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Rancho Seco

Site-Specific ISFSI License Renewal (SNM-2510) Docket 72-11

Second Pre-Application Meeting with the NRC
August 4, 2017

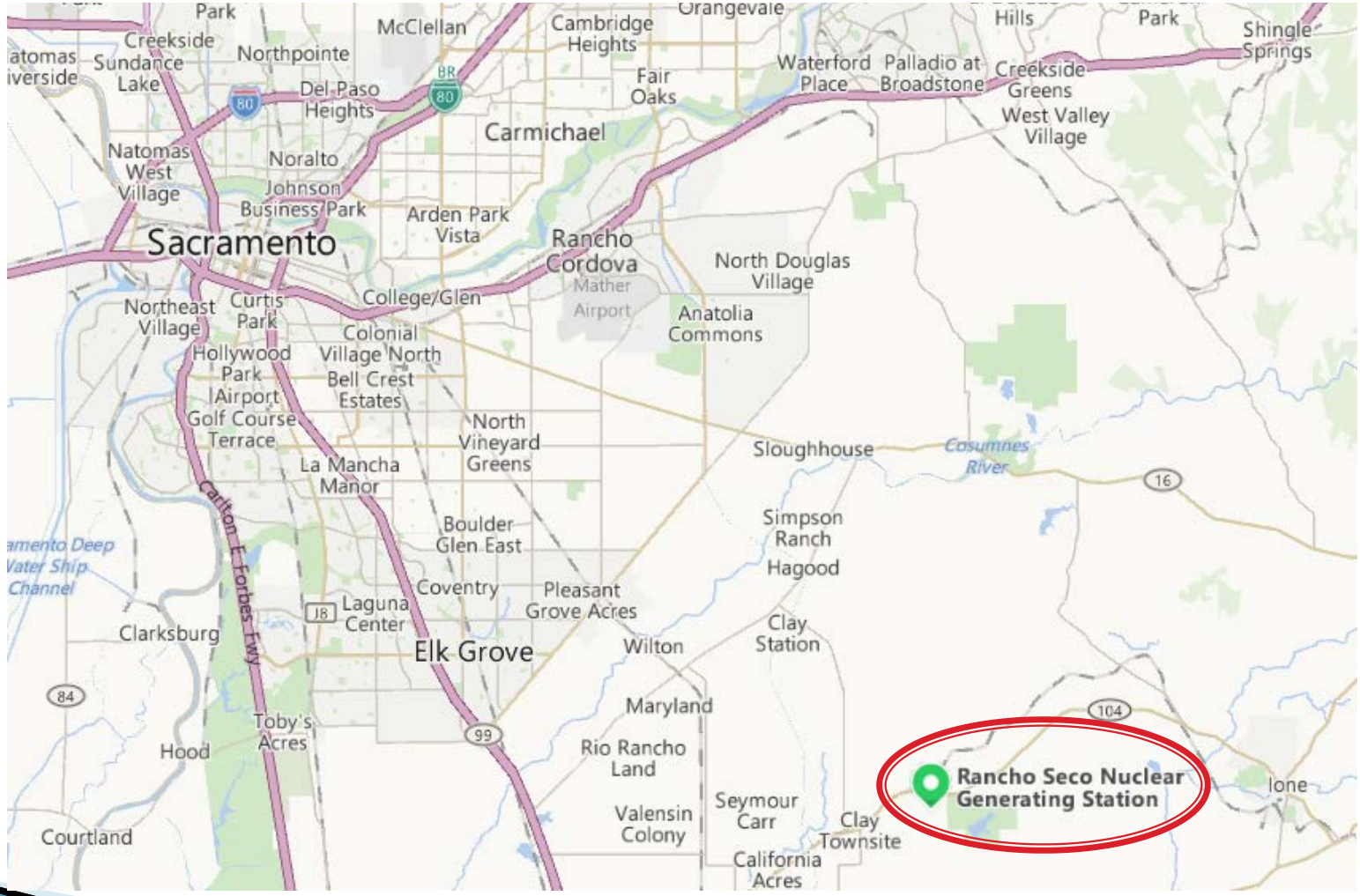
Agenda

- Introductions
- Rancho Seco ISFSI Background
- NRC Regulations & Guidance
- License Renewal Application (LRA) Status
- Scoping and Aging Management Reviews (AMRs)
  - Materials of In-Scope SSCs
  - Time-Limited Aging Analyses
  - Aging Management Programs
- Pre-Application Inspection and Results
- Summary
- Remaining Activities

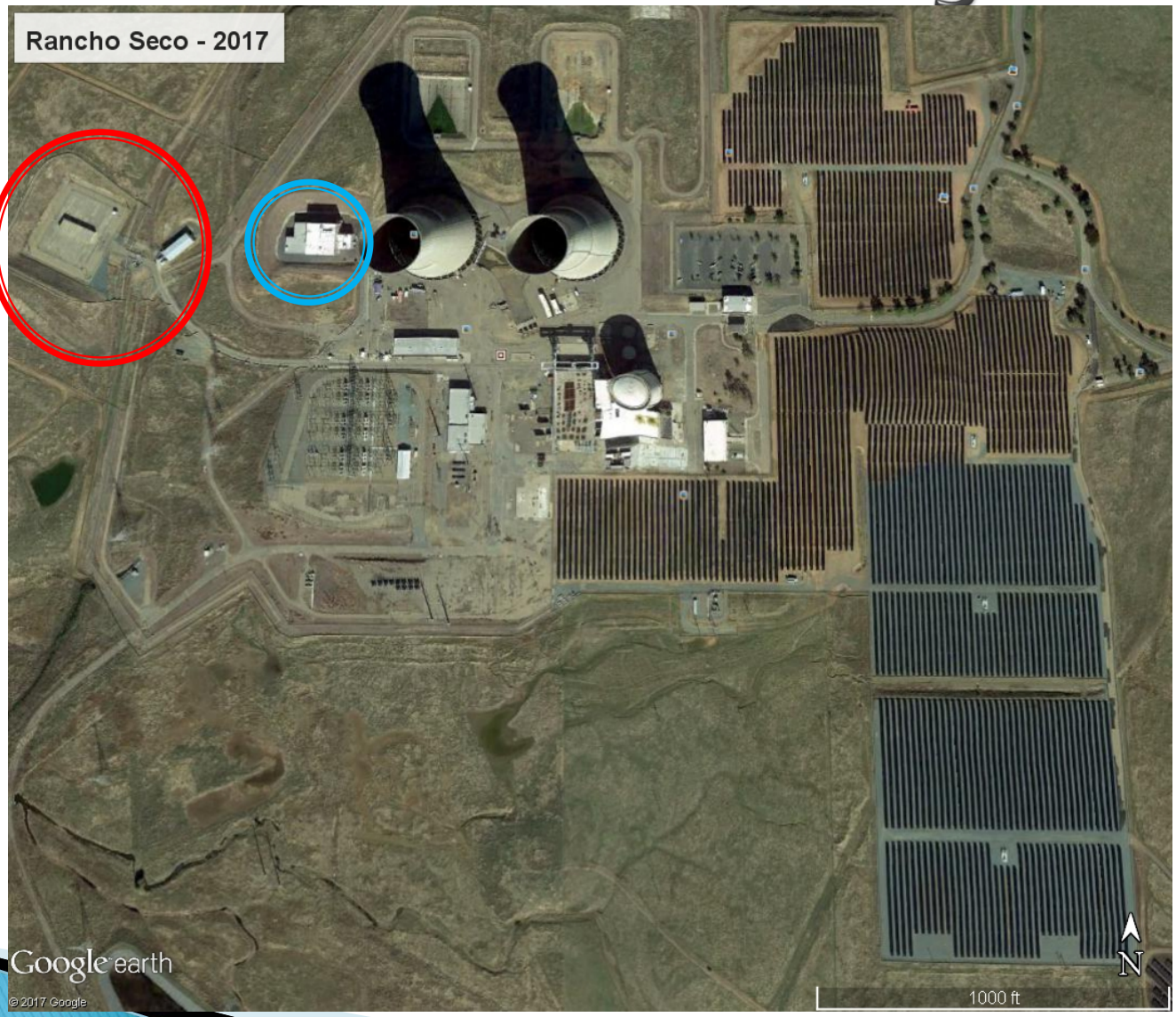
Ranch Seco ISFSI Background

- License granted June 30, 2000
  - Initial 20-year term
  - Two exemptions (administrative)
  - Three Amendments
  - Amendment 4 under review
- LRA will request a 40-year period of extended operation (PEO)
  - Deadline for timely renewal: 6/30/18
  - Intent is to submit well in advance

Rancho Seco ISFSI Background



Rancho Seco ISFSI Background



NRC Regulations and Guidance

- 10 CFR 72.42
- NUREG-1927 Rev. 1
- NEI 14-03 Revision 2
- NUREG-1748 Rev. 2
- Draft NRC MAPS Report
- NUREG-1801 Rev. 2
- ISG-2 Rev. 0

LRA Status

- Chapter 1 – General Information (final draft complete)
- Chapter 2 – Scoping Evaluation (final draft complete)
- Chapter 3 – Aging Management Review (Sept. 2017)
- App. A – Time-Limited Aging Analyses (August 2017)
- App. B – Aging Management Program (October 2017)
- App. C – Changes to ISFSI SAR (November 2017)
- App. D – Changes to License Conditions and Technical Specifications (December 2017)
- App. E – Environmental Report Supplement (January 2018)
- App. F – Decommissioning Funding (January 2018)
- Compiled LRA will have a final, comprehensive review before submittal after all sections are completed

Scoping Evaluation

- Identified Systems, Structures and Components (SSCs) subject to aging management review (AMR)
- Scoping criteria from NUREG-1927, Section 2
- Scoping process:
  - Review drawings for each of the main components (SSCs) of the Rancho Seco ISFSI
  - Identify SSCs to the subcomponent level as either in-scope or not in scope
  - Produce a detailed database for each system component and subcomponent
  - The summarized Scoping Evaluation results are presented in a detailed table within the LRA

Scoping Evaluation Major Component Results

SSC	NUEREG-1927 Criterion 1	NUREG-1927 Criterion 2	In-Scope?
Dry Shielded Canister (DSC)	Yes	N/A	Yes
Horizontal Storage Module (HSM)	Yes	N/A	Yes
MP187 Transfer Cask (TC)	Yes	N/A	Yes
Transfer Cask Lifting Yoke	No	No	No
Spent Fuel Assemblies (except fuel pellets)	Yes	N/A	Yes
ISFSI Basemat	No	Yes	Yes
ISFSI Approach Apron	No	No	No
Auxiliary Equipment	No	No	No

Aging Management Review

- TLAA Definition (NUREG-1927)
- TLAAs are calculations or analyses meeting all of the following:
  - Involves ITS SSCs in-scope for license renewal
  - Considers the effects of aging
  - Involves time-limited aging assumptions defined by the initial operating term
  - Is relevant to making a safety determination
  - Involves conclusions forming the basis for SSCs to perform their intended functions
  - Contains or is incorporated by reference in the design basis

Aging Management Review

- The following TLAAs for the Rancho Seco ISFSI LRA were identified:
  - Mechanical fatigue analysis for DSCs
    - Result: Fatigue during PEO remains within limits
  - Mechanical fatigue analysis for MP187 transfer cask
    - Result: Fatigue during PEO remains within limits
  - Boron depletion analysis for DSC fuel basket poison plates
    - Result: B-10 density is 99.999% of fabricated value after 60 years

- Additional AMR calculations supporting license renewal:
  - Gamma irradiation and neutron fluence for concrete & metals
    - Result: Dose and fluence do not significantly affect concrete/metal material performance
  - Combustible gas generation in TC neutron shield resin
    - Result: Combustible gas released from radiation is insignificant

Aging Management Review

- Materials/Environments/Aging Effects
  - Identify materials associated with in-scope SSCs
  - Identify the service environments for these SSCs
  - Identify the aging effects and mechanisms requiring monitoring and/or management

Materials of In-Scope SSCs

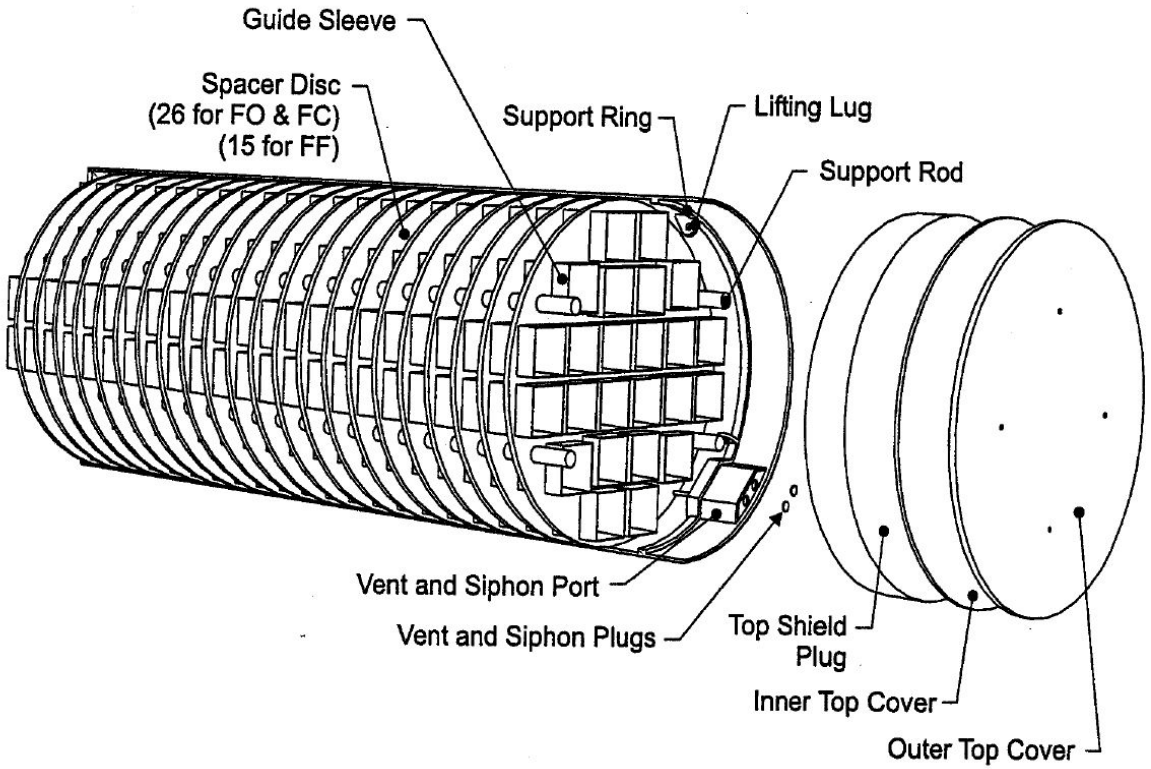
DSC:

Main Assembly:

- stainless steel: shell, support rods, spacer discs (FF-DSC), cover plates
- carbon steel: shield plugs, casing plates, spacer discs (FO & FC-DSC w/electroless nickel)

Basket Assembly:

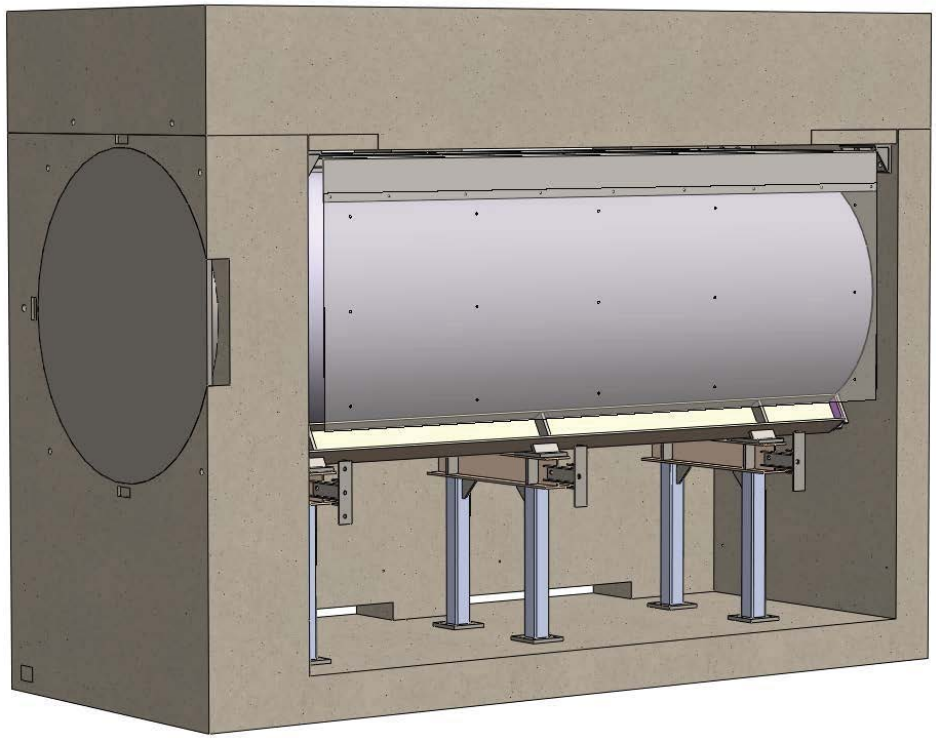
- stainless steel
- Boral poison plate material



Materials of In-Scope SSCs

HSM:

- Reinforced concrete walls, floor, roof
- Carbon steel: DSC support structure w/stainless steel Nitrile 60 rail plates; door plates, heat shields, retainer assembly, docking ring, miscellaneous hardware



Aging Management Reviews

Materials of In-Scope SSCs (cont'd)

MP187 Transfer Cask:

- Stainless steel shell; lead gamma shielding; carbon steel fasteners; aluminum support rings & angles; Nitronic 60 canister rails

Aging Management Reviews

Aging Management Reviews

Fuel Assemblies:

- Stainless steel nozzles and guide tubes
- Zirconium-based alloy spacer grid assemblies
- Zircaloy-4 cladding

ISFSI Basemat:

- Reinforced concrete

Aging Management Reviews

- Identification of Environments for in-Scope SSCs:
  - **Inert Gas** –Helium environment inside the DSC cavity
  - **Sheltered** – Protected environment such as HSM interior or MP187 TC inside storage building
  - **Embedded/Encased** – Material sealed inside another material (example concrete rebar)
  - **Outdoor** – Physically exposed to rain, wind, snow etc. (e.g. HSM exterior, ISFSI basemat)
  - **Below-Grade**– exposure to soil conditions

Aging Management Reviews

- Aging Effects and Mechanisms
  - DSC
    - Loss of material due to corrosion (crevice, pitting or galvanic)
    - Loss of material due to cracking (SCC)
  - HSM concrete
    - Loss of material and cracking due to freeze-thaw cycles
    - Loss of material due to aggressive chemical attack
    - Loss of material due to corrosion
    - Change in material properties from leaching, aggressive chemical attack

Aging Management Reviews

- Aging Effects and Mechanisms (cont'd)
  - MP187 Transfer Cask
    - Loss of material due to corrosion (general, crevice, pitting or galvanic) or wear
    - Cracking due to SCC, thermal fatigue
    - Change in material properties due to elevated temp & irradiation embrittlement
  - ISFSI Basemat
    - Loss of material and cracking due to freeze-thaw cycles
    - Loss of material due to aggressive chemical attack
    - Loss of material due to corrosion (including embedded steel)
    - Loss of material due to delayed ettringite formation
    - Cracking due to reaction with aggregates or settlement
    - Change in material properties from leaching, aggressive chemical attack

Aging Management Programs

- Aging Management Programs
  - For components and subcomponents in-scope and not having a TLAA or other time-based AMR calculation
  - Address aging effects and mechanisms identified 10 Elements for an each AMP from NUREG-1927
- Tollgates
  - Under development as part of the AMPs
  - NEI 14-03 guidance as applicable to Rancho Seco
  - Reviewing other recent LRAs (e.g., TMI-2)

Aging Management Programs

- Proposed AMPs:
  - HSM inspection program for external and internal surfaces
  - DSC external surfaces inspection program
  - MP187 Transfer Cask external and internal inspection
  - ISFSI Basemat above-ground horizontal surfaces

- Frequency of AMPs:
  - Baseline AMP inspection: Within 24 months following the start of the PEO
  - HSM/DSC/Basemat: 10 year frequency from date of baseline inspection
  - MP187 Transfer Cask: prior to use

Pre-Application Inspection

- SMUD/TN performed a pre-application inspection on May 24, 2017
  - Certified VT-3 and HSM fabrication/concrete SME inspectors
  - Best-effort remote and direct visual inspection :
    - DSC
    - HSMs
    - Basemat

Pre-Application Inspection

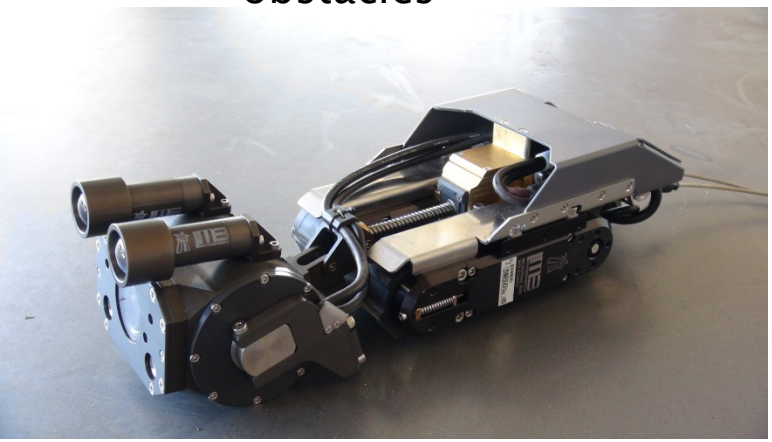
- Selection Criteria
  - Time DSC was in service
  - Initial heat load
  - Fabrication and design considerations
  - HSM array configuration/wind direction

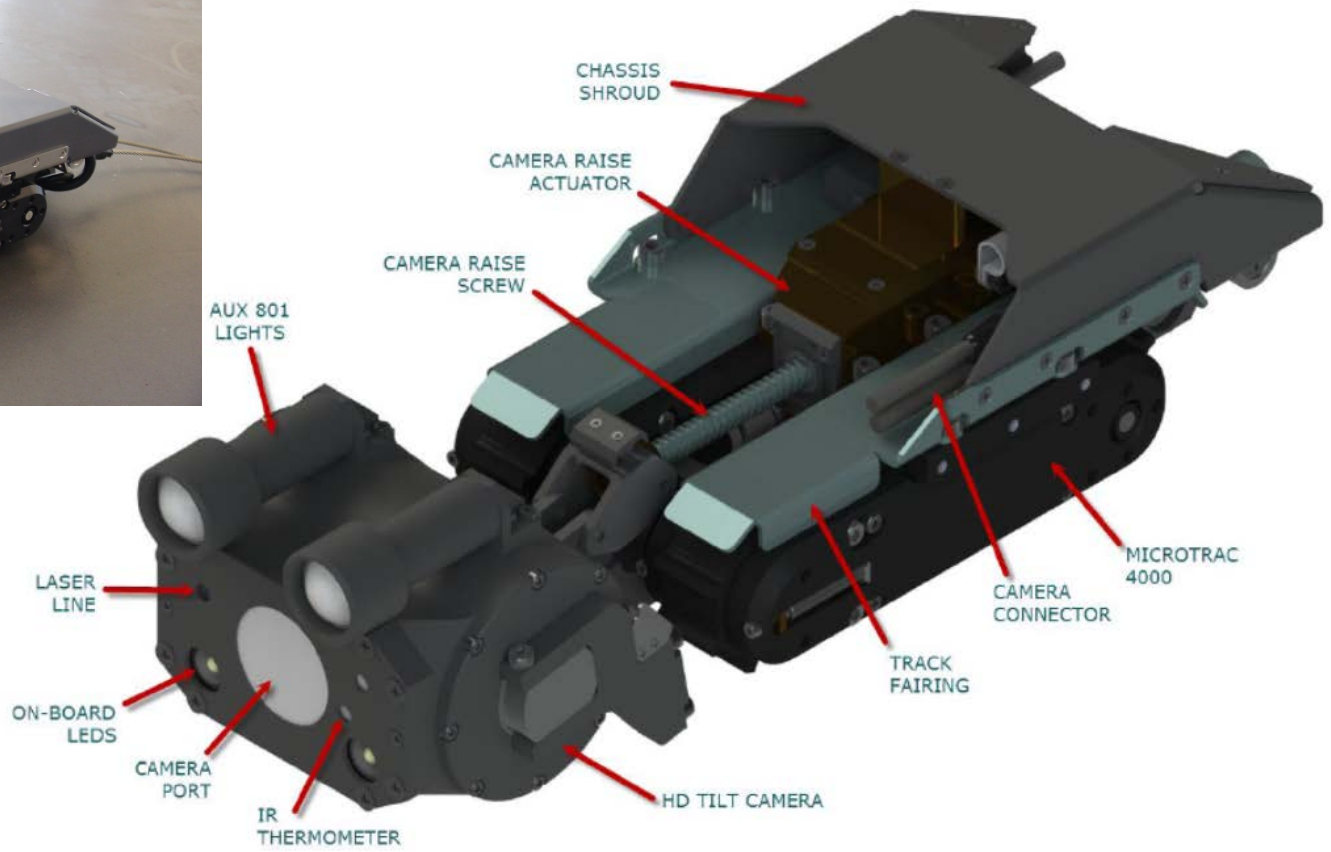
Pre-Application Inspection

- Based on the selection criteria, DSC #FO24P-P01 stored within HSM #20 was chosen for the pre-app inspection. Key considerations:
  - This DSC/HSM pair has the longest time in-service
  - Although this DSC had rather high initial heat load, time in service yielded low shell temperature (99.8 – 145.9°F)

Pre-Application Inspection

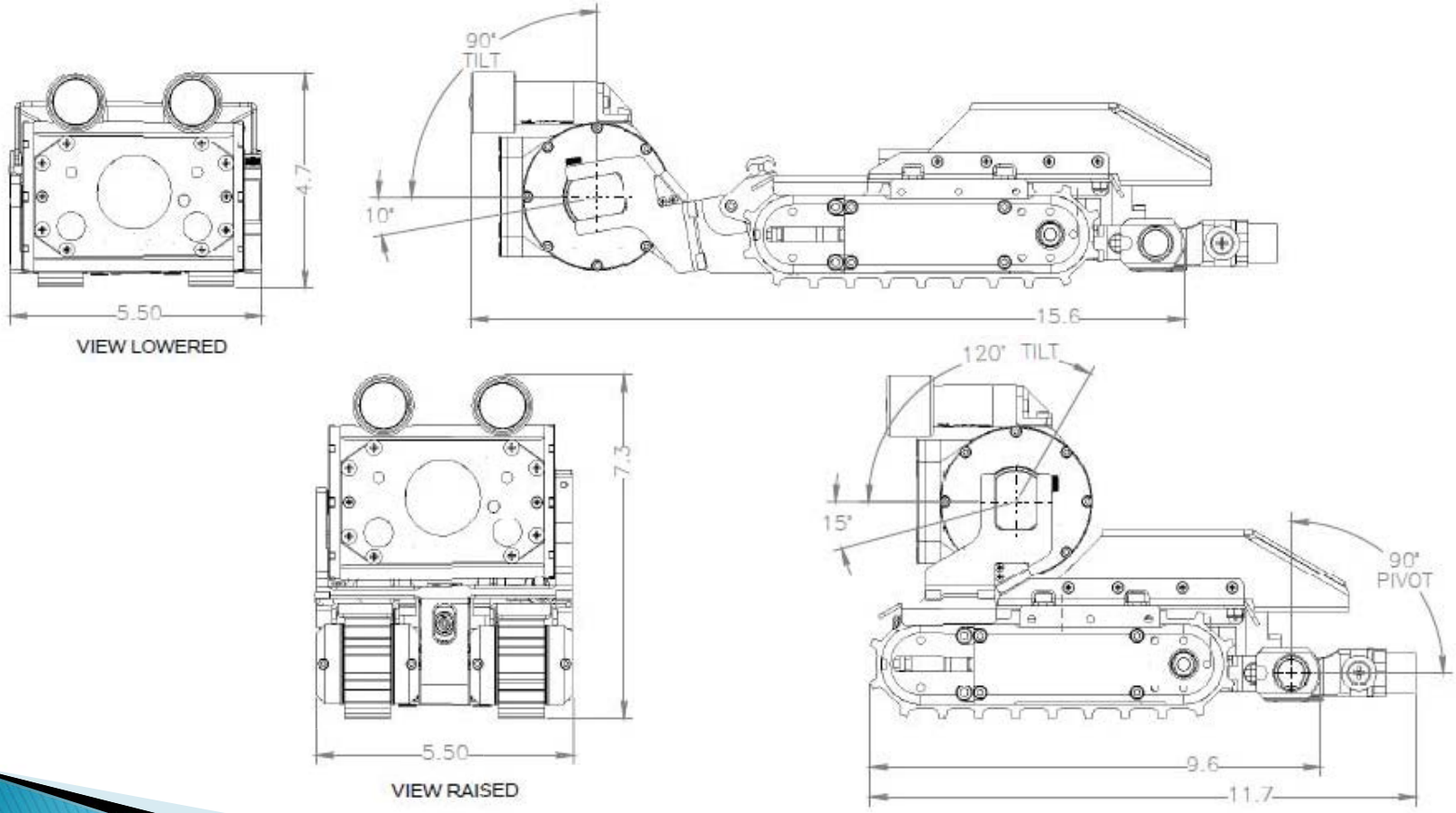
- Remote visual inspection was performed with the MaggHd Crawler
  - Designed and fabricated to overcome the access and environments obstacles





Pre-Application Inspection

- MaggHd Crawler



Pre-Application Inspection

- MaggHd Crawler Controls

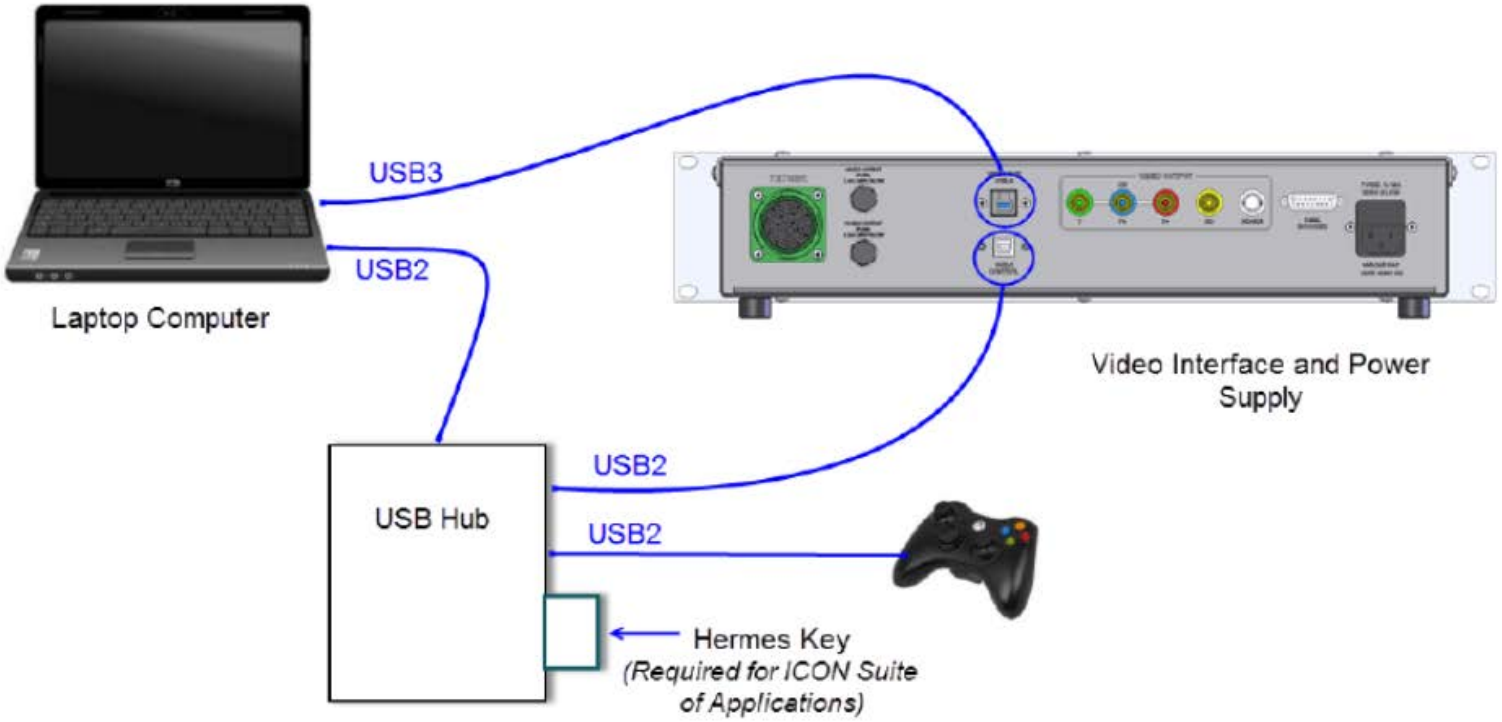
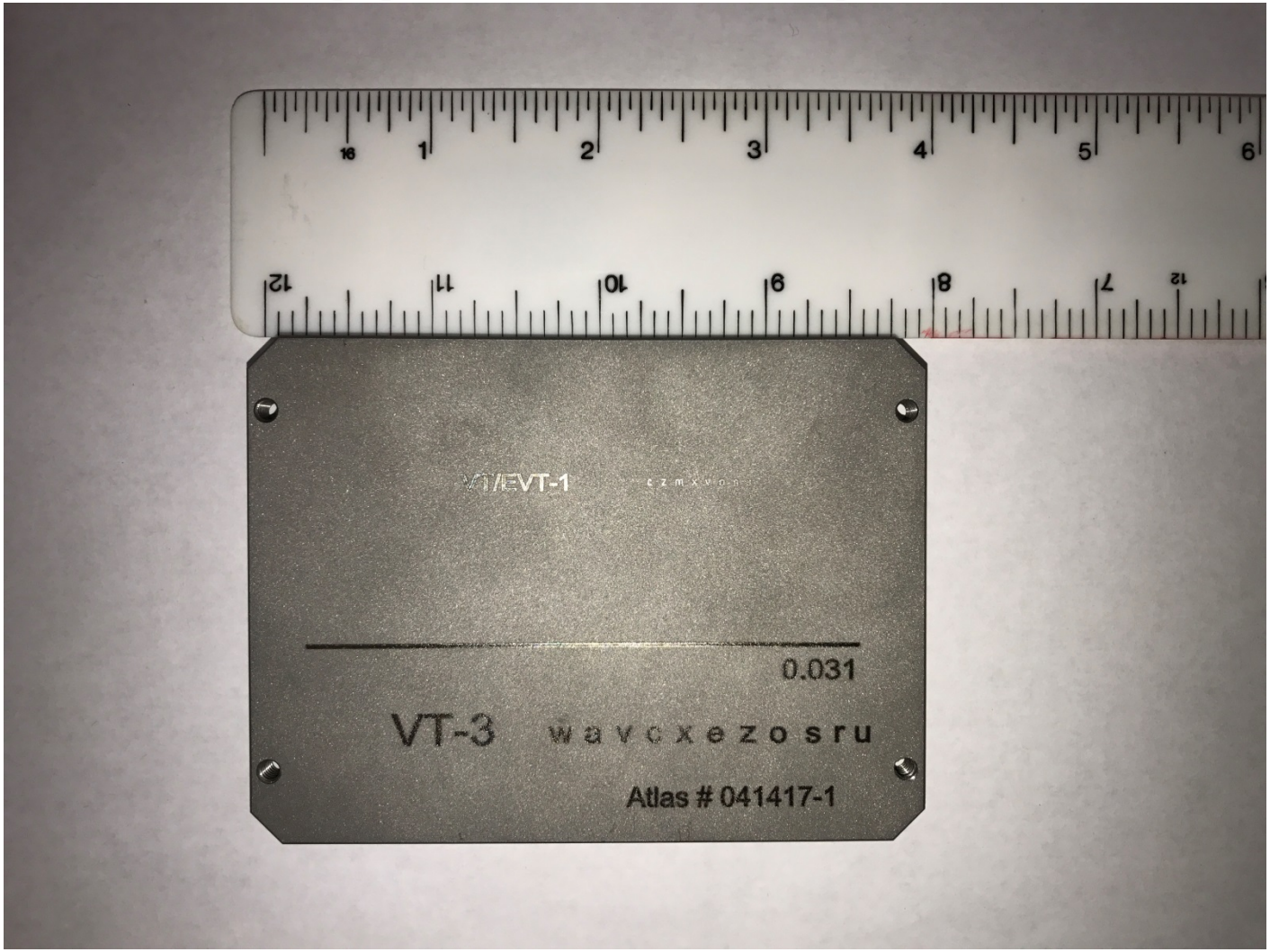


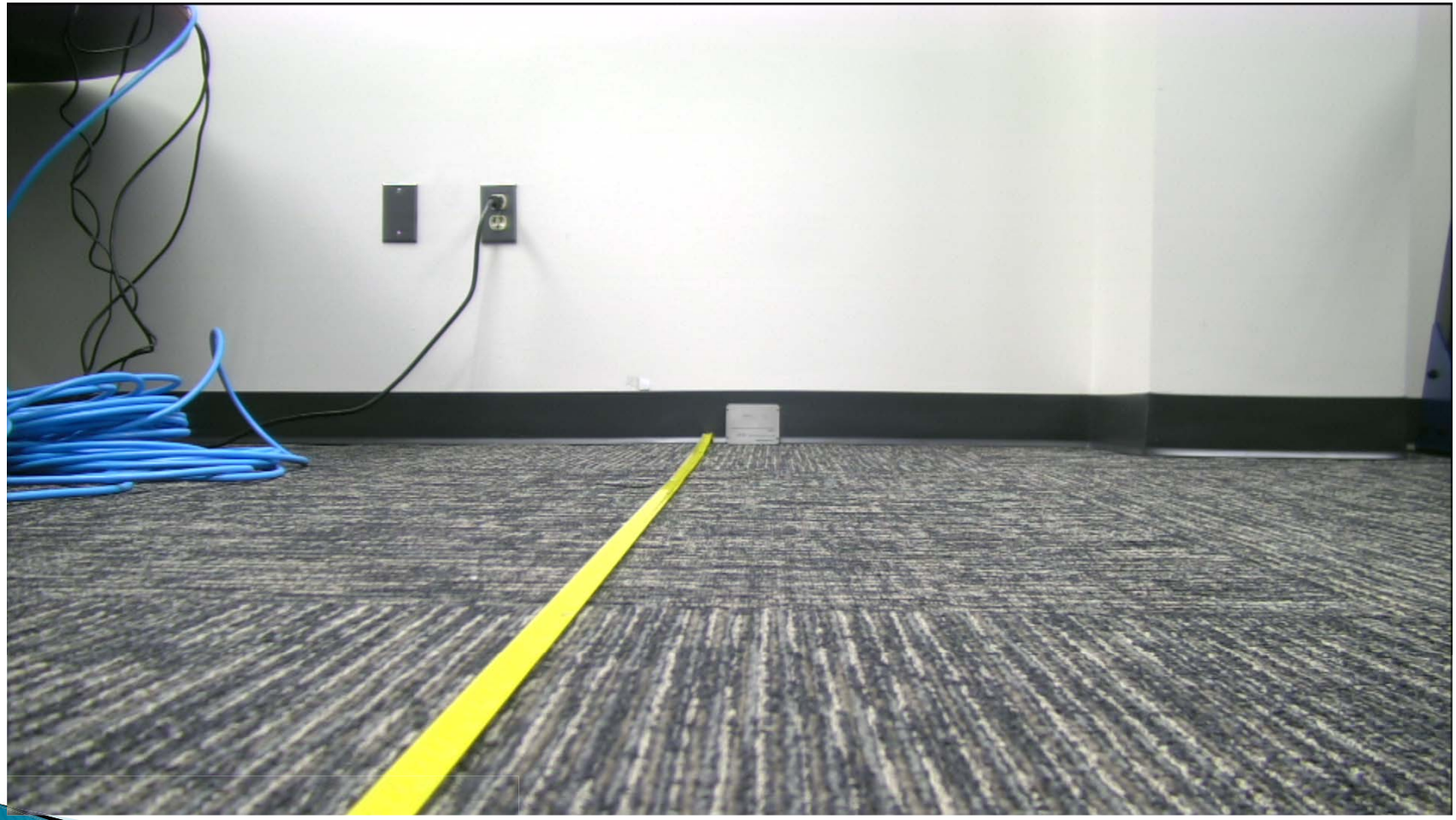
Figure 3 – System Connections

Pre-Application Inspection

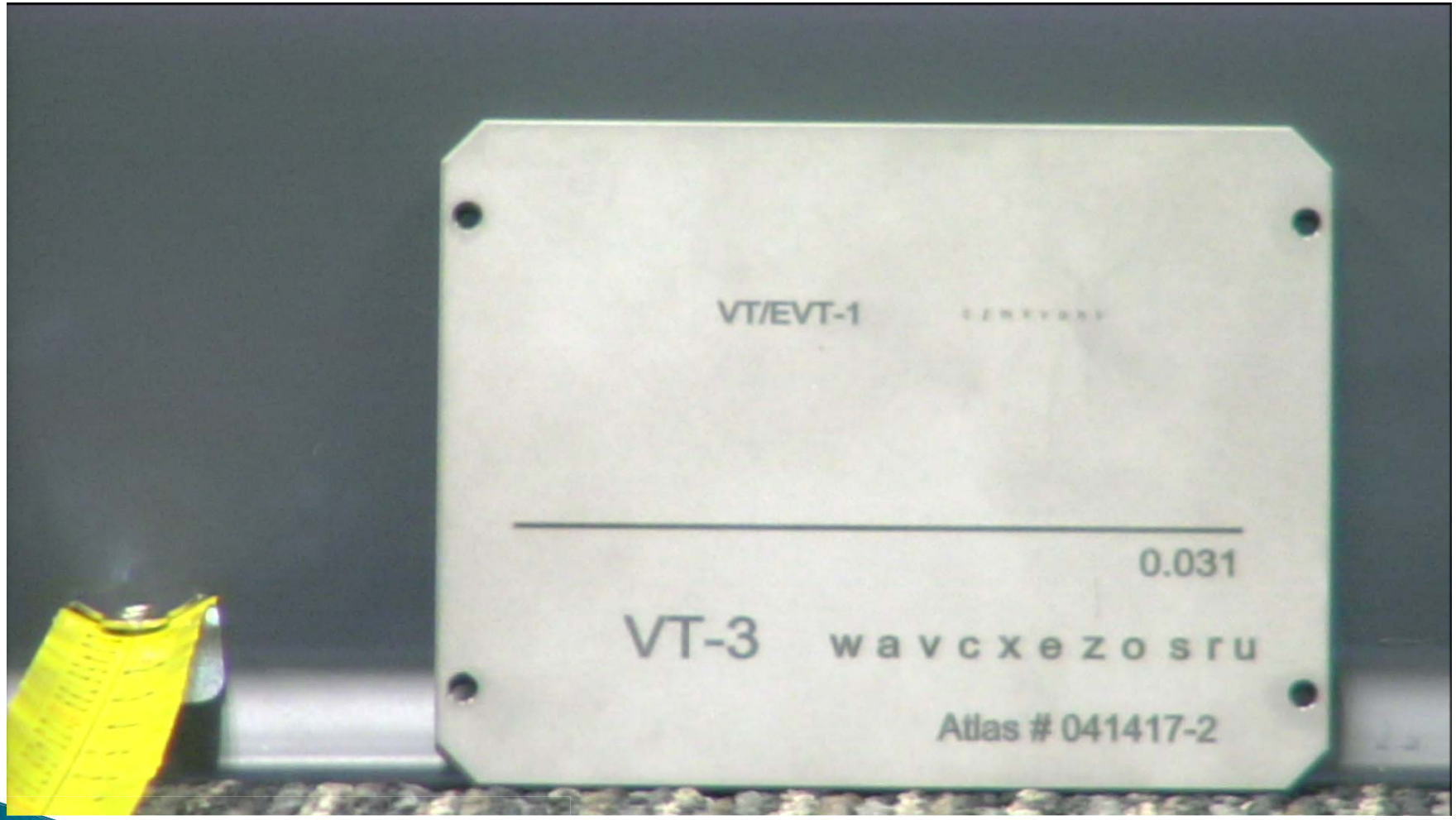
Pre-Application Inspection



Pre-Application Inspection



Pre-Application Inspection



Pre-Application Inspection

- HSM
  - Roof (direct visual)
  - Front door (direct visual – exterior; remote visual – interior)
  - End Walls & Floor (remote visual – interior)
  - Vent Openings (direct visual – exterior; remote visual – lower interior)
  - Heat Shields (remote visual – interior)
  - DSC Support Structure (remote visual – interior)
- DSC
  - Shell Bottom (remote visual – interior)
- Basemat
  - Direct visual of Basemat surfaces extending beyond HSM array perimeter

Pre-Application Inspection

- Chloride Sample Analysis:
  - Surrogate chloride sample obtained from steel and aluminum structure surfaces in the Rancho Seco Auxiliary and Turbine Buildings
  - Test samples, control samples from each building
  - Control samples cleaned, measured for chlorides
  - Test samples' chloride level minus control samples' levels determine deposited chlorides
- Auxiliary Building Sample Result:
  - 18.5 mg/m^2 (horizontal surface)
  - Much lower than published values measured at other study sites, ranging from 60 to 200 mg/m^2
  - CISCC Susceptibility Ranking "2" on a 10 scale

Pre-App Inspection Photos

Figure 23

Picture: HSM Array South Elevation (HSM-02 far left)

Pre-App Inspection Photos

Figure 24

Picture: West End Shield Wall South Panel

The end shield walls consist of four vertical slabs attached to the end modules with through studs at the bottom and metal straps at the top. The concrete surface has minor superficial map cracking that is not deleterious. There are no spalls. The grout patches for filling the lifting embeds are sound. The light discolorations are superficial and appear to be part of the original construction.

Pre-App Inspection Photos

Figure 26

Picture: End Shield Walls East Side

The east shield walls are identical to the west panels. There are two shear keys reinforced with galvanized angles at the corners. The shear keys are intact. There are no spalls and the visible cracks are typical and minor. The grout patches for filling the lifting embeds are sound. The light discolorations are superficial and appear to be part of the original construction.

Pre-App Inspection Photos

Figure 27

Picture: Base mat East Side facing south

Pre-App Inspection Photos

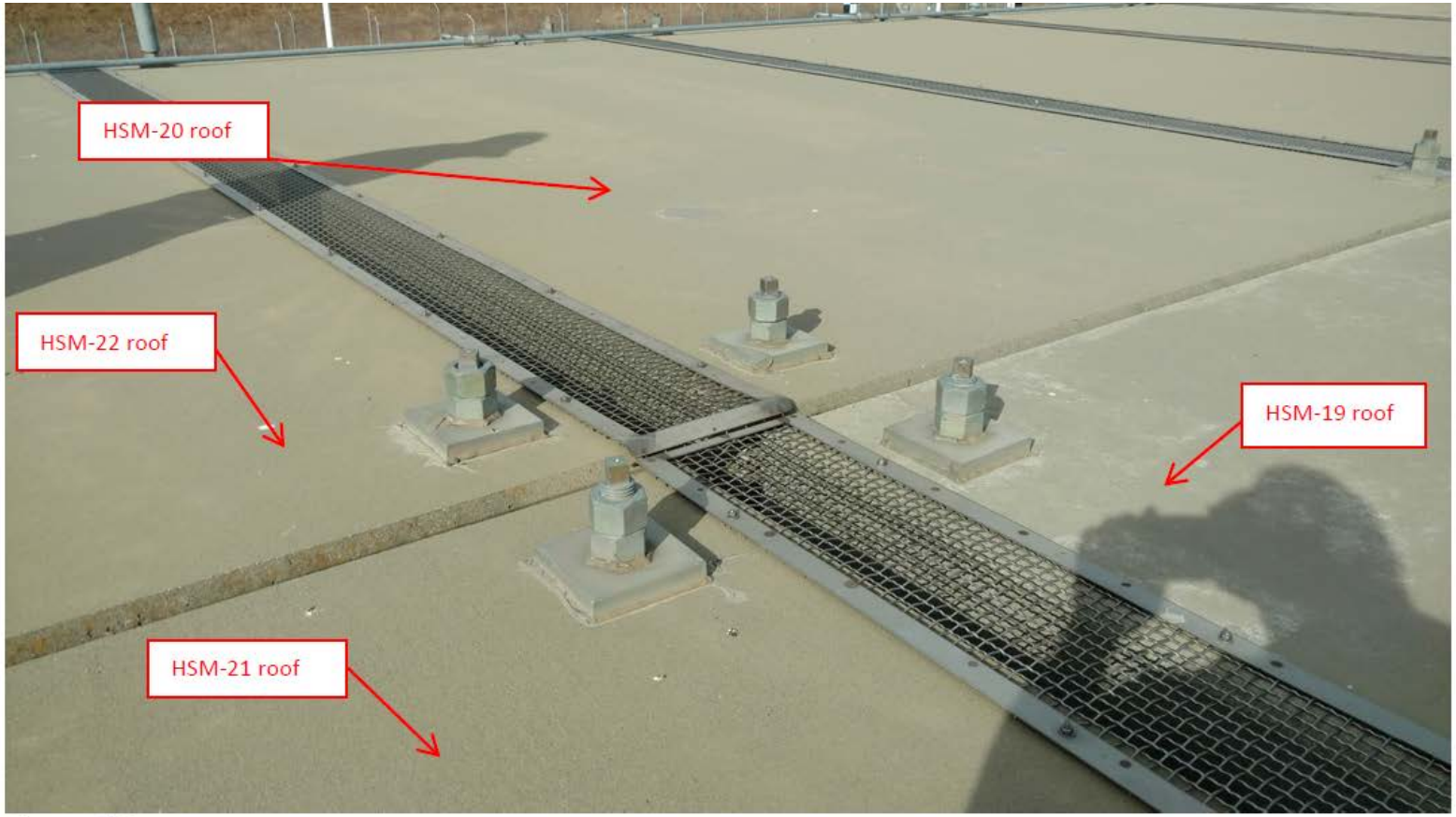


Figure 22

Picture: HSM-20 Roof

Pre-App Inspection Photos

Figure 6

Picture: Floor at HSM Interior Northwest Corner, looking north.

No anomalies noted.

Pre-App Inspection Photos

Figure 11

Picture: Northwest corner. Items visible in the picture are the side and upper heat shields mounted on the side wall and ceiling, respectively. The DSC is at right (dark gray).

The DSC support rail is at the far right. No anomalies noted.

Pre-App Inspection Photos

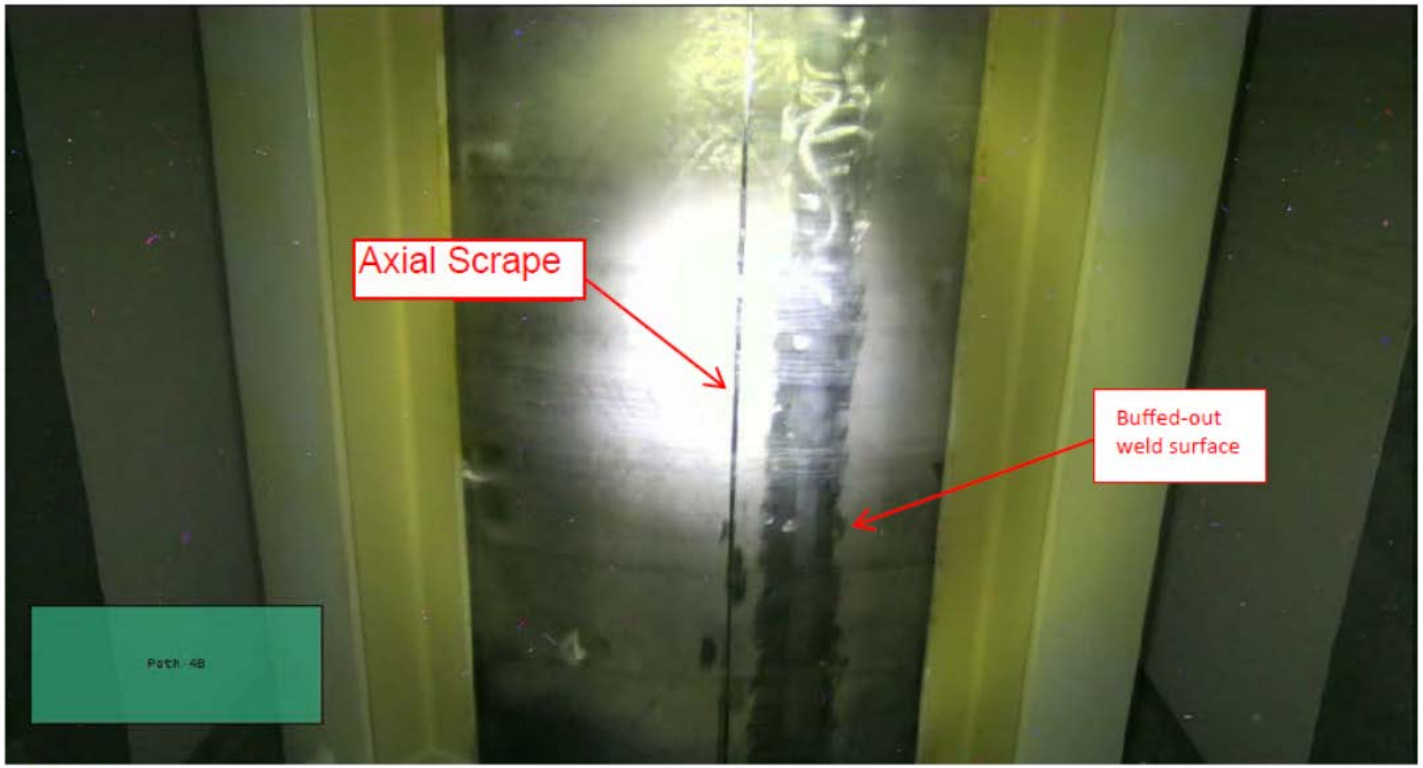
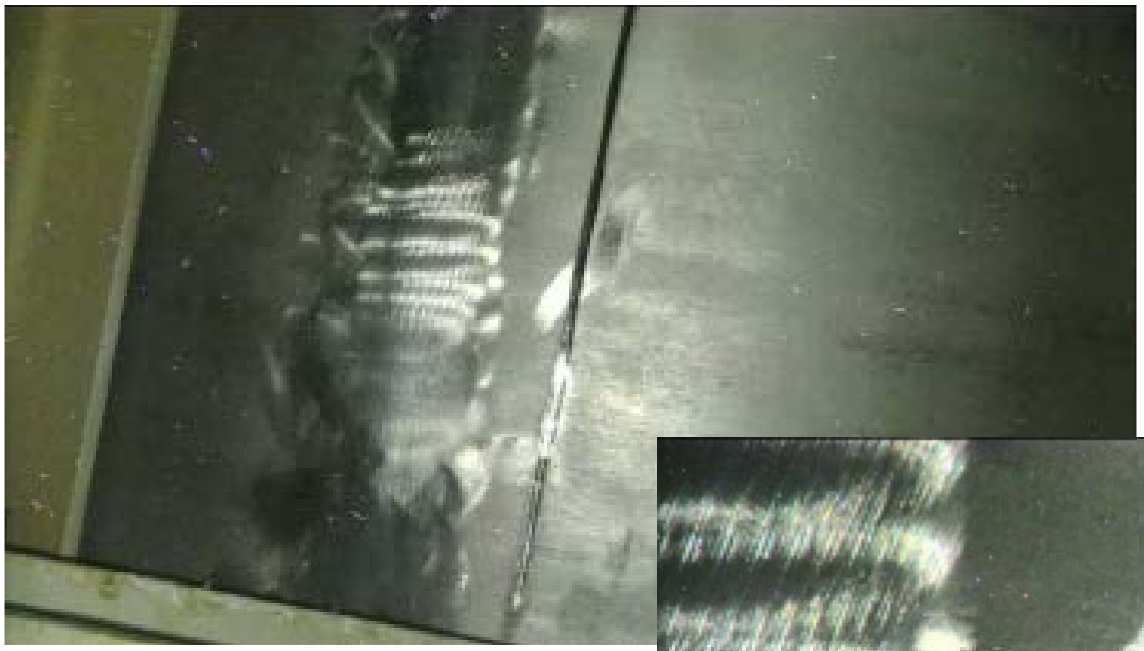
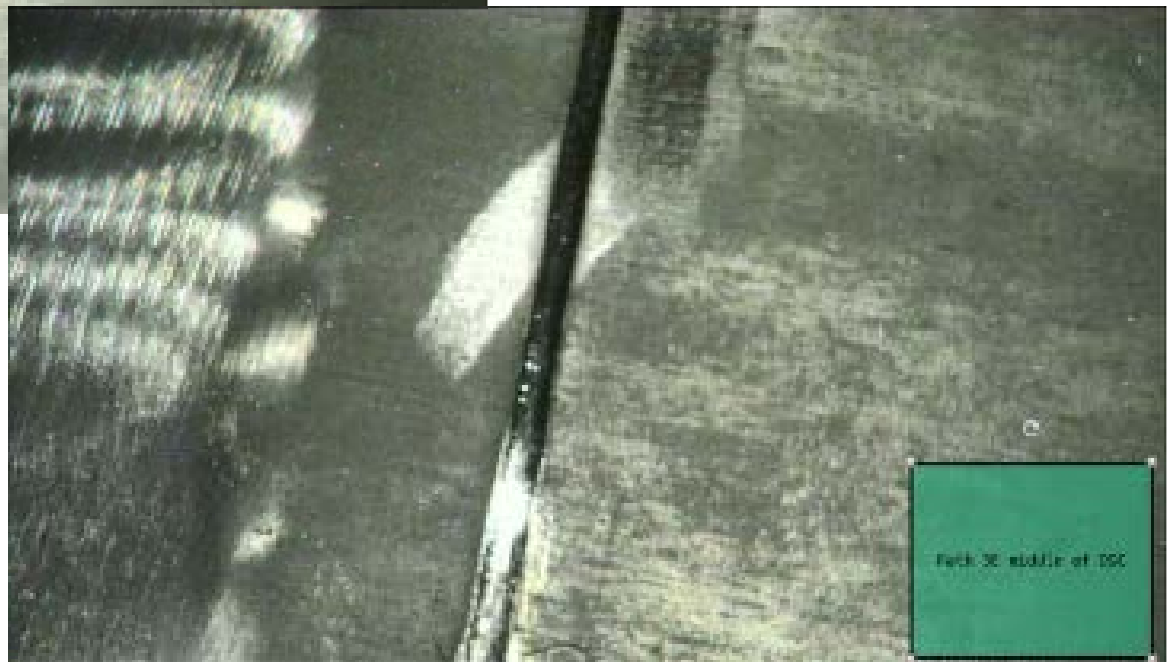


Figure 17

Scrape on bottom of DSC extends from approximately 4" from south DSC Door to the middle of the DSC along axial line. Also, buffed-out weld surface can be seen to the right of the scrape. No indication of degradation was observed.

Pre-App Inspection Photos





Pre-App Inspection Photos

Figure 20

Picture: DSC Bottom and support rail, east side, between Support #2 and Support #3.

Note discoloration streaks can be seen on the DSC that appear to be rail lubricant carried by rainwater intrusion. The streaks appear to be dry with no indication of active water intrusion.

DSC/HSM Interior Video Inspection

- DSC #P01 centerline South to North
- HSM 20 North and South interiors

Pre-Application Inspection Results

- Overall observations:
  - DSC scrape that occurred during DSC handling, previously identified and accepted as-is
    - Visual assessment after 15+ years in service
    - No signs of any active degradation
  - Several dried discolored liquid tracks likely due to rainwater intrusion on DSC shell
  - No indications of age related degradation observed in HSM steel support structures
  - No indications of age related degradation observed in basemat or HSM concrete

Summary

- Rancho Seco ISFSI site is a fundamentally benign environment for potential degradation of metal and concrete
  - Not near a source of salt water
  - No operating cooling towers
  - No snow/ice management activities to create airborne chlorides
  - Low humidity
- DSCs and HSMs SSCs are in very good condition after over 15 years of service
- Appropriate AMPs are being established to monitor aging effects and managing aging mechanisms of these SSCs.
- Proposed AMPs and frequencies will be commensurate with the materials and service environments for in-scope SSCs

Remaining Activities

- Complete remaining individual LRA chapters and appendices and compile LRA (thru Q1 2018)
- Final technical and editorial review (Jan-Feb 2018)
- SMUD management review and approval
- Finalize and submit LRA (March 2018)
  - 90 days in advance of timely renewal deadline
  - Consulting NRC "Guidance for Electronic Submittals"

NRC Observations from the Rancho Seco ISFSI Inspection

Darrell Dunn

August 4, 2017

Background

- Rancho Seco Independent Spent Fuel Storage Installation (ISFSI) license issued on 6/30/2000
- Rancho Seco ISFSI has 22 loaded systems
  - 21 spent fuel storage systems 72-1004 24PT pressurized water reactor (PWR) dry storage canisters (DSCs) - loading completed on 8/22/2002
  - 1 greater than class C (GTCC) waste canister - loaded 8/22/2006
- MP187 used to transfer DSCs to the concrete horizontal storage modules (HSMs)
- NRC staff observed the Rancho Seco ISFSI inspection conducted to support the ISFSI license renewal

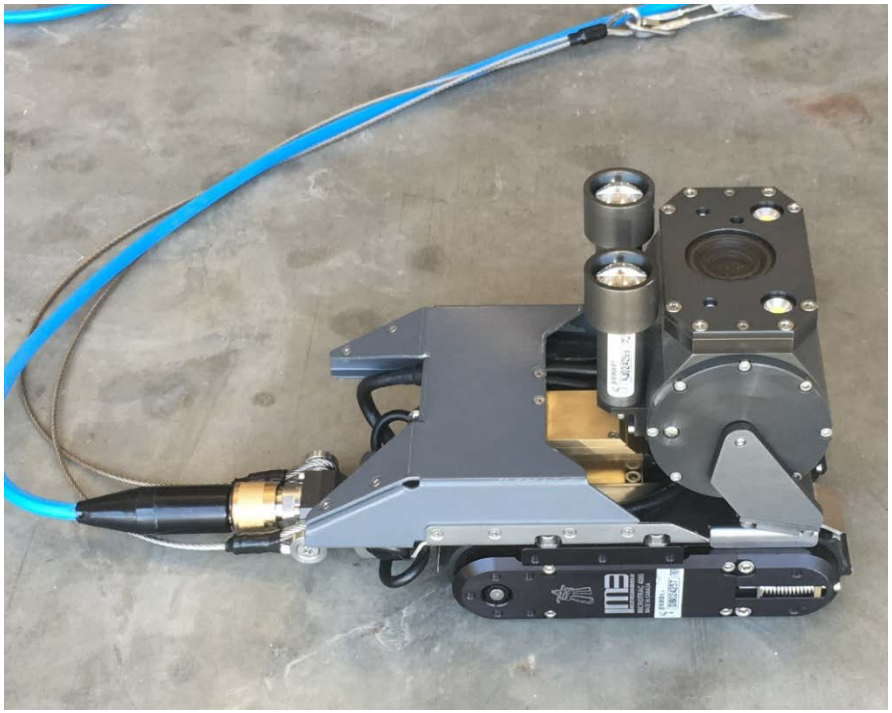
NRC Staff Observation

- NRC staff observed the Rancho Seco ISFSI inspection conducted in May 2017 to support the ISFSI license renewal
  - Inspection System Testing
  - Canister and Internal HSM Inspection
  - Exterior Concrete Inspection
  - Observations of Transfer System Components

Inspection System Testing

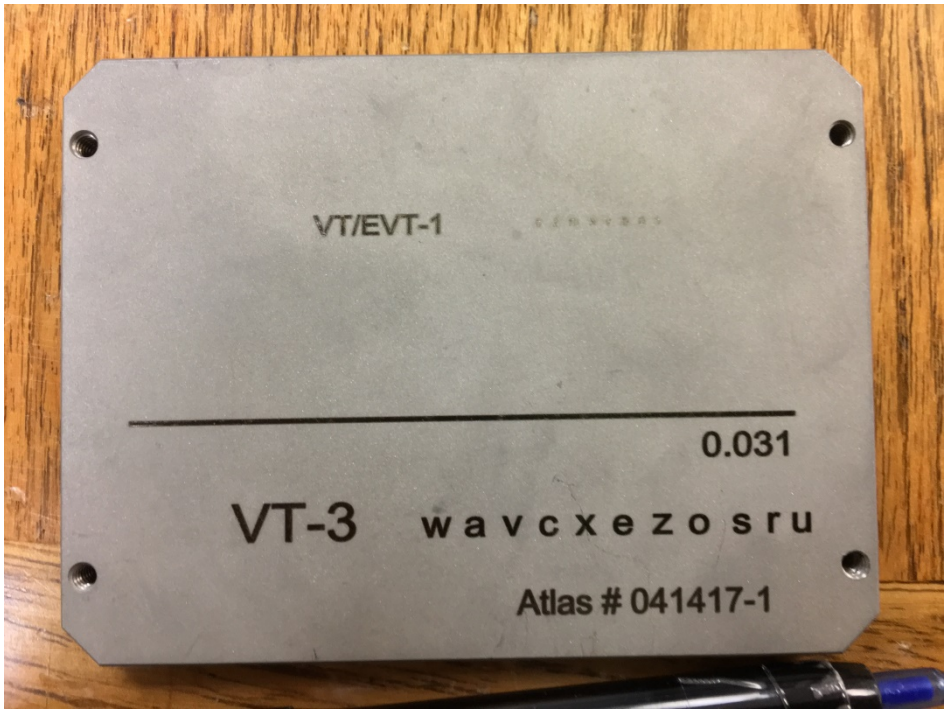
- Equipment testing conducted following site orientation and site access training
- Equipment unpacking, inventory, and setup
- Primary inspection robot performance testing
  - Mobility
  - Camera operation and visual acuity testing
  - Lighting operation
- Secondary robot performance testing

Inspection System Testing



- Primary robot for conducting remote visual inspection
  - Color high definition camera
  - LED lighting
  - Parallel lasers for distance measurement

Inspection System Testing

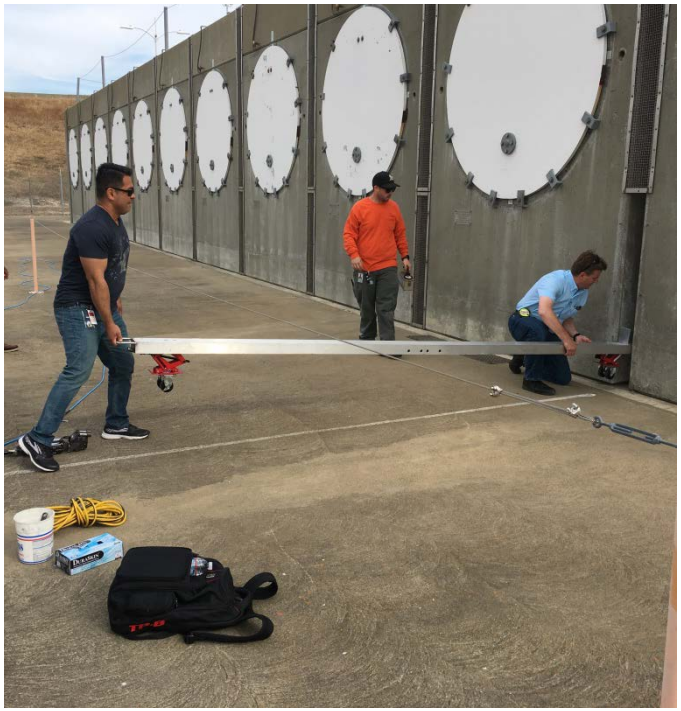


- ASME VT-1/VT-3 test card
- Backup robot

Canister and Internal HSM Inspection

- Canister and HSM inspected was HSM# 20 and loaded with spent fuel
- Inspection system robot used to examine the bottom of the canister
- Inspection of interior HSM concrete
- Inspection of DSC support structure
- Written inspection protocol followed to make sure all accessible structures, systems and components were inspected and documented

Canister and Internal HSM Inspection



- Robot access ramp installation

- Robot Access ramp installed
- Inspection robot cable management during inspection

Exterior Concrete Inspection

- External surface concrete inspection
- HSM top slab examination

Transfer System Components

- Transfer system components stored in an insulated building next to the ISFSI pad
- Transfer system components
  - MP187 Transportation/Transfer Cask
  - Transfer Cask Yoke
  - Transfer Cask Trailer

Transfer System Components

- MP187 bottom end

- MP187 top end with lid

Transfer System Components

- MP187 Cask transfer trailer

- MP 187 Cask yoke

NRC Observations of the Inspection

- Inspection was well planned
  - Identified HSM and canister to be inspected
  - Verification of equipment operation and performance
  - Qualified inspection personnel
  - Followed written procedure
  - Backup robot as a contingency
- Inspection was documented
  - Pictures and video from HSM interior
  - Pictures and documentation of concrete inspection
- Additional data collected
  - Atmospheric deposits collected for analysis

NRC Observations of the Inspection

- Condition of all important to safety structures, systems and components were verified
  - DSC loaded with spent fuel
  - DSC support structure inside the HSM
  - Internal and external concrete surfaces
  - ISFSI concrete pad
- Transfer components are accessible and stored in a sheltered environment
  - MP187 Transportation/Transfer Cask
  - Transfer Cask Trailer
  - MP187 Cask Yoke