

**2017 Annual Inspection and
Status Report for the Boiling
Nuclear Superheater
(BONUS) Decommissioned
Reactor Site,
Rincón, Puerto Rico**

July 2017



U.S. DEPARTMENT OF
ENERGY

Legacy
Management

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Abbreviations

BONUS	Boiling Nuclear Superheater
DOE	U.S. Department of Energy
LM	Office of Legacy Management
Navarro	Navarro Research and Engineering, Inc.
PL	photograph location
PREPA	Puerto Rico Electric Power Authority

Executive Summary

The Boiling Nuclear Superheater (BONUS) Decommissioned Reactor Site, located on the west coast of Puerto Rico in the town of Rincón, was inspected on May 31, 2017. The inspection included checking the integrity of the entombed reactor system, the containment building, site security, general housekeeping, and the condition of the surrounding land. Power to the site was out during the inspection, but lack of power did not prohibit the inspection team from completing their work. Lighting was provided by flashlight for the inspection of the containment building. The site was found to be in good condition, and the integrity of the entombed reactor system was excellent. No cause for a follow-up inspection was identified.

Puerto Rico Electric Power Authority personnel have done an excellent job responding to maintenance items and recommendations from previous site inspections in 2010 and 2013.

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1.0 Introduction

This report presents the findings from the U.S. Department of Energy (DOE) Office of Legacy Management (LM) inspection of the Boiling Nuclear Superheater (BONUS) Decommissioned Reactor Site, in Rincón, Puerto Rico, on Wednesday May 31, 2017.

Navarro Research and Engineering, Inc. (Navarro), the DOE Legacy Management Support (LMS) contractor, conducted the site inspection. The inspection was made by the LMS site lead, the LMS Stakeholder Engagement manager, and LMS decontamination and decommissioning support staff. The LM program director and DOE site manager accompanied the inspection. Two Puerto Rico Electric Power Authority (PREPA) personnel served as escorts at the BONUS site.

The site inspection was conducted in accordance with the *Long-Term Surveillance and Maintenance Plan for the Boiling Nuclear Superheater (BONUS) Reactor Facility, Rincón, Puerto Rico* and procedures established by Navarro for site inspections. The primary purpose for the inspection was to confirm the integrity of the entombed reactor and the building in which the entombed reactor is located. Additional objectives included assessing site security, the general housekeeping of the site, and any changes in the surrounding area that might adversely impact the long-term sustainability of the facility.

Section 4.3 of the BONUS LTSP prescribes the requirements for the LM site inspection.

Inspection Requirement	LTSP Section	Status
Contact PREPA	4.3	PREPA was contacted.
Contact the mayor of Rincón	4.3	A request was made to have PREPA make this contact. Due to several schedule changes, no direct contact with the mayor was made.
Prepare and follow an inspection checklist	4.3.1	Checklist was prepared.

Prior to beginning the inspection, personnel reviewed and signed the Job Safety Analysis for the site inspection and source disposition at the BONUS Decommissioned Reactor Site (expiration 1/31/2018).

Power to the site was out during the inspection, but the lack of power did not prohibit the inspection team from completing their work. While inspecting the containment building, the team used lighting provided by flashlights.

The BONUS facility consists of the containment building, which houses the entombed reactor system and outside support buildings. PREPA currently uses the decommissioned BONUS facility as a museum. It is opened to the public for scheduled tours, and approximately 5 or 6 tours are conducted each year.

DOE retains responsibility for the entombed radioactive materials that remain at the BONUS facility. DOE conducted an environmental assessment and concluded that there was no unacceptable risk to human health or the environment from fixed radioactive contaminated areas (*Finding of No Significant Impact for Authorizing the Puerto Rico Electric Power Authority (PREPA) to Allow Public Access to the Boiling Nuclear Superheat (BONUS) Reactor Building*,

Rincon Puerto Rico, dated 2003 and revision dated 2009). However, there are limited and discrete areas within the museum building that have fixed residual radioactive contamination, and these areas are isolated, shielded, and posted to protect visitors and workers.

2.0 Inspection Results

Features discussed in this report are shown on the attached site drawing (Appendix A). Photographs to support specific observations are identified in the text and on the drawing by photograph location (PL) numbers. Inspection items, issues, actions, and findings for 2017 are provide in Table 1 and discussed below.

Table 1. 2017 Inspection Items, Issues, Actions, and Findings

No.	Item	Issue	Action	2017 Inspection Finding
1	Access	Site security and access accountability.	Inspectors need to sign in on required log sheet at the security gate upon arrival.	The site security guard met the team at the access gate. The inspection team signed in on the required log sheet.
2	Specific site surveillance features	See site-specific surveillance features listed below.	Inspect: <ul style="list-style-type: none"> • Roads and parking area • Entrance gate • Access through the security gate • Security fence • Enclosed domed building and monolith plaques 	Surveillances features were inspected. All were found to be in good shape, with the exception of the security fence, which was in fair condition.
3	Enclosed domed building – entombed concrete monolith and monolith penetrations	Structural defects or degradation can result in loss of containment or radioactive materials	Inspect for possible indications of structural problems, such as cracking, staining, and spalling.	The entombed reactor system was found to be in excellent condition, and its integrity was confirmed. No indications of structural problems, such as cracking, staining, or spalling, were identified on the entombed concrete monolith and monolith penetrations.
4	Enclosed domed building – external piping systems	Systems were flushed during decommissioning. Incidental contamination remains, which may be released if systems corrode or otherwise fail.	Inspect for possible indications of deterioration, such as peeling and blistering paint, staining, and flaking.	External piping systems showed no signs of deterioration such as peeling and blistering paint, staining, and flaking.
5	Enclosed domed building – basement	Some areas contain radiological contamination in excess of DOE standards; the general public is not allowed access to contaminated areas.	Note condition of access control barricades.	Access control barricades to the basement were in place and in good order.

Table 1. 2017 Inspection Items, Issues, Actions, and Findings (continued).

No.	Item	Issue	Action	2017 Inspection Finding
6	Enclosed domed building – basement flooding	Water accumulating in basement may mobilize and redistribute surface contamination. Basement flooded in 1998 due to Hurricane Georges. After flood, storm water drains were unplugged, and the rubber door seals were replaced.	Inspect rubber door seals and storm water drains.	No water was present on the basement floor.
7	Enclosed domed building – main floor	Some areas contain radiological contamination in excess of DOE standards; the general public is not allowed access to contaminated areas. Check to see if access to stairways leading to the basement level is being effectively maintained and controlled to keep the public out—this was a comment made in the 2016 Radiological Report.	Note condition of access control barricades, ceramic floor tile, and lead blocks; note general housekeeping.	Access control barricades on the main floor were in place and in good order. Ceramic floor tiles and lead blocks were in good shape. General housekeeping was good. Stairways leading to the basement level are being effectively maintained and controlled to keep the public out.
8	Enclosed domed building – mezzanine	Some areas contain radiological contamination in excess of DOE standards; the general public is not allowed access to contaminated areas.	Note condition of access control to mezzanine; note general housekeeping.	Access control barricades to the mezzanine were in place and in good order.
9	Enclosed domed building – exterior	Building should appear well maintained. In 2013, the outer surface of the containment dome was repainted. In 2013, the rubber seal at the base of the containment dome was repaired.	Visually inspect.	The outer surface of the dome was in excellent condition. A secondary rubber seal installed at the base of the containment building is functioning properly. Overlaps of the secondary seal should be caulked, and the ends of the seal should be better attached to the wall of the containment building dome.
10	Surrounding land	New or changing features or activities adjacent to the site may affect site security. The retaining wall on the west side of the facility near the beach is broken due to a close-growing palm tree. The area surrounding the retaining wall is overgrown with vegetation.	Note changes within 0.25 mile (400 m) of site.	Inspectors noted no significant changes to the surrounding area that might impact the long-term sustainability of the facility. The perimeter security fence is in fair condition but needs some minor repairs. Vegetation is encroaching on the fence fabric in some places, support posts need to be reattached, and west-side openings large enough for a person to get through need to be closed. The retaining wall on the west side of the facility near the beach remains serviceable.

Table 1. 2017 Inspection Items, Issues, Actions, and Findings (continued).

No.	Item	Issue	Action	2017 Inspection Finding
11	General site upkeep	Building should appear well maintained.	Observe and evaluate changes in site conditions.	<p>General housekeeping around the site is good. Areas between buildings and along the fence line are free of trash and, with the exception of vegetation encroaching on the perimeter fence fabric in a few places, landscaping is good.</p> <p>The auditorium and patio area are in good shape and are currently being used by PREPA.</p> <p>The training center is not being used, and the interior is exposed to the elements.</p> <p>Ventilation and humidity levels within the containment dome and museum continue to be a challenge. Many excellent museum displays are showing wear due to the conditions.</p> <p>BONUS site records previously stored in the containment dome have been moved to a climate-controlled office in the PREPA building in San Juan. The record boxes and loose documents were repackaged into 386 boxes but not reindexed.</p>
12	Site security	A security guard should be stationed at all times.	Ensure a security guard is present.	Round-the-clock site security is good.
13	Erosion	Ensure that hillslopes and beach adjacent to site are not actively eroding in a way that could adversely affect the facility.	Evaluate erosional features on adjacent slopes and beach.	The hillslopes and beach adjacent to the site are not actively eroding in a way that could adversely affect the facility.

2.1 Containment Building and Entombed Reactor System

The containment building houses the entombed reactor system. The dome of the containment building has a diameter of approximately 160 feet and a circumference of approximately 502 feet. The entombed reactor system was found to be in excellent condition, and its integrity was confirmed. No indications of structural problems, such as cracking, staining, or spalling, were identified on the entombed concrete monolith and monolith penetrations. External piping systems showed no signs of deterioration such as peeling and blistering paint, staining, and flaking. Access control barricades in the basement, on the main floor, and the mezzanine were in place and in good order. No water was present on the basement floor.

The outer surface of the dome was reconditioned and painted in 2013 (PL-1). The freight door (on the east side of the containment dome) is sealed shut. A small raised platform of concrete is

installed at the base of the freight door to provide added protection against water seeping beneath the door (PL-2).

A rubber seal is installed around the base of the containment dome to keep water from seeping into the building. In 2010, the seal was observed to be cracked, ripped, and missing in some spots. Evidence of water seepage was observed in a few spots along the top of the basement wall inside the containment dome, which indicated that the seal was leaking in those areas. PREPA then installed a secondary rubber seal over the damaged primary seal to carry water away from the underlying damaged seal. Inspectors noted that overlaps of the secondary seal should be caulked (PL-3) and the ends of the secondary seal need to be trimmed and better secured to the dome, perhaps using a caulking compound (PL-4). No evidence of recent water seepage was observed along the top of the basement wall in the containment building during this year's inspection, which indicates that the secondary seal is functioning properly.

The inspection team observed that the basement room in the containment dome that previously stored 204 boxes of BONUS records and loose BONUS documents was empty. The records are now stored in a climate-controlled office in the PREPA building in downtown San Juan.

2.2 Site Security

Site security consists of a guard shack that is staffed around the clock, a motor-operated entrance gate (24 feet wide), and a security fence (6-foot-high chain-link fence topped with three strands of barbed wire) that encloses approximately 5 acres. Round-the-clock site security is good. Upon arrival, the security guard was present.

Upon arrival, the security gate was found to be closed and locked. The on-duty security guard allowed the inspection team to enter the grounds. The perimeter security fence was found to be in fair condition but in need of minor repairs. Vegetation is growing in the fabric of the fence in several areas (PL-5). Some support posts are bent or need to be reconnected (PL-6). An area on the west fence line has some openings large enough for a person to crawl through (PL-7). Barbed wire is no longer required on the security fence, but several sections of the security fence are missing barbed wire (PL-8), and it has been bent back along several areas (PL-9).

2.3 Support Facilities

Support facilities (auditorium, patio area, and training center) are located on the west side of the property (PL-10). The support buildings have no effect on the integrity of the containment building entombment but were inspected to get a better understanding of their present condition and potential future use.

The auditorium is in good condition and is currently being used by PREPA. It consists of a stage area with seating for approximately 100 (PL-11). The patio area is located just outside of the auditorium. It is in good condition and is also currently used by PREPA on an as-needed basis (PL-12). The training center is not currently being used. For safety reasons, the inspection team did not go inside the training center. Photos (taken from windows and just inside the entrance) reveal that the interior is exposed to the outside elements. Water was present on the floors (PL-13), and the ceiling is crumbling, with expanding patches of exposed rebar (PL-14).

2.4 General Housekeeping

General housekeeping around the site was good. Areas between buildings and along the fence line were free of trash. Except for vegetation encroaching upon the security fence in areas, the landscaping is well maintained (PL-15 and PL-16).

Ventilation and humidity levels within the containment building continue to be a challenge. Many of the excellent museum displays are showing wear due to poor ventilation and humidity.

2.5 Surrounding Area

No significant changes to the surrounding area that might impact the long-term sustainability of the facility were noted during the inspection. The retaining wall on the west side of the facility, near the beach, is leaning, broken in several areas, and will eventually fall (PL-17 and PL-18). The wall remains serviceable, and continued monitoring is all that is required at this time. Storm drains leading from the site were found to be clear and free of debris (PL-19).

3.0 Recommendations

Better seal overlaps and ends of the secondary rubber seal installed at the base of the containment dome to keep moisture out. Perhaps caulk the seal overlaps and trim, caulk, and better attach the ends of the rubber seal to the wall of the containment building dome.

Minor repairs are needed on the site security fence: bent and detached fence supports need to be repaired, vegetation along the fence line should be cleared, and holes in the fence fabric large enough for a person to pass through should be fixed.

4.0 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	45	Looking northeast toward the containment dome
PL-2	270	Freight door on east side of containment dome with concrete lip installed at the base of the door to provide added protection against water seeping beneath the door
PL-3	NA	Overlap of secondary seal at base of containment dome
PL-4	225	Corner of rubber seal on the east side of the north air lock. Ends need to be trimmed and better secured to wall of the containment building dome to help keep moisture out.
PL-5	225	Looking southwest down the security fence line behind the northeast side of the training center. Vegetation is encroaching on the fence fabric.
PL-6	260	Looking southwest at the security fence line. Heavy vegetation is on the fence fabric. Barbed wire is present, but support posts are bent, and some horizontal support posts are not properly connected.
PL-7	30	Repair made to fence fabric. Large access holes remain on sides of the repair at the base of the fence.
PL-8	90	Looking east down the south security fence line. Barbed wire on top of the security fence is missing.
PL-9	360	Looking north along east security fence line
PL-10	270	Discussion taking place in front of support buildings. The auditorium with patio is on the left. The unused training center is on the right.
PL-11	130	Interior of auditorium
PL-12	60	Looking northeast at southwest corner of the auditorium and the attached patio area. Dome of containment building is in the background.
PL-13	280	Interior of the training center
PL-14	130	Looking inside of training center window at the deteriorating ceiling
PL-15	170	Looking southeast at the guard shack
PL-16	315	Looking northwest at the containment dome
PL-17	45	Retaining wall at base of security fence along beach on west side of property. Wall is leaning, heavy vegetation is on fence fabric, and the barbed wire is bent.
PL-18	15	Broken section of retaining wall on west side of property due to tree growth
PL-19	60	Storm drain outlets clear of debris

Abbreviation:

NA = not applicable or accessible



PL-1. Looking northeast toward the containment dome



PL-2. Freight door on east side of containment dome with concrete lip installed at the base of the door to provide added protection against water seeping beneath the door



PL-3. Overlap of secondary seal at base of containment dome



PL-4. Corner of rubber seal on the east side of the north air lock. Ends need to be trimmed and better secured to wall of the containment building dome to help keep moisture out.



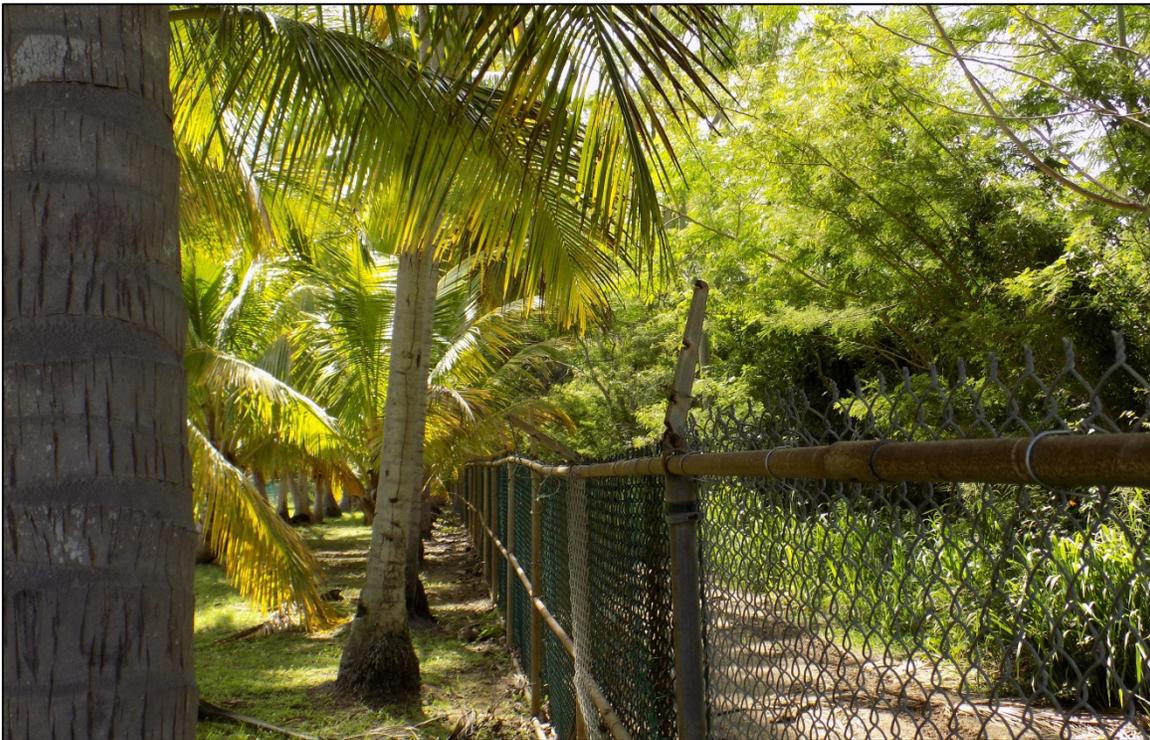
PL-5. Looking southwest down the security fence line behind the northeast side of the training center. Vegetation is encroaching on the fence fabric.



PL-6. Looking southwest at the security fence line. Heavy vegetation is on the fence fabric. Barbed wire is present, but support posts are bent, and some horizontal support posts are not properly connected.



PL-7. Repair made to fence fabric. Large access holes remain on sides of the repair at the base of the fence.



PL-8. Looking east down the south security fence line. Barbed wire on top of the security fence is missing.



PL-9. Looking north along east security fence line



*PL-10. Discussion taking place in front of support buildings. The auditorium with patio is on the left.
The unused training center in on the right.*



PL-11. Interior of auditorium



PL-12. Looking northeast at southwest corner of the auditorium and the attached patio area. Dome of containment building is in the background.



PL-13. Interior of the training center



PL-14. Looking inside of training center window at the deteriorating ceiling



PL-15. Looking southeast at the guard shack



PL- 16. Looking northwest at the containment dome



PL-17. Retaining wall at base of security fence along beach on west side of property. Wall is leaning, heavy vegetation is on fence fabric, and the barbed wire is bent.



PL-18. Broken section of retaining wall on west side of property due to tree growth



PL-19. Storm drain outlets clear of debris

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Appendix A

Site Drawing

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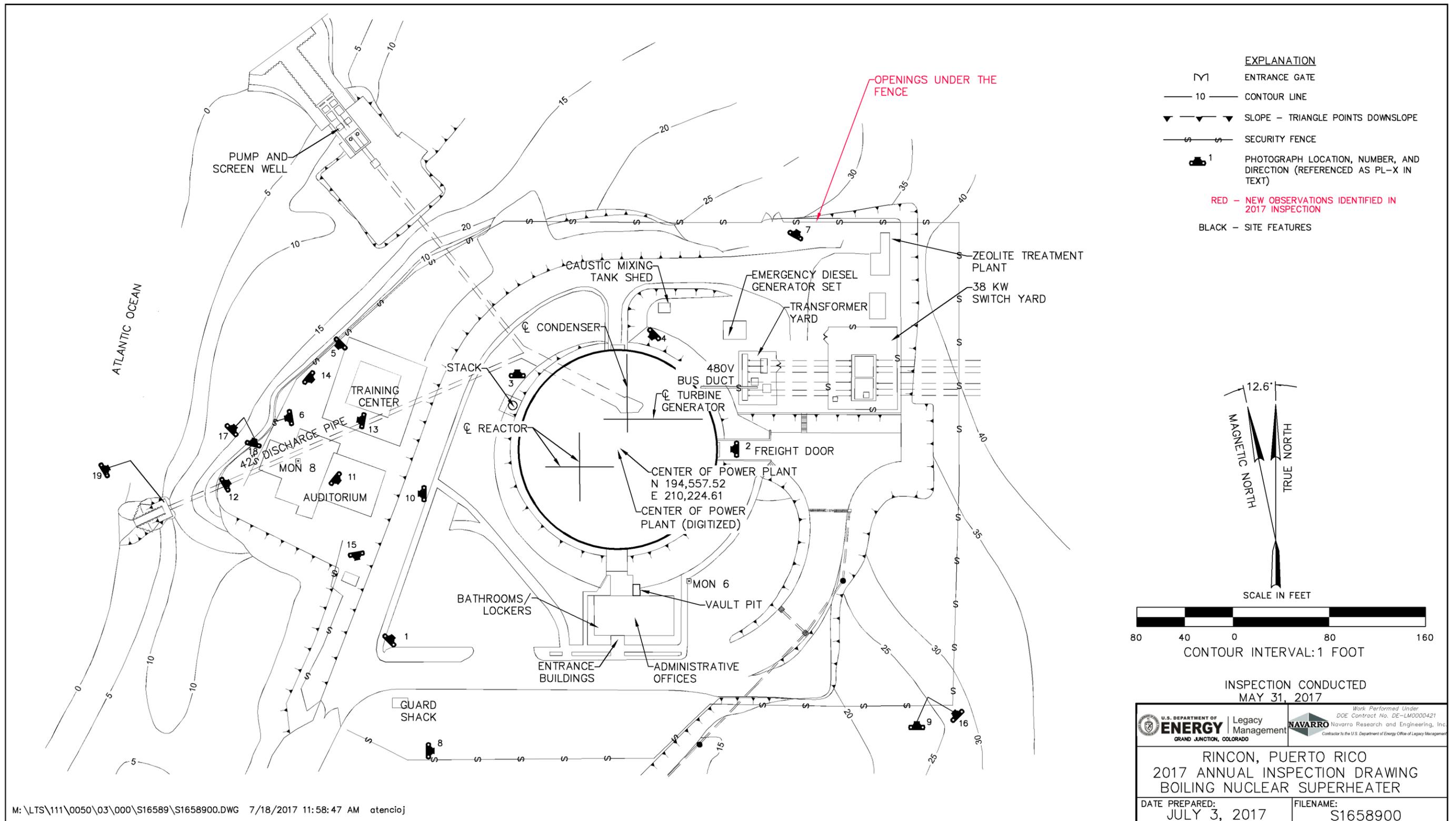


Figure A-1. Annual Inspection Drawing, Rincón, Puerto Rico, BONUS Site

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