Entergy

Entergy Nuclear Operations, Inc.
Palisades Nuclear Plant
27780 Blue Star Memorial Highway
Covert, MI 49043

July 16, 2007

10 CFR 50.90

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

Palisades Nuclear Plant
Docket 50-255
License No. DPR-20

Response to Request for Additional Information Regarding License Amendment Request for Emergency Core Cooling Systems Surveillance Requirement (TAC No. MD5259)

Dear Sir or Madam:

By letter dated April 18, 2007, Entergy Nuclear Operations, Inc. (ENO) requested Nuclear Regulatory Commission (NRC) review and approval of a license amendment request for Palisades Nuclear Plant. The proposed amendment would revise Technical Specification 3.5.2, "ECCS [Emergency Core Cooling Systems] – Operating," specifically, Surveillance Requirement 3.5.2.9, to reflect the configuration of the containment recirculation sump following modifications.

By electronic mail dated June 5, 2007, the NRC requested additional information on the proposed amendment. On June 14, 2007, a teleconference was held with the NRC staff to discuss the request. Enclosure 1 provides ENO's responses, including clarifications provided during the June 14, 2007, teleconference with the NRC staff.

Summary of Commitments

This letter contains no new commitments and no revision to existing commitments.

I declare under penalty of perjury that the foregoing is true and correct. Executed on July 16, 2007.

Thomas Kelvin for CJS

Christopher J. Schwarz
Site Vice President
Palisades Nuclear Plant

Enclosure (1)

CC Administrator, Region III, USNRC
Project Manager, Palisades, USNRC
Resident Inspector, Palisades, USNRC

ENCLOSURE 1
RAI RESPONSE ON ECCS SURVEILLANCE REQUIREMENT LAR
PALISADES NUCLEAR PLANT

Entergy Nuclear Operations, Inc. (ENO) requested Nuclear Regulatory Commission (NRC) review and approval of a license amendment request for Palisades Nuclear Plant (PNP). The proposed amendment would revise Technical Specification (TS) 3.5.2, "ECCS [Emergency Core Cooling Systems] – Operating," specifically, Surveillance Requirement (SR) 3.5.2.9, to reflect the configuration of the containment recirculation sump following modifications. The NRC requested additional information on the proposed amendment. ENO's responses, including clarifications provided during a June 14, 2007, teleconference with the NRC staff are provided below.

NRC Request

1. *How will Palisades ensure that the strainers will not incur undetected latent damage (e.g., from maintenance or operations activities on or in the vicinity of the strainers) that could adversely impact the strainer's performance?*

ENO Response

1. ENO plans to use procedural controls to ensure that the strainers at PNP will not incur undetected latent damage that could adversely impact the strainer's performance. The procedures and descriptions are provided below.

   Procedure RT-92, "Inspection of ECCS Train Containment Sump Suction Inlet," documents the steps to perform the required TS SR inspections. ENO plans to revise this procedure to reflect the change to TS SR 3.5.2.9. The pending revision provides the process to perform visual inspection during Modes 5 or 6 to verify that the containment sump entrance pathways, which include the passive strainer assemblies, floor drain debris screens, containment sump vent line debris screens and reactor vessel cavity drain corium plug bottom cup assemblies, show no evidence of structural distress or abnormal corrosion. This procedure also contains instructions to perform a cleanliness inspection of the containment sump, the sump level switches and the containment sump drain. These inspections ensure that foreign materials, including unidentified organic material that may develop on the sump interior, is removed.

   A new procedure is being developed to provide instruction to require a visual inspection following any maintenance activity performed on the containment envelope that requires breaching any containment sump envelope entrance pathway. The purpose of this inspection is to verify that the affected containment sump entrance pathways show no evidence of debris, structural distress, gaps or defects in the containment sump

envelope connection prior to returning the affected containment sump envelope to service.

ENO plans to revise procedure SOP-1A, "Primary Coolant System," to reflect the change to TS SR 3.5.2.9. The pending revision contains direction for general visual inspection of the surface of the containment sump strainer assemblies, containment sump downcomer screens, containment sump vent line debris screens, and the containment sump 590' elevation floor drain screens at containment closeout. This inspection is to confirm that there is no evidence of structural distress, gaps, defects, or damage in the strainer assemblies, strainer discharge piping, floor drain debris screens, sump vent debris screens, or downcomer debris screens.

NRC Request

2. *The installation of the new containment sump strainer increases the metal heat sink mass in containment. Does this metal heat sink mass increase impact the LOCA analyses (e.g., containment pressure)? If so, please explain how.*

ENO Response

2. The metal heat sink mass increase has an insignificant impact on the loss-of-coolant accident (LOCA) analyses. AREVA, the fuel vendor for PNP, assessed the effect of the addition of the passive strainer assemblies on the existing 10 CFR 50, Appendix K Large Break LOCA (LBLOCA) analyses. Incorporation of the passive strainer assemblies and associated discharge piping adds approximately 12,000 lbm of metal and approximately 3,750 ft^2 of surface area, which represents approximately only 0.26% of the effective mass in the containment and approximately only 1.6% of the effective surface area. AREVA concluded that incorporation of the sump screen strainers and associated piping has an insignificant effect on containment pressure and an insignificant effect on the peak cladding temperature for the LBLOCA analysis of record. Though no re-analysis was necessary for the PNP Appendix K LBLOCA analysis of record, AREVA addressed this change in the Palisades Cycle 20 Safety Analysis Report. ENO reviewed the AREVA analysis and concurs with the conclusion.

NRC Request

3. *Please explain how the combination of the new strainers and the new screens will provide equivalent performance to the existing screen and how they will meet the existing licensing basis for the sump. Please describe the design of both, including penetration sizes.*

ENO Response

3. The new strainers and new screens are designed to provide performance equivalent to, or better than, the existing screen and meet the existing licensing basis for the sump. The containment sump design basis function is to provide the ability to recirculate primary coolant system (PCS) water, following a LOCA, via the ECCS high pressure safety injection (HPSI) and containment spray (CS) pumps.

   The existing sump screens consist of two stainless steel screen assemblies, one for each ECCS containment sump suction. Each assembly has five panels and each panel is approximately 37" in height, 20" in width, fabricated from No. 6 stainless steel cloth mesh (0.047" diameter wire mesh on 0.125" square center spacing) mounted on structural angle frames extending from the floor of the sump to the ceiling, which completely cover each of two ECCS/CS pump suction lines and are located interior to the containment sump. The size of the existing screen openings was based on restricting debris greater than 0.178" (on the diagonal of the square mesh) into the ECCS/CS pump suction lines.

   The new sump strainers are passive Sure-Flow® Strainers, located outside the containment sump. The strainer assemblies, together with the debris screens and the reactor cavity drain plugs (corium plugs), completely protect the common containment sump rather than protecting only the ECCS/CS pump suction lines. The passive strainer assemblies prevent the debris greater than 0.045" from entering the containment sump envelope following a LBLOCA. The new passive strainer 0.045" diameter perforation size was chosen as it was the smallest hole diameter commercially available without using special fabrication methods. The debris screens are fabricated from the same 0.045" perforated plate, though no credit is taken for post-LOCA debris loaded flow through these minor openings in the containment sump envelope. Debris removal is required for the continued operation of the ECCS/CS components. The new strainer assembly and debris screens represent a significant enhancement with respect to GSI-191. The capability of the new strainers to minimize the head loss due to debris across the strainers to ensure required HPSI and CS pump flows from the containment sump is integral to acceptable recirculation performance.

The effective area of each of the existing containment sump screens is approximately 26 ft^2 (approximately 52 ft^2 total in the sump). The effective surface area for the new containment sump strainer assemblies is approximately 3500 ft^2. This increase in surface area reduces the flow velocity through the screens and results in less debris head loss as well as less debris bypassing the strainer and reaching the pumps and reactor core. The strainer configuration is designed to limit the head loss during post-LOCA design conditions. Therefore, the new strainer assemblies continue to provide the ability to recirculate PCS, following a LOCA, via the ECCS HPSI and CS pumps, as well as, or better than, the existing containment sump screens.

The design function of the existing containment sump screens is to provide ECCS pump suction protection based on an assumption that half of each sump screen is covered with debris such that water cannot flow through the blocked portion of the screen. The other 50% is assumed to remain completely unblocked. The blockage assumption of 50% is consistent with Regulatory Position 7 of Regulatory Guide 1.82, "Water Sources for Long-Term Recirculation Cooling Following a Loss-of-Coolant Accident," June 1974.

As stated above, the effective area of the existing screens is approximately 52 ft^2, while the effective surface area for the containment sump strainer assemblies is approximately 3500 ft^2. The non-deterministic 50% screen blockage in the existing design function, if applied to the new passive strainer assemblies, far exceeds the approximately 26 ft^2 surface area provided by the existing screens. Assuming half of each sump screen is covered with debris such that water cannot flow through the blocked portion of the screen and the other 50% remains completely unblocked, the existing containment sump screens provide ECCS pump suction protection. The new passive strainer assemblies are expected to continue to provide ECCS pump suction protection equal to or better than the existing containment sump screens due to the increased effective surface area.

During the June 14, 2007, teleconference the NRC staff requested information on the single failure criteria for the new passive strainer assemblies. This information is provided below.

The change from separate protection of each ECCS train containment sump suction inlets to protection of a common containment sump envelope does not introduce a change in the system effects associated with a credible single failure on the ECCS containment sump suction inlet screen. ENO's review of the PNP licensing basis concluded that the application of a single passive failure of the passive containment sump

strainer assemblies and the associated containment sump debris screens is not required per ANSI/ANS 58.9-1981, "Single Failure Criteria for [Light Water Reactor] LWR Safety-Related Fluid Systems." No single failure of the system pressure boundary or its flow blockage is credible. Therefore, the original licensing basis is maintained.

Currently, should a non-credible single failure of the existing ECCS containment sump suction inlet screen occur, it would result in introducing debris into both trains of HPSI, as the existing CS system train configuration is not hydraulically separated. Both trains of CS system tie into a common CS system header which serves as the suction source for both trains of the HPSI pumps via the HPSI subcooling lines. The ECCS and CS system pump suctions are automatically switched to the containment sump when the safety injection and refueling water tank level falls to a preset point. At this time, the flow path from the containment sump is opened, the safety injection and refueling water tank flow path is closed and the low pressure safety injection pumps are stopped. Water from the containment sump is then circulated by the containment spray pumps and cooled by the shutdown cooling heat exchangers. CS system flow is branched downstream of the shutdown heat exchangers to the HPSI subcooling lines. The HPSI subcooling valves are opened to ensure adequate net positive suction head for operating high pressure safety injection pumps. Therefore, a single failure of either existing ECCS train containment sump suction inlet results in debris being introduced to both trains of HPSI and associated downstream HPSI and CS system serviced components.

The change to a common containment sump envelope, with its containment sump envelope protective strainers and debris screens, does not adversely affect or introduce change in the downstream effects associated with a single failure, except for the containment spray pumps. However, as discussed above, this is a condition beyond the licensing basis.

During the June 14, 2007, teleconference the NRC staff requested a more detailed description of the corium plugs and their function. This information is provided below.

The reactor cavity flooding system consists of a network of floor drain piping arranged to perform two functions:

1. Collect normal expected floor drains and transport these drains to the containment sump for subsequent disposal outside the containment.

2. Collect a portion of the containment spray water and transport this water into the reactor cavity for flooding and cooling the outside of the reactor vessel bottom head.

The two one-inch drain lines at the bottom of the reactor cavity contain drain plugs designed to inhibit the flow of core debris (corium) into the containment sump in the event of a core meltdown and subsequent reactor vessel failure. The plugs are also designed to permit the normal flow of water through the drain lines. The corium plugs form an inherent debris screen equal to the 0.045" perforated debris screens protecting the containment sump envelope.

The corium plugs were installed in 1996 as part of a plant modification. The modification consisted of inserting stainless steel canisters containing ceramic pellets into the two one-inch reactor cavity drain lines to restrict the flow of corium into the sump in the event of a reactor vessel breach. The pellets have a melting temperature on the order of 3400 °F and are stable under normal operating and design basis accident environmental conditions. The canisters are designed to withstand an instantaneous blast load from the reactor vessel coincident with a seismic event. The canisters are designed to permit normal water drainage. The drain lines do not have any active components. The reactor cavity flooding system is not included in the mitigation of any design basis event. A core melt/reactor vessel bottom failure is not a design basis event.

The details for the drain line plugs are shown on plant Drawing M74, sheet 1. A portion of this drawing showing the drain line configuration (Detail B) is provided as Attachment 1. The drain plug detail is shown on plant Drawing M74, sheet 2. A portion of this drawing showing the cavity drain plug configuration is provided as Attachment 2.

Under a design basis LOCA, the reactor cavity flooding system debris laden water collected in the floor drains above the 590' elevation transports into the reactor cavity. The post-LOCA fibrous debris transported in the reactor cavity bridges and deposits on the 0.188" and 0.063" cavity drain plug end cap openings and/or in the tortuous pathway created by the ¼" diameter, ¼" long ceramic pellets contained in the 18" long cavity drain plug, and effectively plugs and prevents debris flow through the two cavity drain lines into the containment sump.

NRC Request

4. *Provide the associated technical specifications (TS) bases and the applicable sections of the updated final safety analysis report (UFSAR) from which the proposed TS surveillance requirement (SR) 3.5.2.9 is derived. {This information is necessary for the staff to determine whether the performance of TS SR 3.5.2.9 provides adequate assurance that the sump, as modified, will perform as described in the accident analysis section of the UFSAR. Therefore, if not included in the UFSAR or bases, the response should included sufficient information for the staff to make this determination and the UFSAR and bases should be updated if required. This information is required for the staff to confirm compliance with 10 CFR 50.36(c)(3).}*

ENO Response

4. The associated TS bases and the applicable sections of UFSAR changes for the proposed TS SR are provided for information below.

   TS Bases Current SR 3.5.2.9
   Periodic inspection of the containment sump ensures that it is unrestricted and stays in proper operating condition. The 18 month Frequency is based on the need to perform this Surveillance under outage conditions. This Frequency is sufficient to detect abnormal degradation and is confirmed by operating experience.

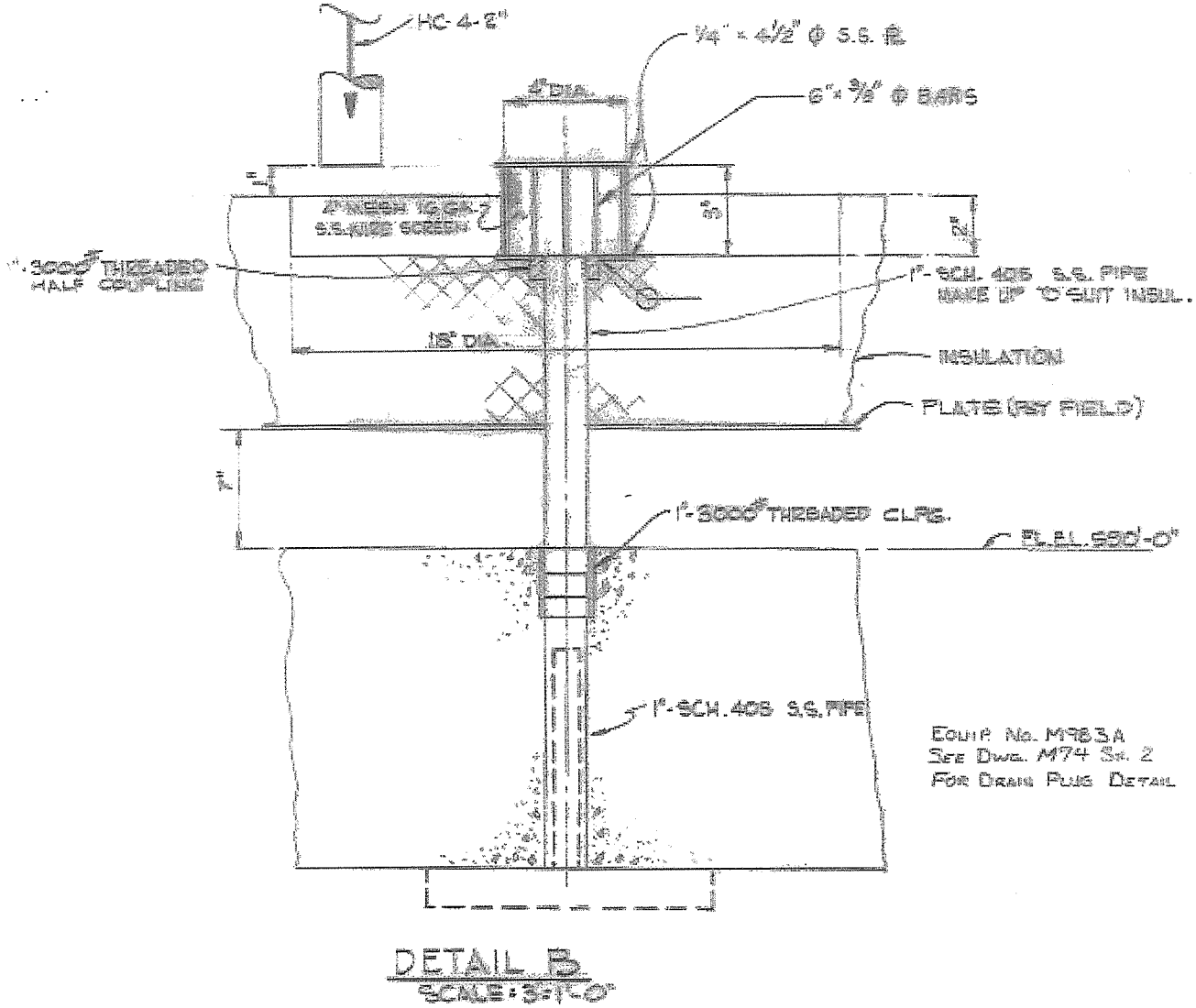
   TS Bases Proposed SR 3.5.2.9
   Periodic inspection of the ECCS train containment sump passive strainer assemblies ensures that the post-LOCA recirculation flowpath to the ECCS train containment sump suction inlets are unrestricted. Periodic inspection of the containment sump entrance pathways, which include containment sump passive strainer assemblies, containment sump downcomer debris screens, containment floor drain debris screens, containment sump vent debris screens and reactor cavity corium plug bottom cup support assemblies ensure that the containment sump stays in proper operating condition. The migration of LOCA-generated debris through the two one-inch reactor cavity drain line corium plugs is not considered to be credible. The 18 month Frequency is based on the need to perform this Surveillance under outage conditions. This Frequency is sufficient to detect abnormal degradation and is confirmed by operating experience.

   The proposed change to the UFSAR consists of adding the following paragraph to section 6.1, "Safety Injection System" after the introductory paragraph under subsection 6.1.3, "Long Term Post LOCA Core Cooling."

UFSAR Proposed 6.1.3 Addition

In response to Generic Safety Issue 191, "Assessment of Debris Accumulation on [Pressurized Water Reactor] PWR Sump Performance," passive containment sump strainer assemblies were installed for segregating post-LOCA generated debris from the containment sump envelope. The strainer assemblies are sized for the bounding debris load generated following a large break loss-of-coolant-accident (LOCA) in order to ensure that HPSI and containment spray pump net positive suction head and system flow rate requirements are met. In addition, passive debris screens are provided on the four remaining containment sump downcomers, seven 590' elevation containment floor drains and two existing containment sump vent lines to ensure that post-LOCA generated debris does not enter the containment sump envelope. Both the sump strainer assemblies and the debris screens meet CPCo Design Class 1 requirements.

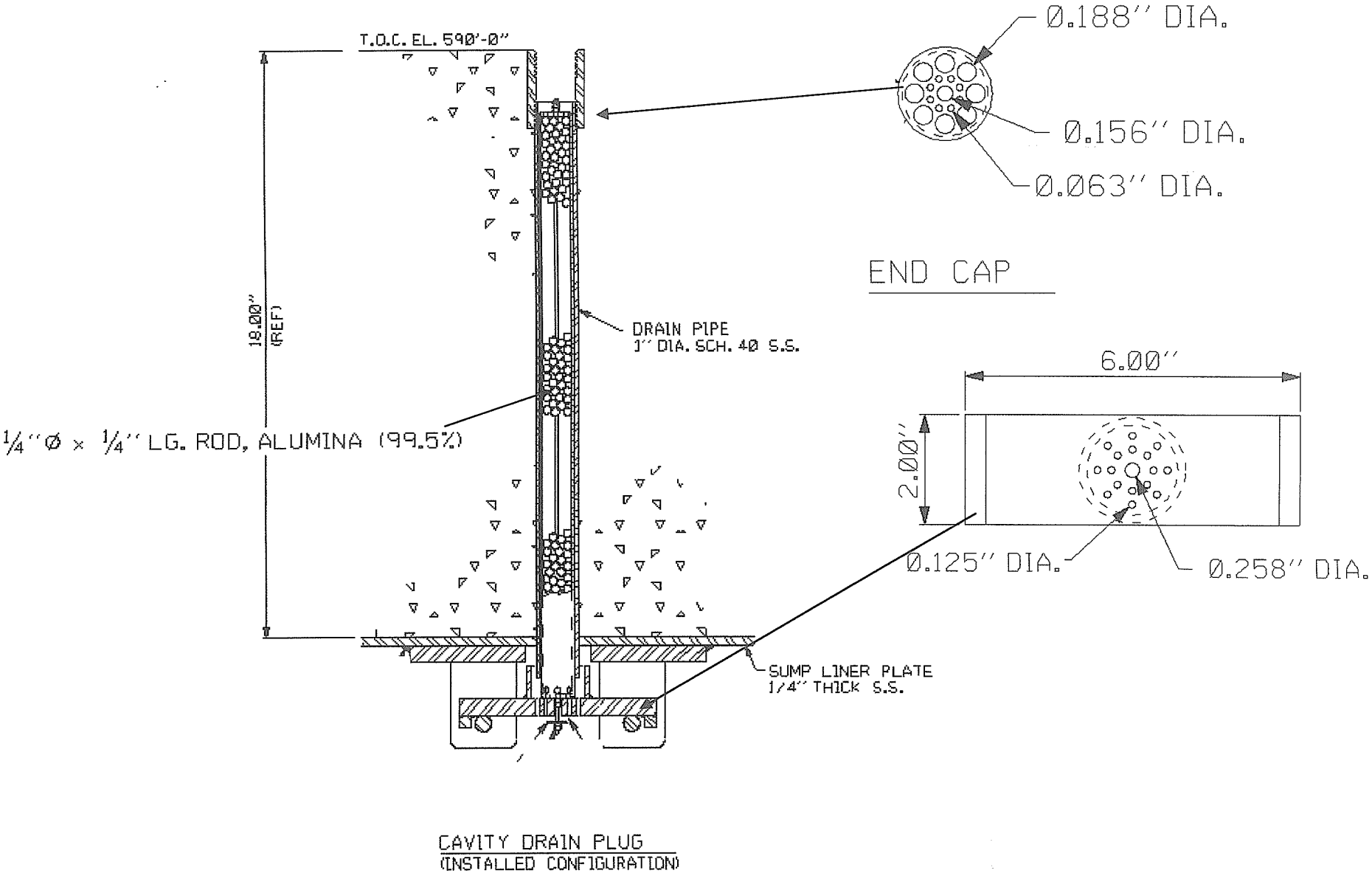
ATTACHMENT 1
DRAIN LINE CONFIGURATION



DETAIL B
SCALE: 3"=1'-0"

Reference M-74, Sheet 1, Revision 12

ATTACHMENT 2
DRAIN PLUG CONFIGURATION



Reference: M-74, Sheet 2, Revision 0