LMS/BON/S25814

2019 Inspection and Status Report for the Boiling Nuclear Superheater (BONUS) Decommissioned Reactor Site, Rincón, Puerto Rico

July 2019

U.S. DEPARTMENT OF ENERGY | Legacy Management

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Contents

Table

Appendix

Abbreviations

BONUS	Boiling Nuclear Superheater
DOE	U.S. Department of Energy
LM	Office of Legacy Management
LMS	Legacy Management Support
LTS&M	Long-Term Surveillance and Maintenance Plan
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 near the town of Rincón, was inspected on May 14, 2019. 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.

Following the last inspection on May 31, 2017, Puerto Rico experienced two hurricanes. They were Hurricane Irma on September 6, 2017, and Hurricane Maria on September 20, 2017. No water penetrated the dome containment building during either hurricane. The site lost power though, which was not restored until May 2018.

This year's inspection found the site to be in fair condition due to remaining hurricane damage, mostly in the form of downed trees on the security fence and on the rooftops of the surrounding outlying support buildings. 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 and responding to hurricane damage from the 2017 storms.

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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 near Rincón, Puerto Rico, on Wednesday, May 14, 2019.

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 with LMS decontamination and decommissioning support staff. The LM site manager and the RCRA/CERCLA/FUSRAP[1] team lead accompanied the inspection. Four Puerto Rico Electric Power Authority (PREPA) personnel served as escorts at the BONUS site.

The 2019 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* (DOE 2016), also referred to as the BONUS LTS&M Plan, and with 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 that contains the entombed reactor. 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.

Following the last inspection on May 31, 2017, Puerto Rico experienced two hurricanes. They were Hurricane Irma on September 6, 2017, and Hurricane Maria on September 20, 2017. No water penetrated the dome containment building during either hurricane. The site lost power though, which was not restored until May 2018.

Section 4.3 of the BONUS LTS&M Plan prescribes the LM site inspection requirements, which are described in the table below.

Inspection Requirement	BONUS LTS&M Plan 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 at the BONUS site.

The BONUS facility consists of the containment building (which houses the entombed reactor system) and separate support buildings. PREPA uses the decommissioned BONUS facility as a museum. It is opened to the public for scheduled tours. Prior to the 2017 hurricanes, approximately 5 or 6 tours were conducted each year. Tours were suspended until May 2018, while the site was without power. Annual tour numbers have not recovered to the previous levels.

[1] RCRA = Resource Conservation and Recovery Act; CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act; FUSRAP = Formerly Utilized Sites Remedial Action Program.

DOE retains responsibility for the entombed radioactive materials that remain at the BONUS facility. In 2003, DOE conducted an environmental assessment and concluded that there was no unacceptable risk to human health or the environment from fixed radioactive contaminated areas. This conclusion was published in the *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* (DOE 2003). 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 site drawing by photograph location (PL) numbers. Inspection items, issues, actions, observations, and recommendations for 2019 are provide in Table 1 and discussed below.

Table 1. 2019 Inspection Items, Issues, Actions, Observations, and Recommendations

No.	Item	Issue	Action	2019 Inspection Observations and Recommendations
1	Access	Site security and access accountability.	Inspectors need to sign in on the required log sheet at the security gate upon arrival.	The site security guard met the team at the access gate and the inspection team signed the required log sheet.
2	Specific site surveillance features	In addition to the information in this row, see site-specific surveillance features listed below in this table.	Inspect the following: • Roads and parking area • Entrance gate • Access through the security gate • Security fence • Retaining wall along beach • Enclosed domed building and monolith plaques	• Roads and parking area were in good shape. • The entrance gate was in good shape. • Access through the security gate was good. • The security fence remains damaged from the hurricanes of 2017. It was down or heavily damaged in several areas. • The retaining wall along the beach was heavily damaged. • The enclosed dome and monolith plaques were in good shape.
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. 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 might 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.

Table 1. 2019 Inspection Items, Issues, Actions, Observations, and Recommendations (continued)

No.	Item	Issue	Action	2019 Inspection Observations and Recommendations
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.
		In November 2018, PREPA conducted a radiation survey that discovered removable contamination at the base of a condensation pump in the Condensate Pump Room of the basement. The contamination consisted of approximately two handfuls of rust debris stained with oil. It is believed that the contamination is somehow related to the 2017 storm events.	Observe posting as a contamination area (rope, and signage) and discuss path forward (e.g., removal/disposal of loose debris and entombment of the pumps).	Access to newly discovered contamination was being properly managed and controlled. Postings were correct. Path forward discussed is to leave contamination in place and develop a Radiological Work Plan for the area for those times when the area needs to be accessed for sampling.
		Asbestos pipe installation exists throughout the basement, but PREPA asbestos-certified personnel have inventoried the pipe installation and stabilized it in place. In accordance with the BONUS LTS&M Plan, asbestos inspections are performed quarterly and air sampling is performed annually by PREPA staff or contractors.	Visually assess piping where available. Discuss current findings from quarterly asbestos inspections and annual air samplings with PREPA personnel.	Visual assessment confirmed that asbestos continues to be managed properly (non-friable condition). Inquired on obtaining copies from PREPA on asbestos monitoring reports. During the next site inspection, perform an assessment to determine the extent of the asbestos present.
6	Enclosed domed building – basement flooding	Water accumulating in basement might mobilize and redistribute surface contamination. Basement flooded in 1998 due to Hurricane Georges. After that 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. Basement floor was exceptionally clean.
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.	Note condition of access control barricades, ceramic floor tile, and lead blocks; note general housekeeping. Check to see if access to stairways leading to the basement level is being effectively maintained and controlled to keep out the public.	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 excellent. Stairways leading to the basement level were being effectively maintained and controlled to keep out the public.

Table 1. 2019 Inspection Items, Issues, Actions, Observations, and Recommendations (continued)

No.	Item	Issue	Action	2019 Inspection Observations and Recommendations
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. General housekeeping was excellent.
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 done was repaired.	Visually inspect.	The outer surface of the dome was in excellent condition, with the exception of one small area that needs to be repainted due to hurricane damage. A secondary rubber seal installed at the base of the containment building is functioning properly. To better ensure long-term integrity of the seal, 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. An area of wasp infestation was noted along the top of the east freight door. The infestation should be addressed before it gets worse.
10	Surrounding land	New or changing features or activities adjacent to the site can 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 meters) of the site.	Inspectors noted significant changes to the surrounding area that might impact the long-term sustainability of the facility. The perimeter security fence is in poor condition. Trees have fallen on several areas, holes exist, and the entire fence is down in some areas. The retaining wall located along the west side of the property (along the beach) was heavily damaged by the 2017 hurricanes and needs to be rebuilt.

Table 1. 2019 Inspection Items, Issues, Actions, Observations, and Recommendations (continued)

No.	Item	Issue	Action	2019 Inspection Observations and Recommendations
11	General site upkeep	Building should appear well maintained.	Observe and evaluate changes in site conditions.	General housekeeping around the site was excellent. Areas between buildings and along the fence line were free of trash. Conditions were good with the exception of vegetation damage resulting from the 2017 hurricanes. The auditorium and patio area were in good shape and were being used by PREPA. The training center was not being used, and the interior was exposed to the elements. Ventilation and humidity levels within the containment dome and museum continue to be a challenge. Many excellent museum displays are in danger of being damaged due to the lack of better controlled temperatures and humidity levels.
12	Site security	A security guard should be stationed at all times.	Ensure a security guard is present.	Round-the-clock site security was good, but the damaged perimeter fence was a security weakness.
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 were not actively eroding in a way that could adversely affect the facility, but hurricane damage along the beach needs to be addressed before it gets a chance to worsen.

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 on 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). Paint in one area of the dome was damaged during the hurricane, and it needs to be repainted as soon as possible (PL-2). The freight door (on the east side of the containment dome) is sealed shut, but an opening above the door had become the home for a wasp infestation. The wasps need to be

removed and the opening needs to be sealed as soon as possible to prevent the infestation from getting worse (PL-3).

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 installed a secondary rubber seal over the damaged primary seal to carry water away from the underlying damaged seal. During this site inspection, inspectors noted that overlaps of the secondary seal should be caulked and the ends of the secondary seal need to be trimmed and better secured to the dome, perhaps using a caulking compound to prolong the life of the seal. 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.

In November 2018, PREPA conducted a radiation survey that discovered removable contamination in the basement, at the base of a condensation pump in the Condensate Pump Room. The contamination consisted of approximately two handfuls of rust debris stained with oil (PL-4 and PL-5). It is believed that the presence of the rust material is somehow connected to the two hurricane storm events of 2017. Inspectors observed that access to the area is being properly controlled. The path forward that was discussed is to (1) leave contamination in place and (2) develop a Radiological Work Plan for the area for those times when the area needs to be accessed for sampling.

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 (i.e., a 6-foot-high chain-link fence topped with three strands of barbed wire) that encloses approximately 5 acres.

Upon arrival, the security guard was present and the gate was 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 poor condition. Numerous downed trees resulting from the 2017 hurricanes damaged the fence in several areas (PL-6, PL-7, PL-8). The fence is entirely down in some areas (PL-9). For security purposes, the fence needs to be repaired as soon as possible.

2.3 Support Facilities

Support facilities (auditorium, patio area, and training center) are located on the west side of the property. 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 was in good condition and was being used by PREPA. It consists of a stage area with seating for approximately 100. The patio area is located just outside of the auditorium. It was in good condition and was also being used by PREPA on an as-needed basis. The training center was not being used. For safety reasons, the inspection team did not go inside the training center. Downed trees were present on the roof of the training center (PL-10).

Based on decommissioning documentation, an underground storage tank may be present on the property. The existence and status of the tank will be determined. If found to be present, it will be determined if further stewardship activities are necessary.

2.4 General Housekeeping

General housekeeping around the site was excellent. Areas between buildings and along the fence line were free of trash. Except for vegetation damage from the 2017 hurricanes, the landscaping was well maintained (PL-11 and PL-12).

Ventilation and humidity levels within the containment building continue to be a challenge. Many of the excellent museum displays were showing wear due to poor ventilation and humidity. Many of the exhibits are in danger of being permanently damaged if conditions are not improved.

2.5 Surrounding Area

The retaining wall on the west side of the facility, near the beach, was severely damaged by the 2017 hurricanes and was in need of repair. Storm drains leading from the site were found to be clear and free of debris (PL-13).

3.0 Recommendations

One small area of the dome should be repainted as soon as possible to help protect the dome from corrosion.

To better ensure the long-term integrity of the secondary rubber seal at the base of the containment dome, overlaps of the seal should be caulked, and the ends should be better attached to the wall of the building.

An area of wasp infestation located along the top of the east freight door should be cleaned of wasps and sealed to prevent future insect infestations.

Hurricane damage to the perimeter fence and the retaining wall along the beach need to be repaired.

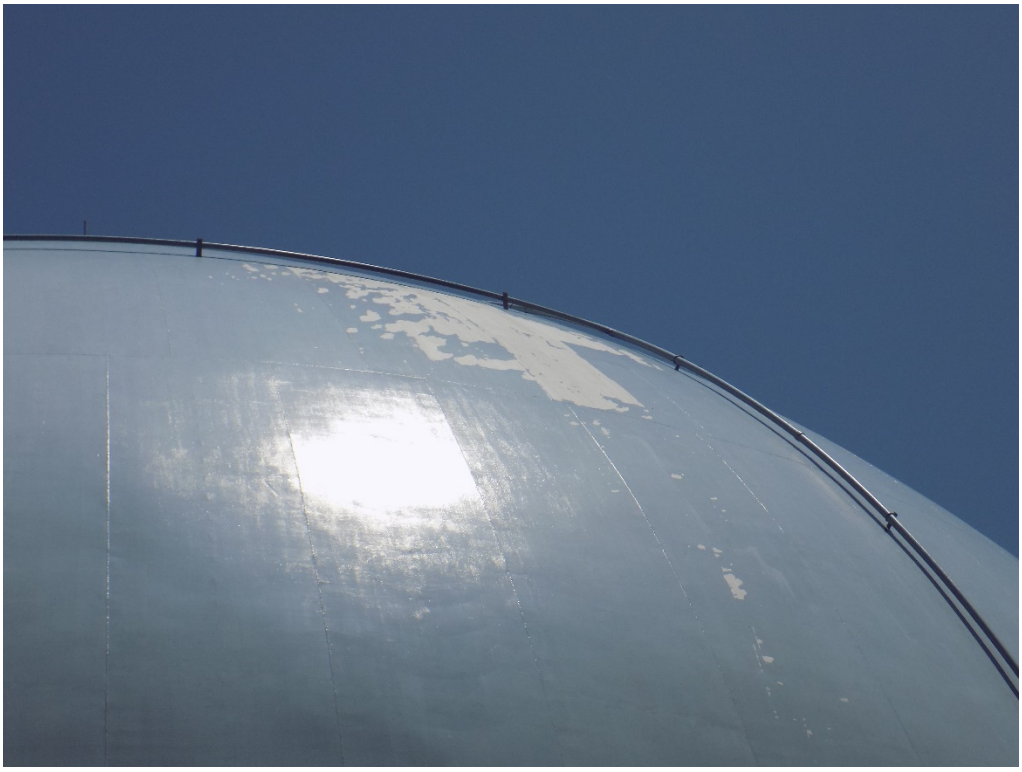
During the next site inspection, a hazard analysis will be conducted to determine the extent of the asbestos piping in the lower level of the facility.

Based on decommissioning documentation, an underground storage tank may be present on the property. The existence and status of the tank will be determined. If found to be present, it will be determined if further stewardship activities are necessary.

4.0 Photographs

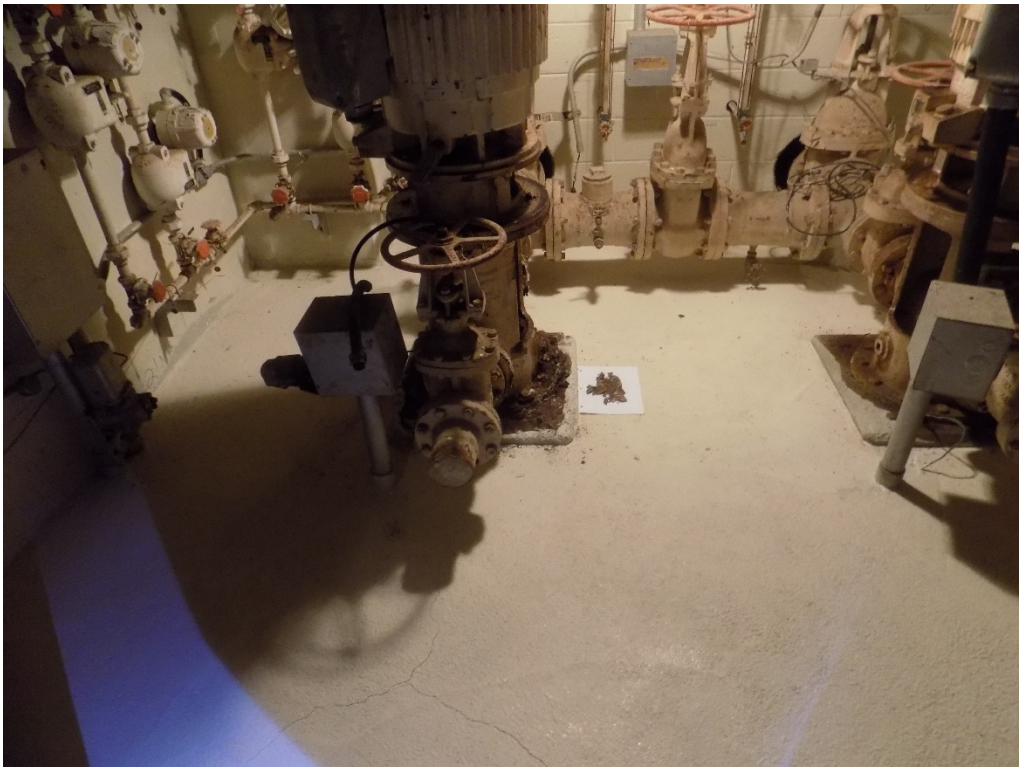
Photograph Location Number	Azimuth	Photograph Description
PL-1	45	Containment dome
PL-2	45	Missing paint on dome
PL-3	0	East freight door with wasp infestation
PL-4	0	Contaminated oil-stained rust at base of condensate pump in basement of containment building
PL-5	0	Contaminated oil-stained rust at base of condensate pump in basement of containment building
PL-6	280	Downed tree on security fence
PL-7	200	Downed tree on security fence
PL-8	90	Downed tree on security fence
PL-9	30	Damaged security fence
PL-10	225	Downed tree on roof of training center
PL-11	225	Containment dome
PL-12	360	Containment dome
PL-13	90	Drain culverts

PL-1. Containment dome



PL-2. Missing paint on dome

PL-3. East freight door with wasp infestation



PL-4. Contaminated oil-stained rust at base of condensate pump in basement of containment building

PL-5. Contaminated oil-stained rust at base of condensate pump in basement of containment building

PL-6. Downed tree on security fence

PL-7. Downed tree on security fence

PL-8. Downed tree on security fence

PL-9. Damaged security fence

PL-10. Downed tree on roof of training center

PL-11. Containment dome

PL-12. Containment dome

PL-13. Drain culverts

5.0 References

DOE (U.S. Department of Energy), 2003. *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,* FONSI DOE/EA-1394, Oak Ridge Operations Office, February 24.

DOE (U.S. Department of Energy), 2016. *Long-Term Surveillance and Maintenance Plan for the Boiling Nuclear Superheater (BONUS) Reactor Facility, Rincón, Puerto Rico,* LMS/BON/S01091, Office of Legacy Management, August.

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Appendix A

Site Drawing

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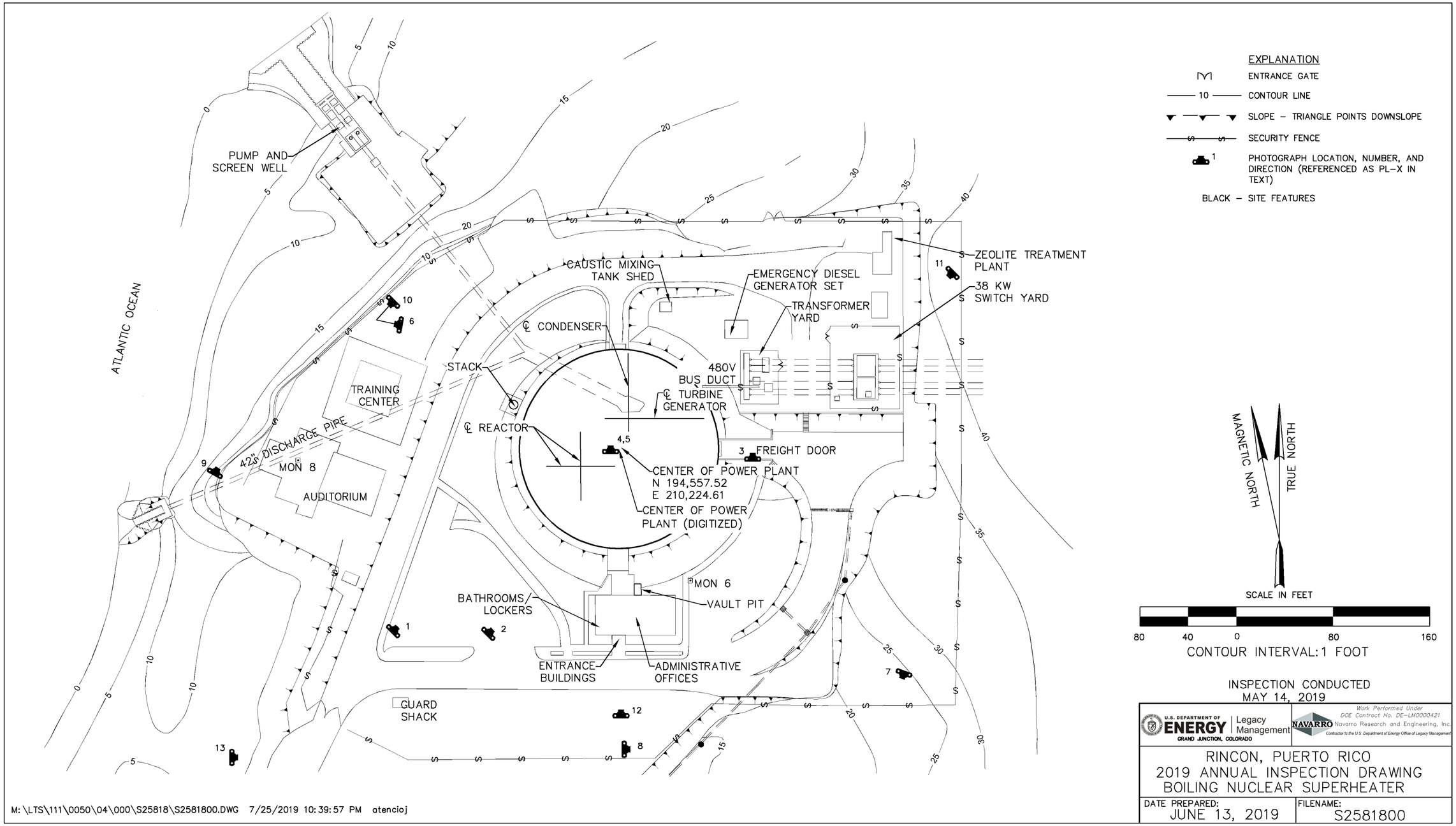

Figure A-1. Annual Inspection Drawing, Rincón, Puerto Rico, BONUS Site

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