Dry Shielded Canister Exemption Request Pre-Application Meeting

Monticello Nuclear Generating Plant

May 14, 2014

DSC Exemption Request Pre-App Meeting

Purpose

- Discuss NSPM's analysis results which demonstrate that public health and safety and environment are best protected by an exemption for DSCs 11 - 16
- Describe the overall plan and schedule for the planned exemption request on DSCs 11 -16
- Obtain NRC feedback on proposed content of exemption request and suitability for NRC review

DSC Exemption Request Pre-App Meeting

Agenda

- Background
- Requested Exemption – Phases I and II
- Technical Assessment – Phases I and II
- Alternatives Examined
- Environmental Consideration
- Schedule
- Discussion

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Background

- MNGP used NUHOMS®-61BTH, Type 1 DSCs in accordance with CoC 1004, Amendment 10 for fall 2013 loading campaign
- 2013 DSC loading campaign planned to load 10 DSCs
- TS 1.2.5 of CoC 1004, Amendment 10 specifies that all DSC closure welds not subjected to full volumetric inspection be PT tested in accordance with ASME B&PV Code Section III, Division 1, Article NB-5000
- Determined that certain elements of the PT examinations performed on DSCs 11 -16 did not comply with the procedure and TS 1.2.5
- At the time of discovery, DSCs 11 – 15 were loaded into their respective HSMs
- DSC 16 was and remains located on the Reactor Building Refuel Floor in the TC

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Background

- Extent of Condition review performed using independent vendor to evaluate weld practices
- Performed additional PT examinations of DSC 16 OTCP weld and discovered linear indications and unsatisfactory weld depth measurements
- Discovered inadequate documentation in loading procedures related to vacuum test duration
- NOS performed extensive review and discovered some human performance errors that do not affect overall DSC suitability
- Verified TS for DSCs 11 -16 have been completed satisfactorily (except for PT exams)
- Weld repairs and satisfactory PT examinations have been completed on DSC 16 OTCP

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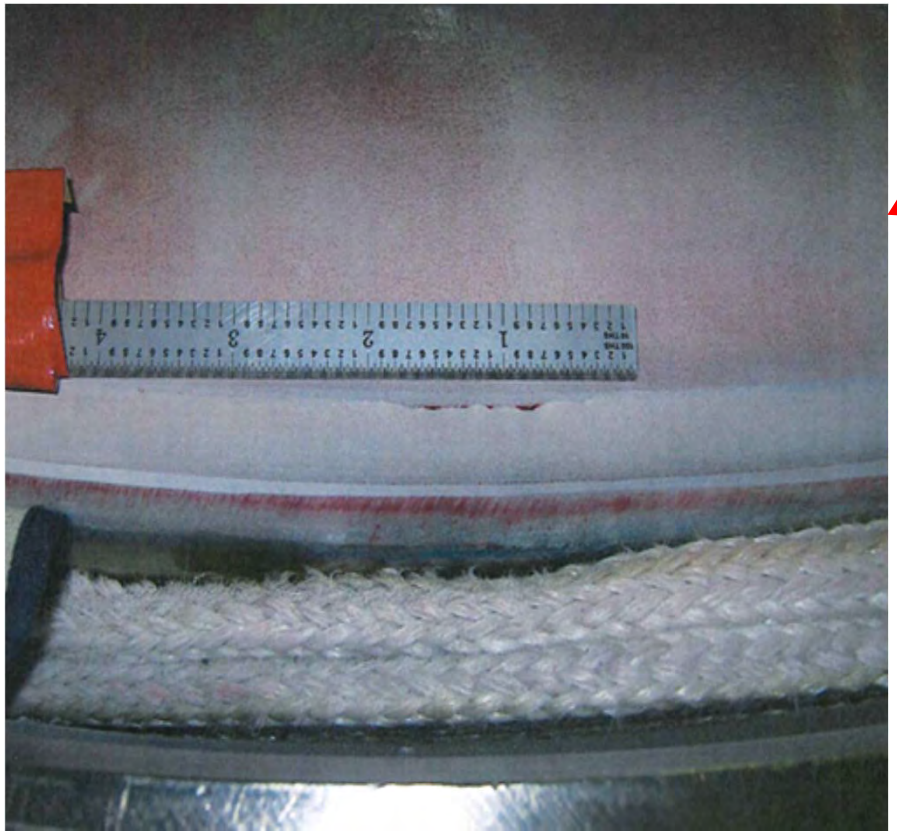

Linear indication DSC 16 OTCP discovered in January 2014

Weld repaired and PT exam completed in April 2014

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Background

- Phase I Plan for DSC 16
  - Will only move DSC 16 off MNGP Refuel Floor when public health and safety can be demonstrated
  - Exemption Request provides basis for moving DSC 16
  - NSPM will request regulatory approval on a near-term schedule to move DSC 16
- Phase II Plan for DSCs 11 – 16
  - Exemption Request will demonstrate suitability for storage of DSCs for duration of general license without conditions
  - NSPM will request regulatory approval on a longer term schedule

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Requested Exemption

- 10 CFR 72.212(b)(3), licensee must *"[e]nsure that each cask used by the general licensee conforms to the terms, conditions, and specifications of a CoC or an amended CoC listed in § 72.214"*
- Portion of 10 CFR 72.212(b)(11) which states that *"[t]he licensee shall comply with the terms, conditions, and specifications of the CoC . . ."*.
- Phase I - Permit near-term movement and insertion of DSC 16 into HSM
- Phase II - Permit long-term storage of DSCs 11 – 16

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Requested Exemption

- Covers the following welds of each applicable DSC
  - Inner Top Cover Plate Weld
  - Siphon Port Cover Plate Weld
  - Vent Port Cover Plate Weld
  - Outer Top Cover Plate Weld
  - Test Port Plug Weld
- Welds are multi-pass welds which require at minimum root and final pass PT examinations

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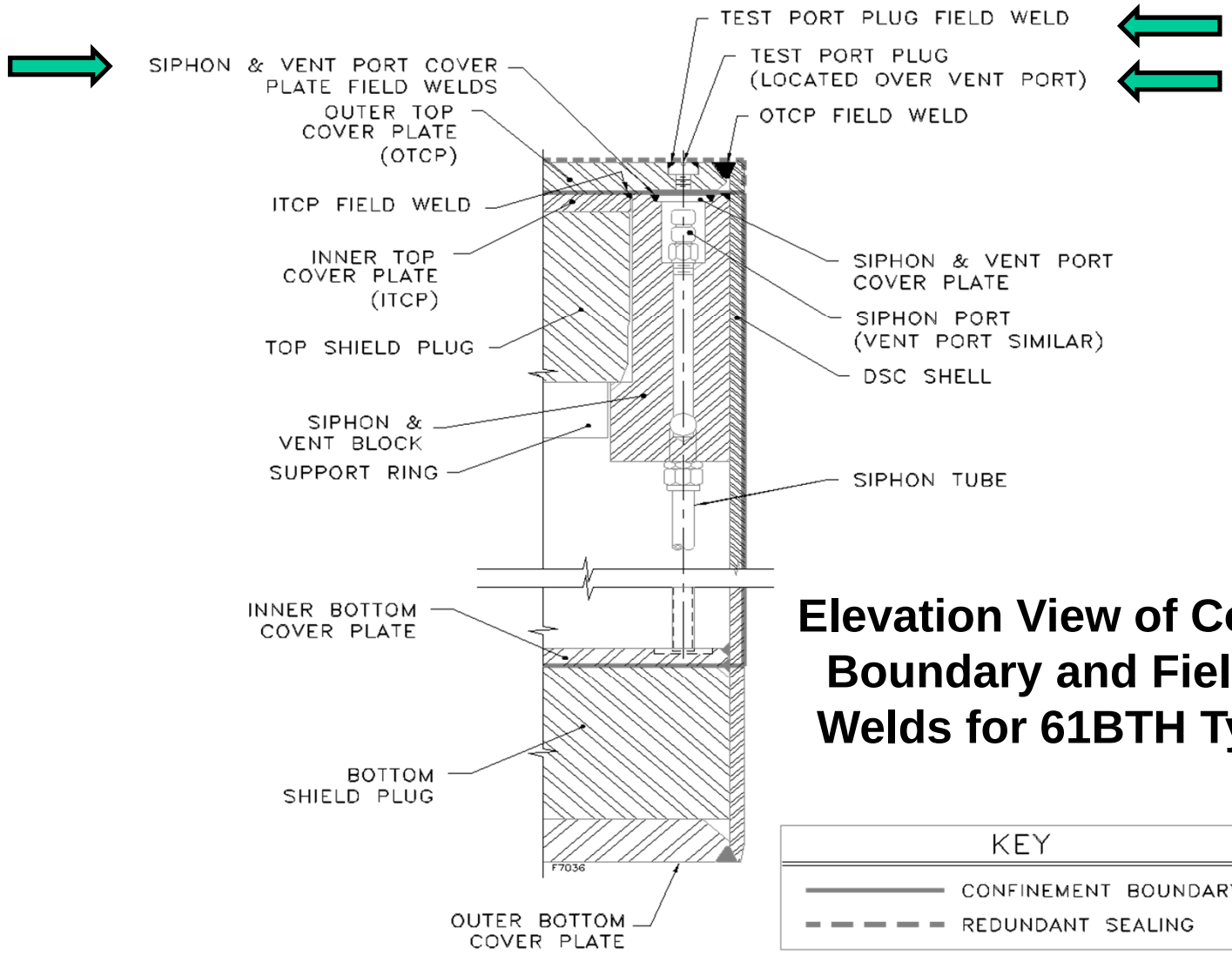

Elevation View of Confinement Boundary and Field Closure Welds for 61BTH Type 1 DSC

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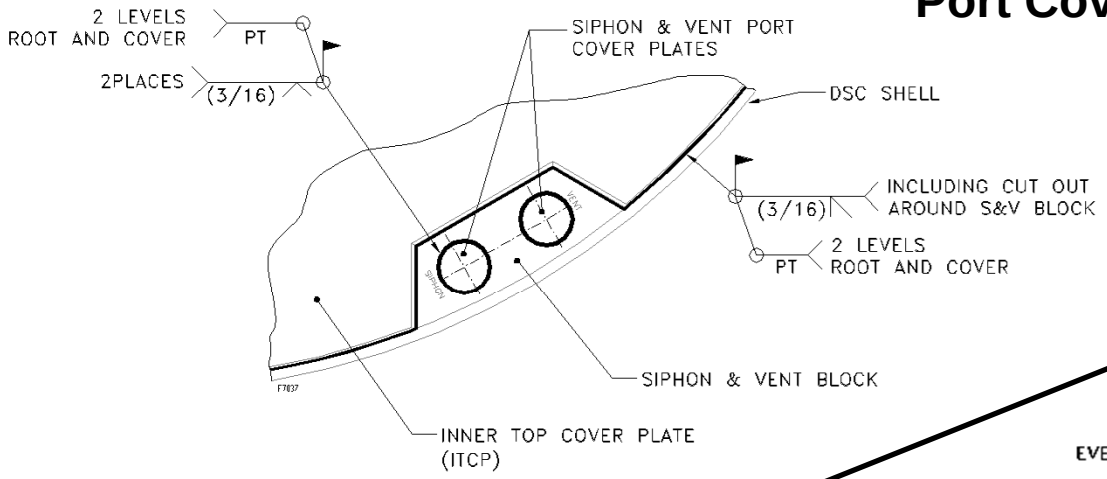
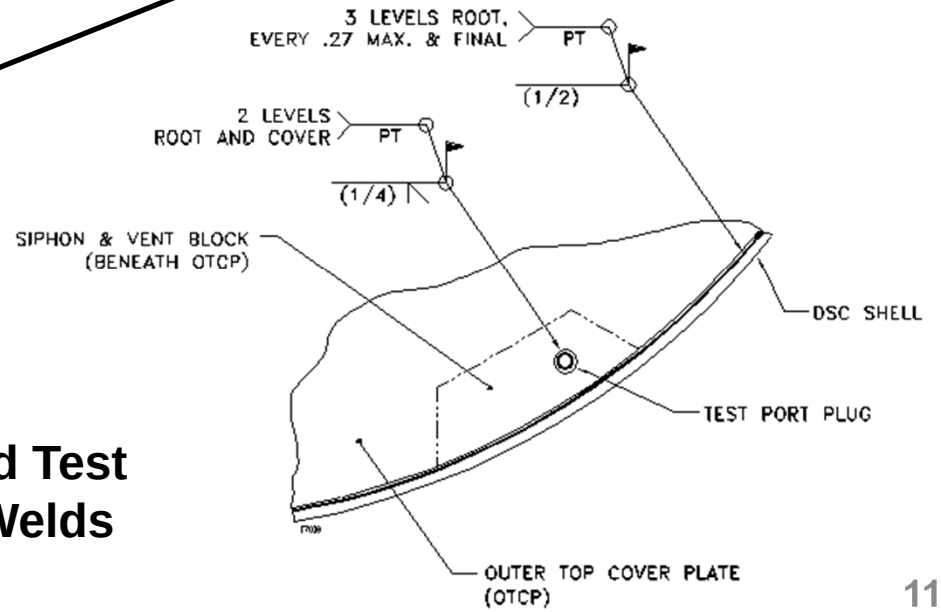
Inner Top Cover Plate and Siphon & Vent Port Cover Plate Field Closure Welds





Outer Top Cover Plate and Test Port Plug Field Closure Welds

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Technical Assessment – Phase I

- Safe to move DSC 16
  - Repairs to DSC 16 have been completed
  - Storage in HSM is preferred (safest) location for DSC
- Additional Controls proposed for the move
  - Limit the height of the DSC during move to 66”
  - Expand distance to non-essential onsite vehicles
  - Expand distance from haul path to fire and explosion potentials
  - Expand controls for sources of combustibles or flammable liquids
  - Pre-stage fire suppression equipment
  - Perform work on weekend to remove interferences

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Technical Assessment – Phase I

- Other DSC accidents, transients not likely during short duration of move
  - Tornado/Winds – Eliminated by procedural controls
  - Earthquake – not predictable, but very low risk
  - Flood - Eliminated by procedural controls
  - Accidental Cask Drop – Evaluated and reduced by Additional Controls
  - Lightning - Eliminated by procedural controls
  - Thermal Heatup - Eliminated by procedural controls
  - DSC leakage – Verified DSC is not leaking
  - Accidental Pressurization – UFSAR analysis remains valid

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Technical Assessment – Phase I

- Alternatives Examined
  - Scope 1: Completely remove OTCP, TPP, SPCP and VPCP welds, remove ITCP weld down to root pass. Reweld per required process, perform VTs, PTs, and TS requirements
  - Scope 2: Completely remove OTCP, TPP, SPCP, VPCP and ITCP welds. Unload fuel from DSC 16, reload at a later date.
  - Each scope formally evaluated by NSPM

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Technical Assessment – Phase I

- Alternative Scope 1 – ITCP root weld exposed:
  - Risk: First-of-a-kind operation to remove weld material down to only root pass of ITCP
    - Could damage DSC to the point where replacement is required
    - Difficult to verify root weld exposure
  - Risk: Introduction of foreign material and debris into SFP
  - Dose: Estimated dose of 1.3 Rem for alternative activities above movement of DSC 16 to HSM
  - Radioactive Waste: OTCP and Generation of metal shavings, potential for damage to ITCP – becoming scrapped
  - Advantage: All weld passes examined by PT

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Technical Assessment – Phase I

- Alternative Scope 2 – Unload DSC 16:
  - Risk: Would damage DSC - replacement is required
  - Risk: Foreign material in form of oil contamination and cuttings in the SFP
  - Risk: Exposure to fuel
  - Risk: Extra handling of fuel and heavy loads in and over SFP
  - Dose: Estimated dose of 1 Rem for alternative activities above movement of DSC 16 to HSM

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DSC in the TC on the MNGP Refuel Floor

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Technical Assessment – Phase I

- Conclusion
  - DSC 16 weld repairs are satisfactory
  - Additional Controls will ensure limited risk of unexpected conditions
  - Short duration of move limits risk of other accidents and transients
  - Lower dose than further work on DSC 16

Conclusion: Acceptance of DSC 16 in current condition and movement of DSC 16 to HSM is the safest alternative

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Technical Assessment – Phase II

- Credited Design Functions of a DSC
  - Criticality Safety
  - Shielding (Radiological Safety)
  - Heat Removal
  - Confinement
  - Structural Support
- AREVA has provided a technical basis that assures design functions are not adversely affected by nonconforming PT examinations

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Technical Assessment – Phase II

Weld	Weld Effect on DSC Design Functions				
	Criticality Safety	Shielding	Heat Removal^	Confinement	Structural Support
Inner Top Cover Plate	NA	NA	NA	X	X
Siphon Port Cover Plate	NA	NA	NA	X	NA
Vent Port Cover Plate	NA	NA	NA	X	NA
Outer Top Cover Plate	NA	NA	NA	NA*	X
Test Port Plug	NA	NA	NA	NA*	NA

^ Direct effects only

* Redundant barrier function for Confinement if inner top cover weld leaks

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Technical Assessment – Phase II

- Criticality Safety and Shielding Functions are not impacted by nonconforming PT examinations
- Thermal Performance (Heat Removal) Function is indirectly affected by nonconforming PT examinations
  - Support from Confinement Function ensures sufficient Thermal Performance through maintenance of helium blanket in DSC cavity
  - DSC cooling is not impacted by nonconforming PT examinations

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Technical Assessment – Phase II

- Confinement Function - Impacted by nonconforming PT examinations
  - ITCP, SPCP and VPCP welds make up the confinement boundary
  - OTCP and TPP weld provides redundant sealing function for structural support of Confinement function
- Cask drop analysis verifies confinement boundary remaining intact
- Adequate margin provided in welds to meet structural criteria

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Technical Assessment – Phase II

- Confinement Function
  - ITCP, SPCP and VPCP welds provide Confinement Function
  - Confinement Function is verified by 2 vacuum pump-down tests per TS 1.2.2
  - Confinement Function is verified by Helium backfill pressure hold test per TS 1.2.3a
  - Confinement Function is verified by Helium Leak Tight testing (ANSI N14.5) per TS 1.2.4a

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Technical Assessment – Phase II

- Confinement Function - OTCP
  - OTCP and TPP welds provide redundant sealing function for ITCP weld confinement function
  - OTCP weld redundant sealing function indirectly verified by helium leak testing after root weld layer is deposited
  - OTCP weld thickness is controlled (multi-pass weld technique) to be less than calculated minimum critical flaw size
  - OTCP weld thickness is measured and verified smaller than calculated minimum critical flaw size
  - VT examination of weld layers performed

Technical Assessment – Phase II

- Weld Assessment
  - UFSAR criteria is a pinhole leak may exist in weld layers
  - Multi-pass welds reduce likelihood that leak will occur through successive weld layers
  - Welds performed using Appendix B QA program
  - Welding performed by procedure and monitored
  - Use of automated welding process
  - Through weld flaw size (OTCP) is controlled (multi-pass weld technique) to be less than calculated minimum critical flaw size

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Inspection of DSC 16

OTCP weld

Technical Assessment – Phase II

- Structural Support Function - Impacted by nonconforming PT examinations
  - Welds modeled at minimum effective throat thickness (ITCP and OTCP)
  - Designed to accommodate normal, off-normal and accident conditions
  - Designed to ASME design criteria with stress reduction factor from ISG-15 applied
  - Nonconforming PT exam does not impact weld formation principles or use of multi-pass weld techniques

Technical Assessment – Phase II

- Structural Support Function - OTCP Weld
  - Limited to 0.27” thick layers – critical flaw size is 0.29”
  - Material strength not changed by proposed exemption
  - Bounding accident remains the transfer cask drop
  - Weld flaws anticipated by ISG-15 require joint efficiency factor of 0.80 - Analysis uses 0.70 factor for conservatism
  - Welds not subject to significant cyclic loading or thermal cycles

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Technical Assessment – Phase II

- Conclusion
  - Exemption Request does not adversely affect Criticality Safety, Shielding/Radiological safety, Heat Removal, Confinement Integrity or Structural Support Functions of DSC
  - Confinement boundary is confirmed via Helium Leak Test that provides a more direct indication of confinement boundary integrity than the required PT examination
  - Weld strength is adequate with margin to meet structural function
  - Therefore, conclude exemption is safe to grant.

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Alternatives Examined

- Rework DSCs 11 - 16 back to Conformance
  - Scope: Completely remove OTCP, TPP, SPCP and VPCP welds, machine ITCP weld down to root pass
  - Rework: Reweld per normal process, perform VTs, PTs, vacuum drying, helium pressure test, and helium leak check in accordance with procedures and TS
  - Risk: First-of-a-kind operation to remove weld material down to only root pass of ITCP
    - may require prior NRC approval
    - could damage DSC to the point where replacement is required
  - Risk: Introduction of foreign material and debris into SFP

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Alternatives Examined

- Rework DSCs 11 - 16 back to Conformance
  - Risk: Movement of DSCs 11 – 15 from HSMs up to Refueling floor and back to HSMs
  - Dose: Estimated dose of 10 Rem for repair activities
  - Radioactive Waste: OTCP and Generation of metal shavings, potential for damage to ITCP – becoming scrapped

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Alternatives Examined

- Replace DSCs 11 - 16
  - Scope: Completely remove OTCP, TPP, SPCP, VPCP, and ITCP welds
  - Scope: Unload fuel assemblies from DSC and place into SFP
  - Replace: Scrap existing DSCs – Replace with new DSCs
  - Load: Prepare and Load Replacement DSCs
  - Weld: Replacement DSCs welded per normal process, perform VTs, PTs, vacuum drying, helium pressure test, and helium leak check in accordance with procedures and TS
  - Risk: Movement of DSCs 11 – 15 from HSMs up to Refueling floor and replacement DSCs back to HSMs

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Alternatives Examined

- Replace DSCs 11 - 16
  - Risk: Reflood of DSC Cavity
  - Risk: Many heavy load lifts over SFP including removal of discarded DSCs
  - Risk: Foreign material in form of oil contamination and cutting in the SFP
  - Dose: Estimated dose of 9 Rem for replacement activities
  - Radioactive Waste: Generation of large sums of metal shavings and six contaminated DSCs

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Alternatives Examined

- Conclusion
  - Lowest risk, lowest dose, lowest radioactive waste generation option is to approve the requested exemption

Conclusion: Suitability of DSCs 11 – 16 for storage in HSM for duration of general license without conditions is demonstrated to be safest alternative

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Environmental Consideration

- Exemption Request
  - Meets the requirements for a categorical exclusion under 10 CFR 51.22(c)(25)
  - No change to the MNGP ISFSI Environmental Report is required
- Alternatives (Repair or Replace)
  - Potential for significant Radioactive Waste and Dose create potential environmental effects

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Schedule

- DSC 16 OTCP weld repair – Complete
- Exemption Request
  - Submit by 06/2014
- Movement of DSC 16 to HSM
- Alternatives
  - No plans to implement alternatives at this time

Acronym List

- ANSI – American National Standards Institute
- ASME – American Society of Mechanical Engineers
- B&PV – Boiler and Pressure Vessel
- BWR – Boiling Water Reactor
- CoC – Certificate of Compliance
- DSC – Dry Shielded Canister
- GDC – General Design Criteria
- HSM – Horizontal Storage Module
- ISFSI – Independent Spent Fuel Storage Installation
- ISG – Interim Staff Guidance
- ITCP – Inner Top Cover Plate
- MNGP – Monticello Nuclear Generating Plant
- NDE – Nondestructive Examination
- NRC – Nuclear Regulatory Commission
- NSPM – Northern States Power – Minnesota
- NOS - Nuclear Oversight
- OTCP – Outer Top Cover Plate
- PT – Dye Penetrant Test
- QA – Quality Assurance
- Rem - Roentgen Equivalent in Man
- SFP – Spent Fuel Pool
- SPCP – Siphon Port Cover Plate
- SSC – Structures, Systems and Components
- TC – Transfer Cask
- TPP – Test Port Plug
- TS – Technical Specifications
- UFSAR – Updated Final Safety Analysis Report
- VPCP – Vent Port Cover Plate
- VT – Visual Examination

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Discussion

Technical Specification Testing Results

Procedural Requirement	DSC					
	11	12	13	14	15	16
TS 1.1.11 - Hydrogen Monitoring performed while welding	X	X	X	X	X	X
TS 1.1.12.4 – Pressure test DSC cavity to ITCP weld. Pressurize to between 29.2 psia and 30.7 psia and hold for minimum of 10 minutes.	X	X	X	X	X	X
Hold time (minutes)	10	10	10	11	11	11
TS 1.2.2 (Initial pump down) - DSC kept at or below 2.8 torr for at least 30 minutes	X	X	X	X	X	X
Initial vacuum reading (torr)	1.40	1.13	1.807	1.198	1.49	1.191
Final vacuum reading (torr)	2.044	1.90	2.53	2.02	2.08	2.011
Hold time (minutes)	30	31	31	31	31	30
TS 1.2.2 (Final pump down) - DSC kept at or below 2.8 torr for at least 30 minutes	X	X	X	X	X	X
Initial vacuum reading (torr)	1.23	1.373	1.872	1.33	1.90	1.330
Final vacuum reading (torr)	1.77	1.859	2.50	1.84	2.34	1.770
Hold time (minutes)	30	33	32	30	31	34
Gauge Error	.011	.0042	.016	.005	.017	.011
TS 1.2.3a - DSC backfilled to pressure of 17.2 psia ± 1.0 psi for at least 30 minutes.	X	X	X	X	X	X
Initial pressure reading (psia)	17.283	17.203	17.234	17.20	17.12	17.031
Final pressure reading (psia)	17.272	17.207	17.210	17.22	17.141	17.04
Pressure Gauge error	0.00	.000174	.00029	.0006	.00012	0.00
Hold time (minutes)	30	30	31	31	31	34
TS 1.2.4a - verified that DSC leakage rate is limited to ≤ 1.0×10^{-7} cubic centimeters/sec	X	X	X	X	X	X
Leakage rate (cc/s)	9.5E-10	1.0E-9	1.4E-9	6.6E-10	5.4E-9	1.5E-9