NorthStar VTY Decommissioning

NDCAP Presentation

Vermont Yankee Nuclear Power Station

1. Turbine
2. Main steam lines
3. Recirculation pump
4. Inboard main steam isolation valve
5. Outboard main steam isolation valve
6. Downcomers
7. Shield plug
8. Dryer/separatory storage pool
9. Reactor building cooling water heat exchangers
10. Reactor building cooling water pump
11. Reactor water cleanup heat exchanger
12. Reactor water cleanup pump
13. Wet AC motor generator set
14. Recirculation motor generator set
15. Fuel pool (spent fuel storage)
16. Spent fuel rack
17. Hydrostatic control unit
18. Steam condenser and treatment
19. Primary containment wall
20. Relieving bridge
21. New fuel storage vault
22. Overhead crane
23. Biological shield wall
24. Steam dryer
25. Steam separator
26. Feed assemblies
27. Reactor vessel
28. Vessel head
29. Main steam outlet
30. Recirculation water outlet
31. Uninterruptible power supply
32. Main transformer
33. Ring header
34. RR service water pump
35. Recirculation inlet
36. Manifold
37. Feedwater inlet
38. Generator
39. Low pressure turbine
40. High pressure turbine
41. Interceptor valve
42. Moisture separator
43. Main condensers
44. Cooling water recirculation
45. Turbine oil tank
46. Emergency diesel generators
47. Overhead crane
48. Condenser storage tank
49. Feedwater pump
50. Control room
51. High pressure headers
52. Main stop valve
53. Turbine lubrication storage tank
54. Excitation cubicle
55. Main generator leads
56. Make-up deaerifiers
57. House heating boiler
58. Classifier
59. Acid storage tank
60. Cauldron storage tank
61. Receiving and storage
62. Generator
63. Turbine building
64. Radiator building
65. Condenser plant separator tanks
66. Condensate plant separator tanks
67. Condensate tank
68. Cash filling area
69. Waste storage tank
70. Trunking houses
71. Sample tanks
72. Surge tank
73. Discharge structure
74. Low pressure headers
75. Intake structure
76. Advanced off-gas building
77. West cooling tower
78. East cooling tower
79. Spray pond
80. Warehouse

Abatement & Demolition | Emergency & Disaster Response | Environmental Remediation | Nuclear Decommissioning
Re-cap and Update from January Meeting:

Major Near Term Work/1st Phase/Critical Path Items:

- Refuel Floor Alignment  **COMPLETE**
- Crane/Material Handling equip (design/fab/checks)  **COMPLETE**
- Spent Fuel Pool Clean Out/Rack Removal  **COMPLETE**
- Vessel Re-flood and Preparation  **COMPLETE**
- Drywell tooling set up/testing & placement  **ON-GOING**
# Project Schedule – Overview (Re-Cap)

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<th>NorthStar Ownership (Target 01.11.2018)</th>
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<td>Final Site Restoration &amp; License Termination</td>
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## Key Project Milestones:

- **Dry Fuel Storage Program**: Completed by Entergy (Fuel on ISFSI - Dec. 31, 2018)
- **Large Component Removal (RPV, RPVI, etc.)**: Engineering & Planning – Complete - March 2022
- **Decontamination & Decommissioning**: Pre-Closing Work – Complete - December 2026
- **Spent Fuel Management**: ISFSI Operations and Management (2019 thru 2026)

## Overall Schedule:

- **Critical Path**
  - Large Component
    - RVI/RV Segmentation – 2019 to 2020
    - Large Components – 2019 - 2022

- **D&D**
  - with Short Term Schedule Targets and Optional Work 2019 - 2026

- **Spent Fuel Storage – ISFSI Management**
Priorities/Upcoming Efforts/Projects

Additional Short Term Schedule Targets and Optional Work in 2019:

- Streamline – Systems and Processes COMPLETE
- Schedules blended and optimized to support Vessel work, abatement/component removal COMPLETE
- Ensuring Environmental Memorandum Of Understanding commitments met ONGOING (working to July 11th deadline with ANR, some sampling and characterization already in progress)
- Facility Management – minor infrastructure changes for access control (safety) ONGOING
- Infrastructure
  - New rail spur COMPLETE/ Temp Bldg erection ONGOING
  - ORANO Container Pad COMPLETE RWC Horizontal Storage Structure ONGOING
- COB demolition COMPLETE
- Cooling Towers demolition PREPPING (ready to commence after abatement)
- Turbine Building (Targets of Opportunity/Still in Plan/Prep/Assess phase)
  - Abatement / Large Component Removal (Turbine/Generator/Main Transformer, etc.)
Containment Head removal for segmentation
Reactor Vessel Segmentation

GE BWR Mark I Reactor Vessel
5 ½” thick forged carbon steel walls, clad with stainless steel
55’ height (not including head)
17’ internal diameter
10 ½“ thick and 22” tall at flange
Reactor Head alone 60 tons
Reactor Vessel approx. 390 tons

Select components within will be cut up and packaged for storage at the ISFSI within a Cask similar to that in which the Spent Fuel is stored.

These select components have been carefully evaluated, due to their high activation levels, and are designated as Greater Than Class C (GTCC) waste.
GE BWR Mark I Reactor Internals

- 3-D Modeling of reactor and associated components allows optimization of cutting and packaging plans

- Specialized tooling of multiple varieties will be used for cutting process

- Cutting and packaging work is broken into “sequences”

- Generally activities will start at the top of the vessel and work downward

- 17 Custom Boxes will be used of 11 different sizes

- Precise geometries will be obtained during cutting

- Most cutting operations will be performed underwater

- Many vessel components already removed (fuel, control rods, instrumentation, etc)
Example of Sequenced segmentation

- **SEQUENCE 8:** Upper Core Grid (UCG) removal and staging

- UCG Grid segmented by WASS PCS in D/S Pit, then placed in GTCC ‘baskets’ and transferred to SFP for temp storage

(Each segmented pieces are predestined for a specific container based on geometry (size) and activation levels)
Specialized Cutting Equipment

- Water Abrasive Suspension system (WASS MCS)
- Abrasive water jet technology
- Will be used for most of the Vessel segmentation cuts
- 3-D Positioning System

Mast Cutting System (MCS) within Reactor Vessel
Specialized Cutting Equipment

- Water Abrasive Suspension system (WASS PCS)
- Abrasive water jet technology
- Will be used for most of the Vessel segmentation cuts
- 3-D Positioning System

Portal Cutting System (PCS) for segmentation cuts
Specialized Cutting Equipment

- Final Segmentation Band Saw (FSBS)
- Mechanical cutting technology
- Used on cylindrical components
- Clamping system to hold components in place
Specialized Cutting Equipment

- Diamond Wire Saw (DWS)
- Mechanical cutting technology
- Used for large and complex geometries with difficult access
Specialized Cutting Equipment

- Portable cutting tools
- Mechanical cutting technology
- For difficult locations in RV cavity
- Multiple adaptations to tooling

Hole Saw

Circular Saw

Hydraulic Shears
Specialized Cutting Equipment

- Split Lathe Cutter
- Used in many projects
- Highly effective and efficient for cutting medium to smaller diameter nozzles
Empty Spent Fuel Pool
Reactor Vessel Head Removal
VCT, Hi-Track (containing NWFC) and Overpack

NorthStar Ownership (Target 01.11.2018)

Partial License Termination (Target 12.31.2026)

License Termination (Est. 12.31.2052)

2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 to 2051 2052

Final Site Restoration & License Termination

Dry Fuel Storage Program (Fuel on ISFSI - Dec. 31, 2018) Completed by Entergy

Large Component Removal (RPV, RPVI, etc.) Engineering & Planning Complete - March 2022

Decontamination & Decommissioning Pre-Closing Work Complete - December 2026

Spent Fuel Management ISFSI Operations and Management (2019 thru 2026)

ISFSI Only Operations Period (2027 thru DOE Fuel Pick-up)

Overall Schedule:

• Critical Path
  ➢ Large Component RVI/RV Segmentation – 2019 to 2020
  ➢ Large Components – 2019 - 2022

• D&D with Short Term Schedule Targets and Optional Work 2019 - 2026

• Spent Fuel Storage – ISFSI Management
Packaging

- Custom Boxes (17 different boxes built to spec in 11 sizes)
- Used for low activity and large components
- Segmented pieces are predestined for a specific container based on geometry (size) and activation levels.
Custom Boxes for Packaging

• Photo showing some of the Custom Boxes that have been built and are on-site staged for use

(Segmented pieces are predestined for a specific container based on geometry (size) and activation levels)
Transfer and Shipping

- Horizontal Transfer station (HTS) used to temporarily store materials prior to shipping

- Specialized Transport Cask system for shipment by Rail or Truck
Rail Refurbishment

- Horizontal Transfer station (HTS) used to temporarily store materials prior to shipping

- Rail refurbishment to support shipping and improve efficiency/safety
Rail Utilization

- Horizontal Transfer station (HTS) component(s) arriving on site by rail

- Will be used to temporarily store materials prior to shipping
Demolition of COB (Construction Office Building)
(COB) pad location for Custom Box storage
HTS construction/pad/location
Cooling Towers as of 5/10/2019
Questions?