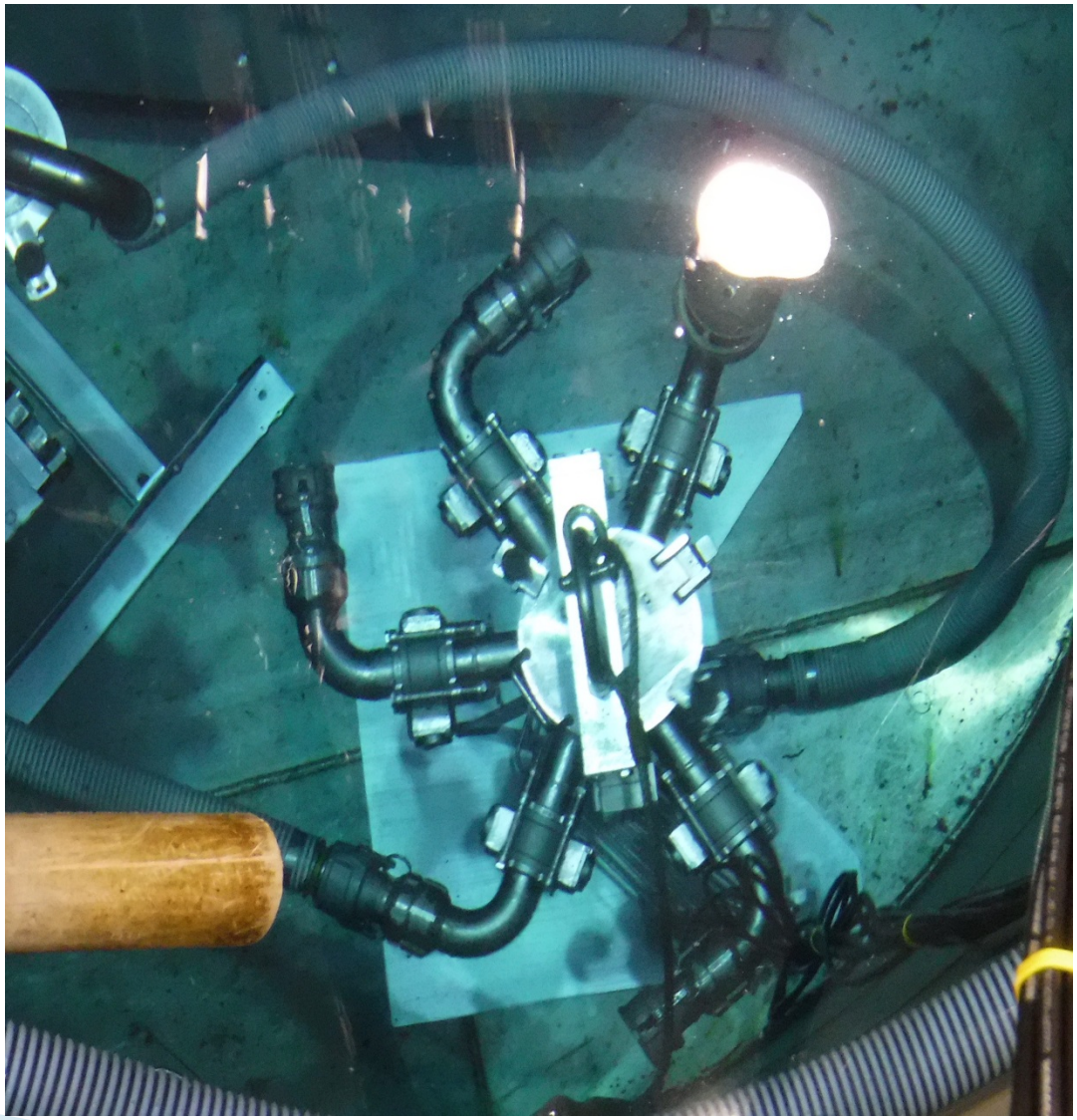
FS-5 Bolt Installation



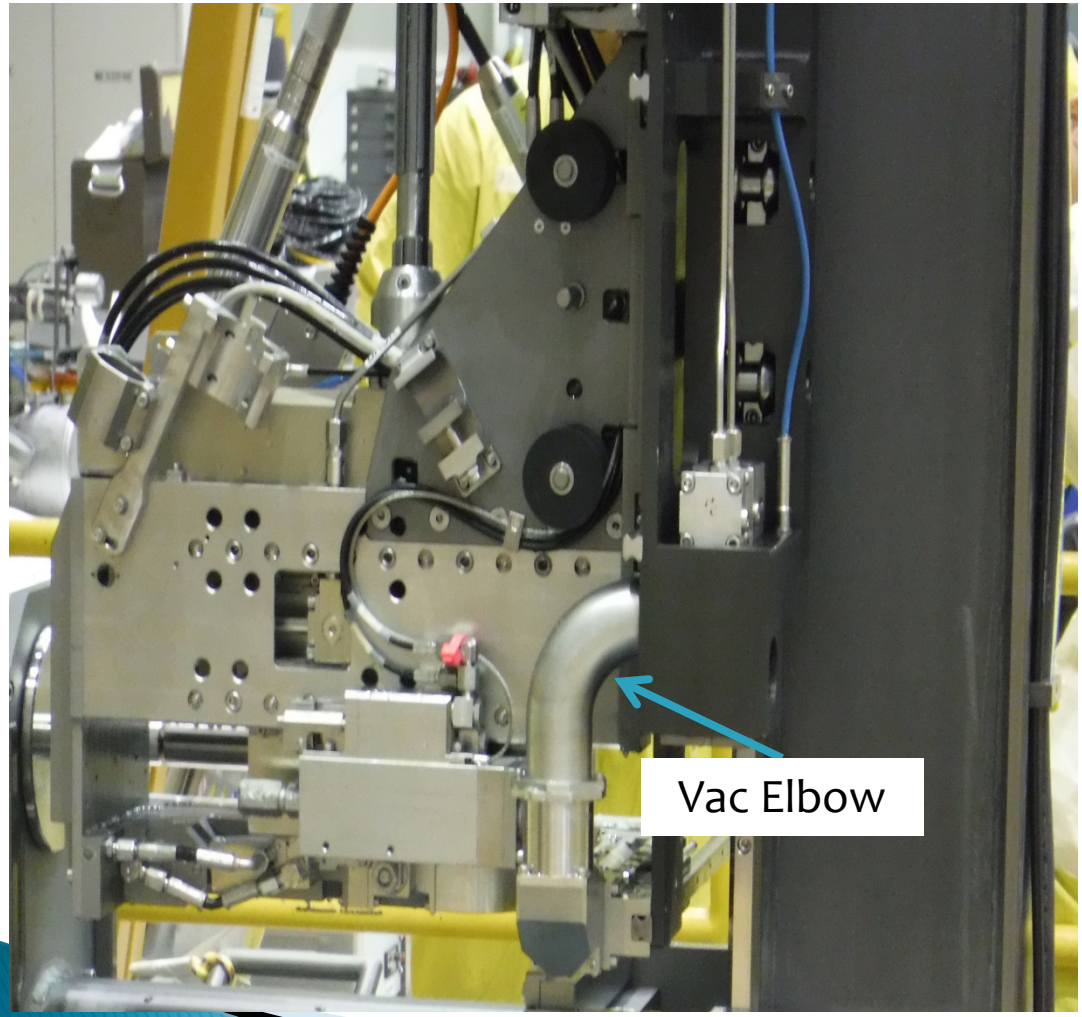
Base Plate

Vacuum System

- The Vacuum system for the Baffle Bolt tooling consists of: The Octopus, Pump motor housing, Fine filter, and flow gauge
- The Octopus and The Pump Motor housing are attached to the Pump Skid located in the bottom of the cavity
- Pump (0.15 Sv/hr), filters (84.0 Sv/hr) and filter housing (.09 Sv/hr) significant sources



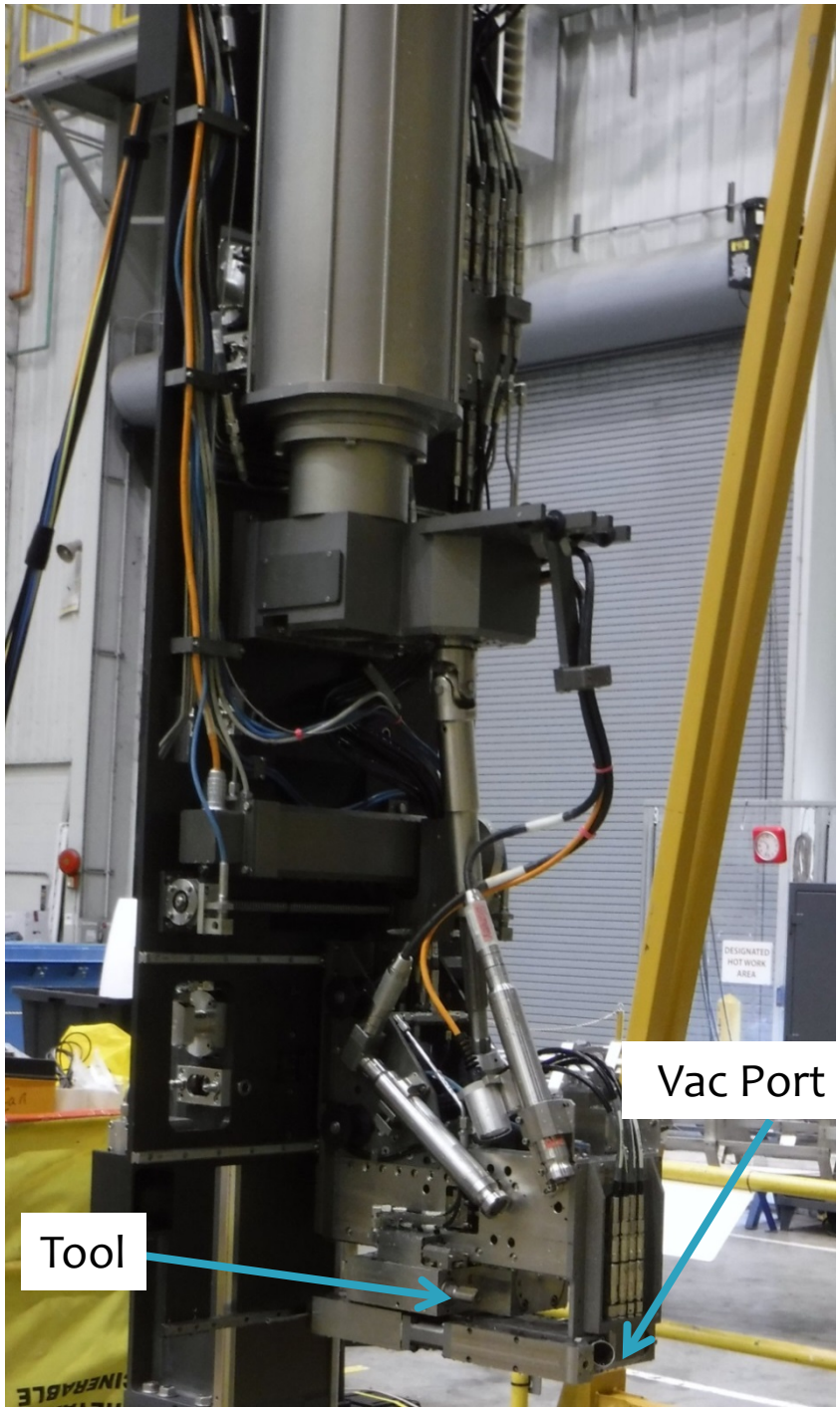
Baffle Bolt Tooling Surveys



- The Carriage will be brought up to 3ft below the surface of the water for an underwater survey
  - Important areas to survey are:
    - The Tool (both in the extended and retracted position)
    - The Vacuum port on the front of the Carriage
    - The Vacuum Elbow on the side of the Carriage
    - Note: Underwater pressure washing may be necessary

Baffle Bolt Tooling Surveys, cont.

- Once the 3ft water readings are satisfactory the tool is raised to 1ft out of water
  - The same areas are surveyed
- Once the 1ft readings are satisfactory the Carriage is raised to the Bridge level and an Ion Chamber reading is obtained on the Tool



Baffle Bolt Tooling Surveys, cont.

- After this reading is taken the tool is placed in a bucket of water and transported to the Tool Refurb area
- Long handled prongs should be used to handle tooling with elevated dose rates
- Open / Closed window Dose Rates and contamination surveys are performed once the Tool is in the Tool Refurb area

Tool Refurb Area

- In the Tool Refurb Area the CO2 Tool cleaner and Ultra Sonic Sink are utilized to clean the Tools

- Once the Tools are cleaned and prepped they are stored in a lead shield racks as necessary until they are ready to be used

Step by Step Survey Process

- Monitor dose rates on the carriage and mast 3’ below the water and at the water line as the carriage is being removed from the water. This is to verify that nothing has gotten caught on the chain or other parts of the carriage that would cause issues at the surface of the water. This is accomplished using an AMP and a tele-pole this practice is utilized while removing anything from the water.
- When the tool stops at 3 ft below the surface, verify contact readings on entire carriage assembly, focusing on the tool head in extended position, vacuum inlet, and the vacuum elbow. (Stop work conditions are *30 mSv/hr)
- If tool head or vacuum area readings are above RP hold point dose rate, inform RP Supervision and have workers pressure wash under water or flush the vacuum system.
- Bring the tool to 1ft above the surface of the water, obtain contact and 30cm readings on the hottest spot on the carriage (typically on the tool head area, vacuum inlet, or the vacuum elbow) **Dose rates must be less than 8 mSv/hr @ 30 cm to continue**

Survey process con't

- If all criteria is met for 30 cm readings bring the tool to the bridge level and get a quick Ion Chamber reading to verify prior surveys. Ion chamber readings have been approx. 3 times lower than what we have been seeing with the AMP-100. (We don't want to keep the workers in higher dose rates then necessary) Allow workers at this time to remove tooling and place in bucket with water for transport to the HRA area.
- When in the HRA get Open/Closed window readings on contact and at 30 cm. Smears should be taken to evaluate RP controls. Document these readings on the survey.

Survey Documentation

- Surveys of BB tools are documented in the remote coverage room
- A spreadsheet has been created to track dose rates and contamination levels on tooling
- Effective communication between the upper containment technician and remote coverage technician is critical

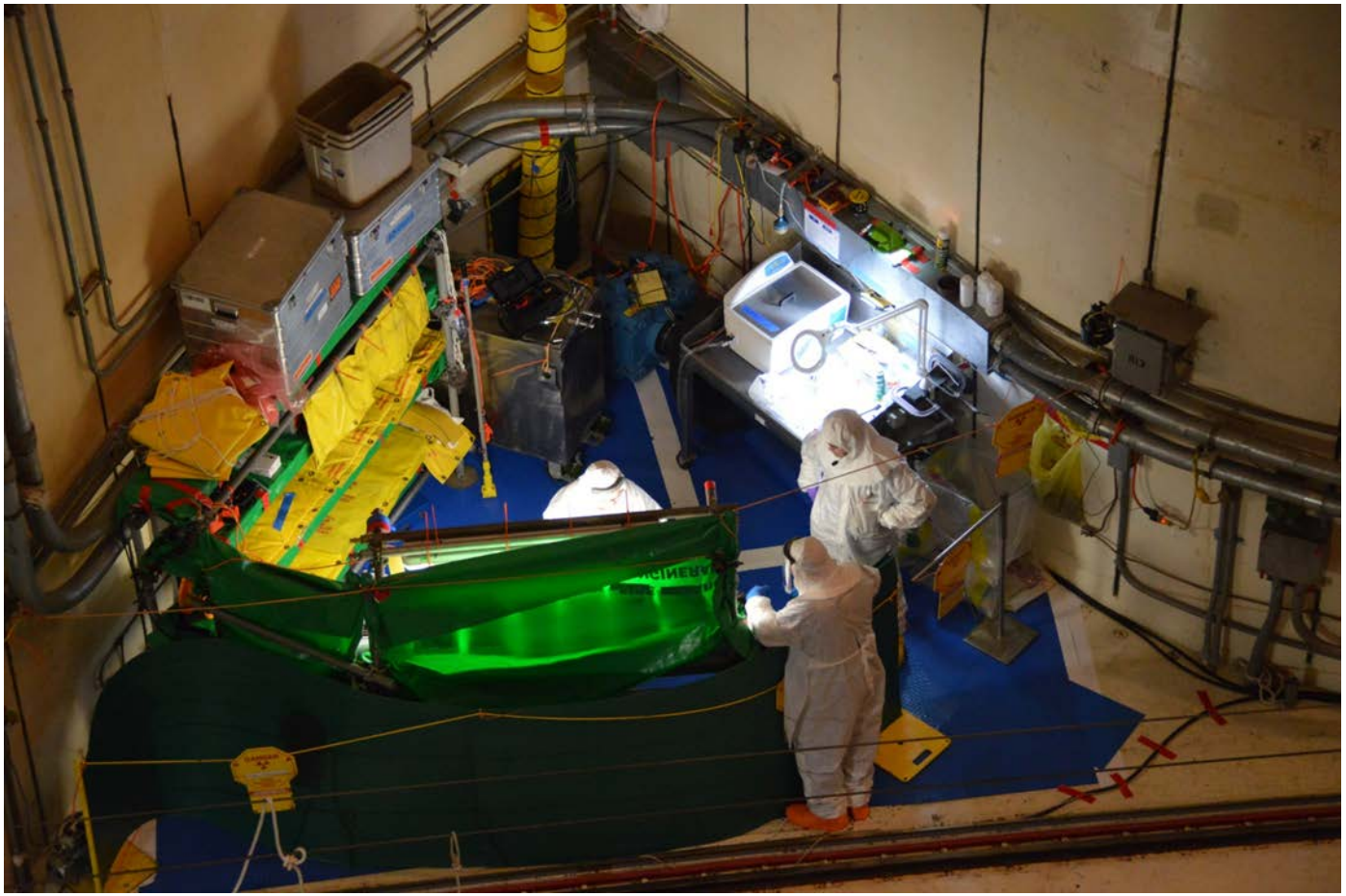
Tool Refurb Area Survey

		Pre Decon			Post Decon					
Time	Tool	Gamma Dose (mr/hr)	Beta Dose (mrad/hr)	Contamination (dpm/100cm^2)	Gamma Dose (mr/hr)	Beta Dose (mrad/hr)	Contamination (dpm/100cm^2)	Initials	Instrument	Comments
0530	FS1	25/3	250/10	200k	23/3	120/6	6k	MR	L177-158208 RO20-353	<20 dpm/100cm2 Alpha RM20-1640
0608	FS3	240/40	360/50	100k	260/32	260/40	2k	MR	L177-158208 RO20-353	<20 dpm/100cm2 Alpha RM20-1640
0649	FS5	1.3/1.1	1.4/1.3	1k	N/A	N/A	N/A	MR	L177-158208 RO20-353	No decon needed
0905	FB9	45/7	120/17	250k	34/7	92/10	30k	JC	V451-1319 L177-265887	CO2 blasted
1158	FB14	*8/2	70/8	400k	*5/3	45/6	5k	IH/WZ	RO20-343 L177-265887	CO2 blasted
1208	FB11	*2/2	*4/2	40k	*2/2	*4/2	10k	IH/WZ	RO20-343 L177-265887	CO2 blasted
1423	FS1	100/14	300/50	1 million	20/10	50/18	20k	JC	RO20-343 L177-265887	CO2 blasted
1615	FS3	N/A	N/A	300k	300/100	300/100	30k	JC	RO20-343 L177-265887	CO2 blasted
1711	FS5	*2/2	*2/2	10k	N/A	N/A	N/A	IH/WZ	RO20-343 L177-265887	No decon needed

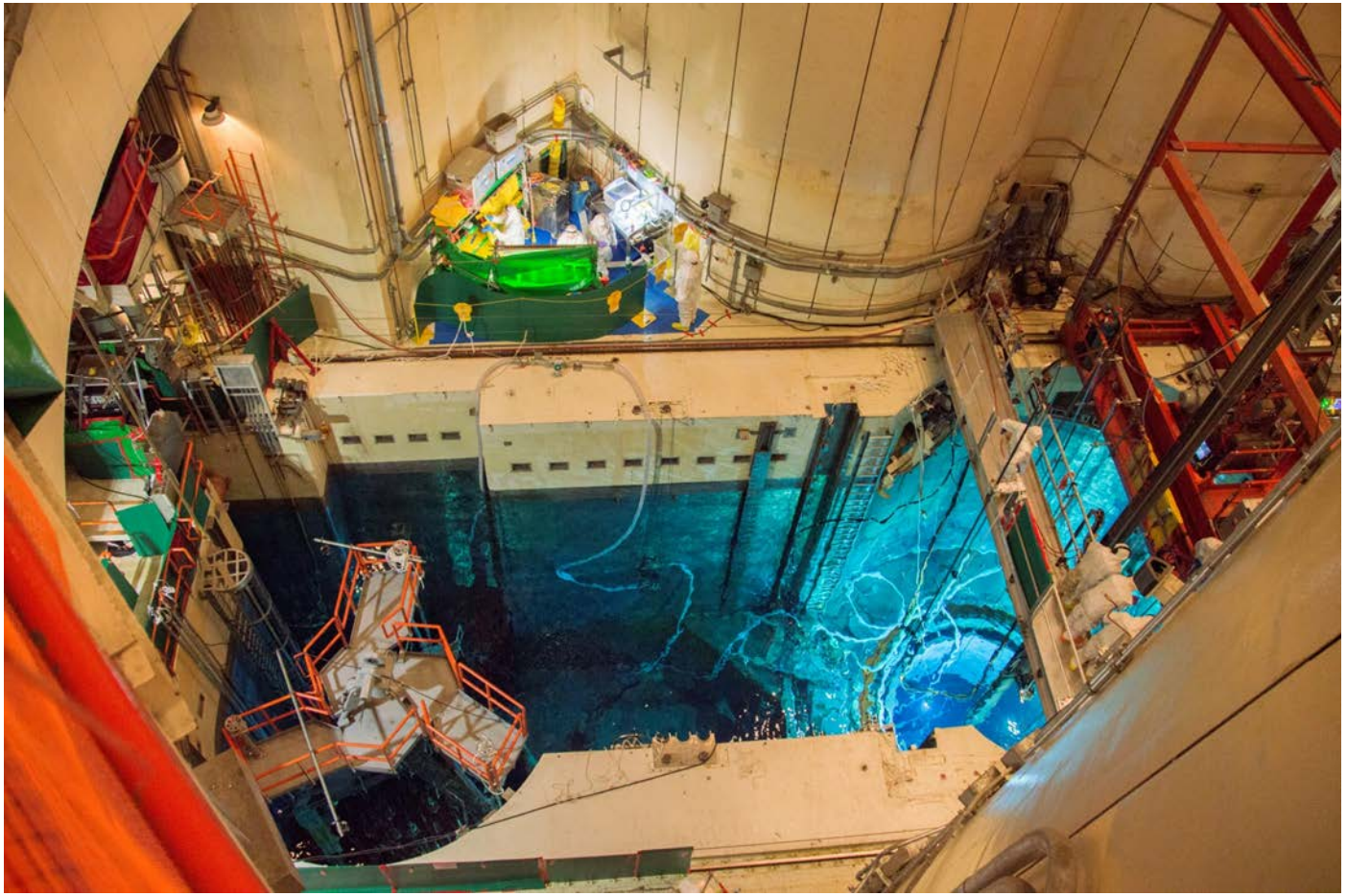
B/G = Beta/Gamma
A = Alpha
Cal. = Calibration tool

Bird's Eye View of Baffle Bolt Work Platform

Tool Repair Area



Overhead View



RP Technician Engagement/Innovation

Results=Continuous Improvement

- U2C19 (2010) = 1.494 mSv/bolt
- U2C23 (2016) = 0.634 mSv/bolt
- U1C28 (2017) = 0.322 mSv/bolt
- U2C24 (2018) = 0.3039 mSv/bolt

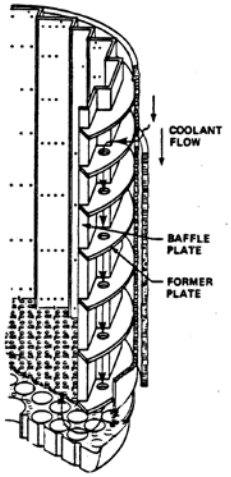
Baffle Bolt Lessons Learned

- Receipt of material – anticipate potentially higher dose rates and contamination levels
- Additional cavity cleanup through SFP demineralizer was established with a temp-mod.
- Ensure accountability for tethered tools (FME)
- Monitor downdraft table used with Co2 blaster and ultrasonic sink to maintain dose rates low
- 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 (2018 0.8-1.2 Sv/hr vs. 2016 2.0-4.0 mSv/hr) (incorporate UP-Flow Demineralizer process for EDM)
- Utilize a “tool pool” to hydrolaze tools underwater in parallel with other activities
- Lifting hook bent when demobilizing core plate FME cover (2016)

Upflow Modification

- Long term mitigation for issues contributing to baffle bolt degradation
- Results in reduction in coolant jetting through baffle joints which can damage fuel
- Both Cook Units operated with fuel defects in 2016

Downflow Configuration



DOWNFLOW
CONFIGURATION

Figure 4-1

Upflow Configuration

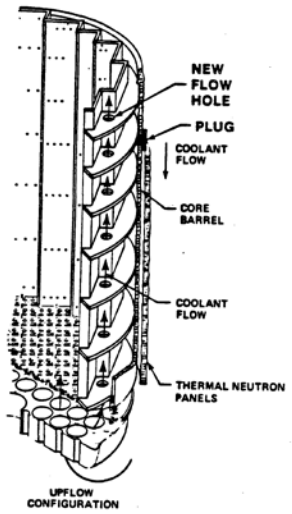
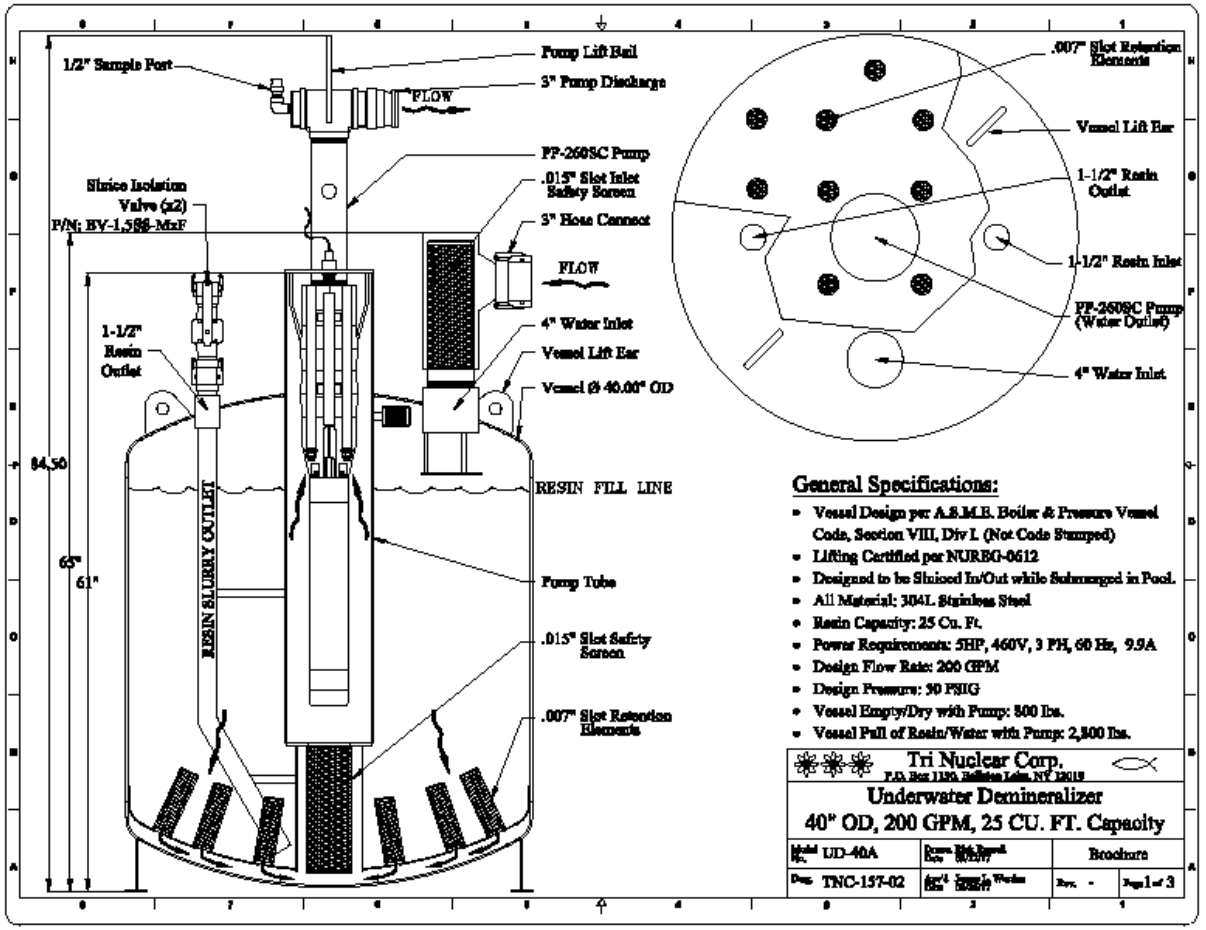


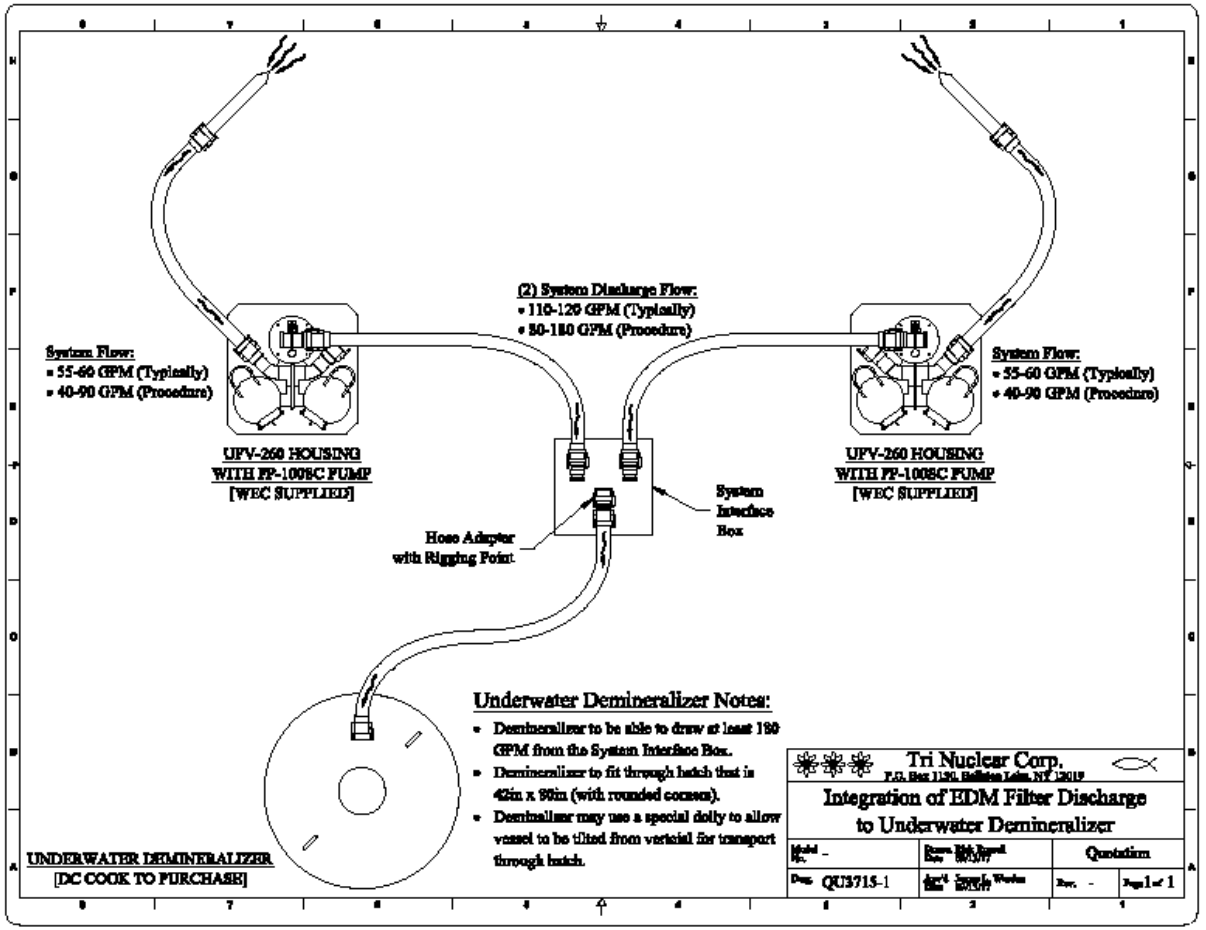
Figure 5-1

5-2

In-Situ Demineralizer



In-Situ Demineralizer Setup



ALARA Initiatives

- An underwater demineralizer was used to collect discharge from EDM filtration to assist cleanup efforts to remove the SWARF generated during EDM
- The baffle bolt mast, vacuum skid, and the empty underwater demineralizer were pressure washed before removing from water
- Cavity water level was maintained by Operations at adequate levels in a tight band

ALARA Initiatives

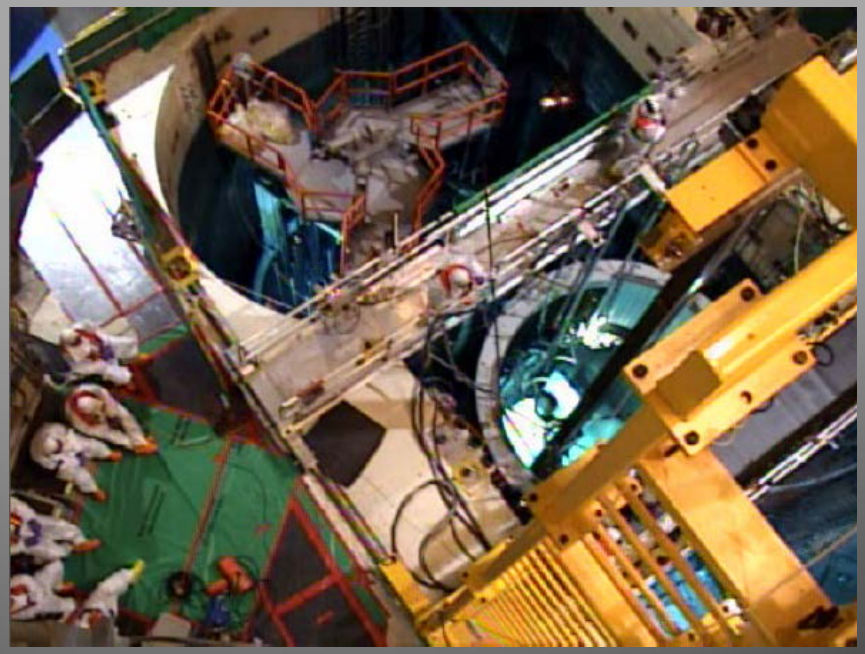
- During sluice activities of the demineralizer, containment workers were evacuated from the area
- The flat angled clear-view shield was used during tool refurbishment activities. Reducing dose rates by a factor of 3.
- Shield Ring on the Core Barrel brought in as part of the Upflow Modification resulted in significant dose reduction to platform workers
- Quick Rack (Smitty) shields placed in the refurbishment area with the opening facing the outer wall to minimize the dose rates in the work area.

ALARA Initiatives

- The 701' shield was moved to the outside of the bio shield wall near the entrance to the upper ice to allow the crew to have a direct escape route in the event of a crane malfunction during the Core Barrel removal
- CO_2 Blaster deconned tools prior to refurbishment down to 600k Bq/100 cm^2
- *All Westinghouse/PCI and Wes-Dyne equipment were refurbished prior to being sent to Cook*

ALARA Initiatives

- Chairs placed in the Low Dose Waiting Area on the #22 RCP hatch made it easier to get the crew's to voluntarily utilize the area and minimized worker time on the bridge in higher dose rates



ALARA Stats

- Baffle Bolts completed a new record for dose per bolt at 0,3039 mSv per bolt (this was a major accomplishment considering the work was performed in parallel with the UPFLOW Mod)
- 3 PCE's:
  - 5000 ccpm (5MBq) particle on the neck of a Westinghouse individual. Lapel hose rubbed on neck
  - 1000 ccpm (0.6 MBq) particle on the chin of a BHI individual, likely from touching chin
  - 400 ccpm (0.04 MBq) particle on the shirt (upper chest) of a PCI FME individual. Worker squeezed between bridge and wall
  - In-situ demineralizer contributed to minimization of SWARF, no system hot spots on restart

Lessons Learned

- EDM process created electrical noise interference with the Baffle Bolt tool which caused early delays
  - This was caused by not following the instillation plan to separate cable runs and power supplies . The cables had to be rerun on opposite sides of the cavity and separation of the power supplies for both the up-flow mod and baffle bolts equipment.
- Ultrasonic sink, down draft table and CO2 blaster were repositioned farther away from the work table to reduce dose rates in the area

Lessons Learned

- Downdraft table used with the CO2 blaster connected to a 2000 cfm HEPA Ventilation unit with a shorter hose and increased surface area under the collection box, increasing flowrate at the table from prior campaigns
  - This reduced the number of times the downdraft table required to be deconned and saved dose
- Two pre-filters were placed in the HEPA to capturing the contamination from the C02 tool cleaning.

Lessons Learned

- Some mitigation of the generation of higher level waste from the EDM process
- 25 ft3 of specialty resin – 0.28 Sv/hr
- In Vessel Demin– reduced overall number of filters from EDM, 30 predicted 9 actual. **No elevated dose rates or contamination levels in refueling cavity post drain down, post EDM**
- More vacuuming of cavity is better
- Monitor vacuum hose closely – hot chip found in hose reading 2.36 Sv/hr
- *Solid demobilization plan is critical*

Questions?

- Thank you for the opportunity to share the ISOE ALARA Lessons Learned from DC Cook