Dresden Application of the Vortex Undervessel Control Rod Drive (CRD) Guide Tube Flushing Tool

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Design

- ✓ Designed to remove crud from inside CRD guide tunes
  - Crud consists of small particles of debris, such as iron oxide and other corrosion products which settle at the bottom of the CRD guide tubes to form a black, silt-like material
  - If left to accumulate, crud can affect the operation of the CRD system and may cause or contribute to reactivity management events
- ✓ Previously, only vacuuming the guide tubes was used before inserting the new blade. By removing the CRD mechanism and connecting the flushing tool in its place, we can flush the crud from underneath without having to change out the blades

How it is Used

- ✓ Once bolted into place the tool is fully inserted, pushing the blade up from the floor of the guide tube.
- ✓ A crud-collecting nozzle is then inserted and emerges inside the guide tube through an opening in the side of the tool (photos to come)
- ✓ The worker then opens a drain valve in the tool's effluent tube. (Once the tool is fully deployed, the worker goes to a low-dose waiting area and remote operation continues vial closed circuit TV and the nozzle gear drive)
- ✓ Gravity and water pressure do the rest – Once the drain valve is open, the crud is flushed from the bottom of the guide tube, where the nozzle collects it and carries it to the drywell equipment drain sump.
- ✓ Dresden flushed 26 guides and exchanged 32 drives total
  - Equals out to exchanging 58 drives

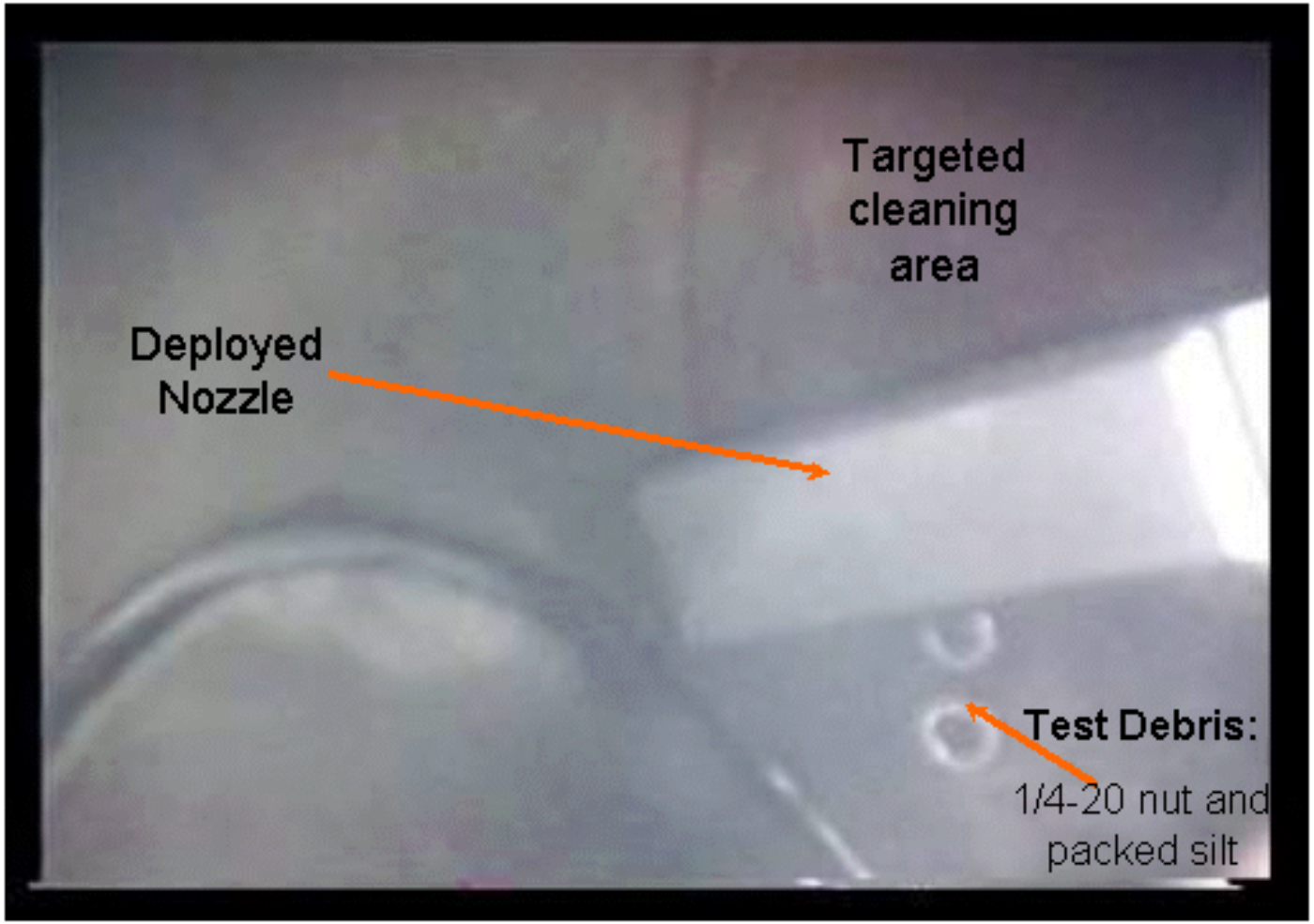
Vortex Tool Pictures

(CRGT flush tool partial inserted)

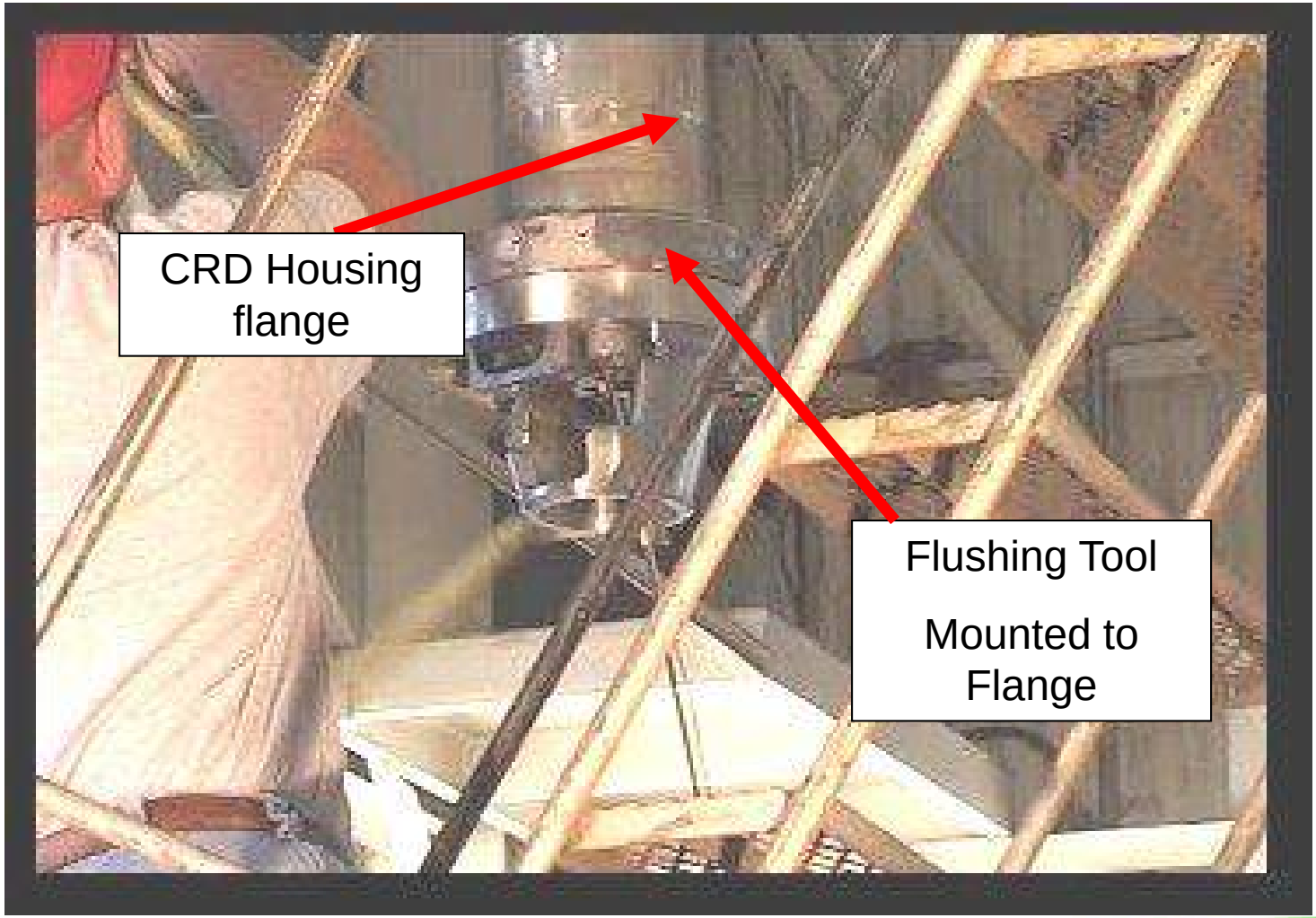
(CRGT flush tool 95% inserted with Nozzle deploying)

(CRGT flush tool 95% inserted with Nozzle deploying)

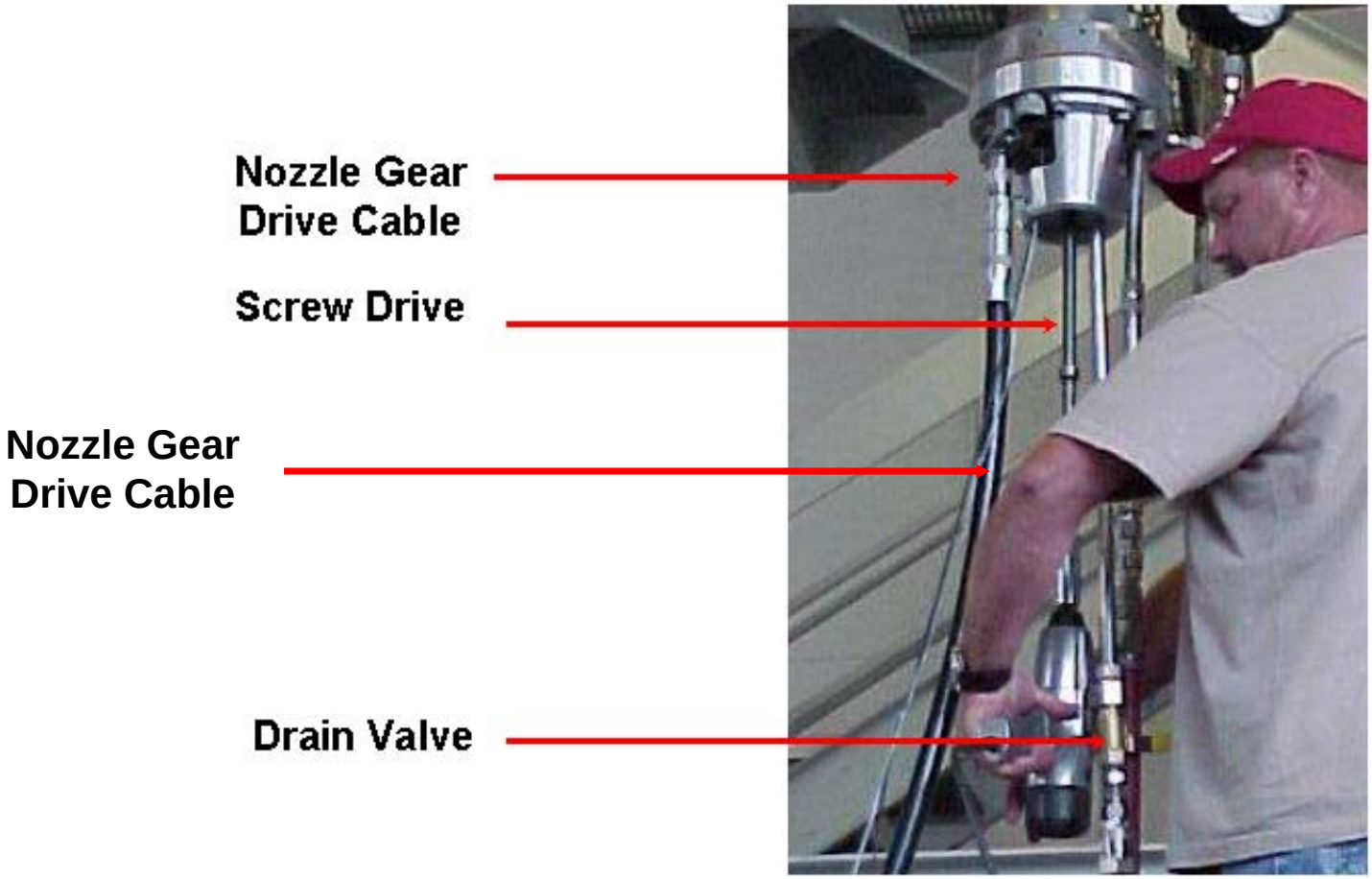
Still Picture from Camera During Flush



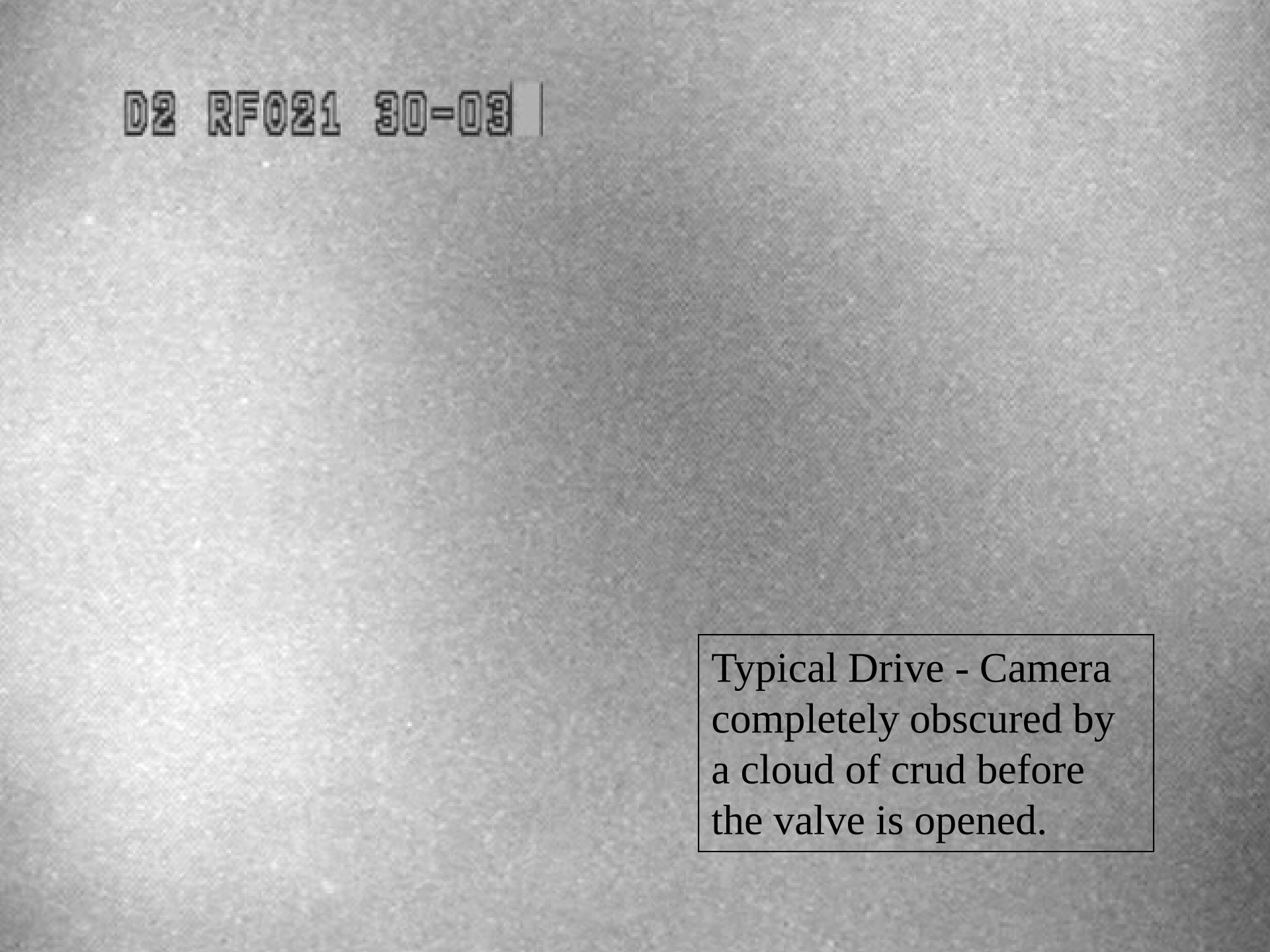
Flushing Tool Installed in the Test CRD Housing



Inserting the Blade to Deploy the Nozzle Using the Tool's Jacking Screw




D2 DW 502 Sub Pile Room
Effluent Tube, filled with black crud



Typical Drive - Camera completely obscured by a cloud of crud before the valve is opened.

Same drive – 2 minutes after flushing

RP Information

- ✓ Removes source term from the bottom of the vessel by approximately 47 Curies
- ✓ The modeling indicated that approximately 1.5 Ci was removed per flush
- ✓ Reduces dose rates under vessel by approximately 24% at head level
- ✓ Removed approximately 35 lbs of crud
- ✓ Understand the flush path based on plant configuration (sumps OOS)
- ✓ Risk of dealing with high source term during this process (undervessel / subpile room)

Vortex Tool Pros vs. Cons

✓ Pros

- Long term source term reduction
- UV dose rate reduction
- CRD operability improvements
- RF schedule
- 47.5 Ci removed from the vessel by flushing CRD guide tubes
- Radiation surveys taken pre and post flush indicate a 24% reduction in exposure at head level under vessel

✓ Cons

- Can't be used on a half carousel plant, no way to get off carousel when valve is opened for flushing
- From a schedule and dose perspective, each flush should be treated as an exchange (i.e. 32 exchanges and 26 flushes equals 58 exchanges)
- Outside support personnel tend to lose intensity/focus when only receiving a CRD per hour

Long Term Goal

- ✓ The intent is to improve control rod drive performance and RP benefits from this by the removal of crud (which is equivalent to source term throughout the system)
  - In order to achieve such a goal, several cycles will occur that require increased number of CRD exchanges. This will cause increased exposure until driver performance increases
  - By using the vortex tool, the waste is properly being processed through the waste processor. This results in lower dose due to it not going through many filters that need to be handled by individuals. The waste processing method is considered the most ALARA way
  - This will lower the amount of source term throughout plant components


Dresden Unit 2
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Vortex Undervessel Guide Tube
Flushing Tool
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