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**FLOODING WALKDOWN REPORT**  
**IN RESPONSE THE 50.54(f) INFORMATION REQUEST REGARDING**  
**NEAR-TERM TASK FORCE RECOMMENDATION 2.3: FLOODING**

**for the**  
**D.C. Cook Nuclear Power Plant**  
**1 Cook Place**  
**Bridgman, MI 49106**

**Unit 1 Facility Operating License No. DPR-58,**  
**NRC Docket No. 50-315**

**Unit 2 Facility Operating License No. DPR-74,**  
**NRC Docket No. 50-316**



Report No:  
CNP: MD-12-FLOOD-002-S-Rev. 0  
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Prepared by: AREVA NP, Inc.  
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**AREVA NP Inc.**



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## **Engineering Information Report**

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REGARDING NEAR-TERM TASK FORCE**

**RECOMMENDATION 2.3: FLOODING**

**for the**

**D.C. COOK NUCLEAR POWER PLANT**

**1 Cook Place, Bridgman, MI 49106**

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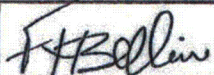

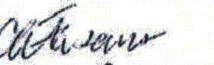

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Safety Related? ☐ YES ☒ NODoes this document contain assumptions requiring verification? ☐ YES ☒ NODoes this document contain Customer Required Format? ☒ YES ☐ NO

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### Record of Revision

Revision No.	Pages/Sections/ Paragraphs Changed	Brief Description / Change Authorization
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## 1.0 PURPOSE

In response to the consequences of the March 11, 2011 earthquake and subsequent tsunami at the Fukushima-Dai-ichi power plant, the U. S. Nuclear Regulatory Commission (NRC) established the Near Term Task Force (NTTF) to conduct a systematic review of NRC processes and regulations, and to make recommendations to the Commission for its policy direction. The NTTF reported a set of recommendations that were intended to clarify and strengthen the regulatory framework for protection against natural phenomena.

On March 12, 2012, the NRC issued an information request pursuant to Title 10 of the Code of Federal Regulations, Section 50.54 (f): 10 CFR 50.54(f) or 50.54(f), (NRC, 2012). In Enclosure 4 of the March 12, 50.54(f) letter, NTTF Recommendation 2.3: Flooding, the NRC requested that licensees perform flood protection walkdowns to identify and address plant-specific degraded, nonconforming, or unanalyzed conditions and cliff-edge effects (through the corrective action program) and verify the adequacy of monitoring and maintenance procedures based on the plant's current licensing basis (CLB).

This report provides the information requested in the March 12, 50.54(f) letter for the Cook Nuclear Plant (CNP) (NRC, 2012). It addresses information listed as the 'Requested Information' in Enclosure 4, paragraph 2 ('a' through 'h'). The 'Requested Information' section of Enclosure 4, paragraph 1 ('a' through 'j'), regarding flooding walkdown procedures, was addressed via Indiana Michigan Power Company's June 8, 2012, acceptance (IMP, 2012) of the industry walkdown guidance (NEI, 2012).

## 2.0 REFERENCES

AREVA, 2012. Cook Nuclear Plant Flooding Walkdown Report: 2012, AREVA Document No. 51-9193521-000 and CNP Document MD-12- FLOOD-001-S-Rev. 0, November, 2012.

CNP, 2010. Seiche, CNP Plant Procedure 12OHP-4022-001-009, Rev. 6, 8/18/10

CNP WO, 2012. CNP Work Order Package 55386986-03: Inspect Turbine Room Sump Emergency Overflow Vault Overflow Check Valve, 6/4/12.

CNP UFSAR, 2012. D. C. Cook Nuclear Plant Updated Final Safety Analysis Report, Docket Nos. 50-315 and 50-316, Revision 24, 3/17/12.

CNP UFSAR Q&R, 1971. CNP UFSAR Amendment 16, September 1971 Question 2.2.1 through 2.2.8 CNP UFSAR Amendment 30, September 1972 Question 2.23

IMP, 2012. Indiana Michigan Power Letter to the NRC, dated June 8, 2012, "Response to NRC Request for Information Pursuant to 10 CFR 50.54(f) Regarding the Flooding Aspects of Recommendations 2.1 and 2.3 of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident,"

NEI, 2012. NEI Report 12-07 [Rev 0-A], *Guidelines for Performing Verification Walkdowns of Plant Protection Features*, May 2012 [NRC endorsed May 31, 2012; updated and re-issued June 18, 2012]

NRC, 2012. Request For Information Pursuant To Title 10 Of The Code Of Federal Regulations 50.54(f) Regarding Recommendations 2.1, 2.3, And 9.3, Of The Near-Term Task Force Review



of Insights From The Fukushima Dai-Ichi Accident, ML12053A340, 3/12/12  
(<http://pbadupws.nrc.gov/docs/ML1205/ML12053A340.pdf>).

NRC, 2012a. Letter from D.L. Skeen (NRC) to A.P. Heymer (NEI), dated May 31, 2012, Endorsement of Nuclear Energy Institute (NEI) 12-07, "Guidelines for Performing Verification Walkdowns of Plant Flood Protection Features".

### 3.0 RESULTS

#### 3.1 Requested Information Item 2(a)

**Describe the design basis flood hazard level(s) for all flood-causing mechanisms, including groundwater ingress.**

The design basis flood results from a weather-driven seiche (seiche) on Lake Michigan (CNP UFSAR, 2012). The CLB for CNP is described in licensing documents as follows:

UFSAR 2.6.2.3 (CNP UFSAR, 2012):

*"To determine the plant elevation necessary to protect the plant from flooding due to seiches, the characteristics of the lake shore at the plant, historical meteorological conditions, and mathematical modeling were used to determine a maximum seiche of 11 feet. This equates to a plant elevation of 594.6 feet above mean sea level (NGVD).*

*"The plant is flood protected from the maximum (monthly mean) high lake water level; however, a design basis seiche occurring when the lake is at its maximum recorded level will cause flooding in the Turbine Building Screen-house. Safety-related components located in the Turbine Building Screen-house have been evaluated for the condition and flood sensitive components have been protected. Therefore protection has been provided for safety-related equipment from flooding, waves, ice storms and other lake related hazards."*

UFSAR 2.8.7 (CNP UFSAR, 2012):

*"Plant grade and the design bases of features related to plant safety are established to consider the coincidence of the maximum seiche postulated for the site with the highest recorded lake level."*

#### Inherent protection of the Auxiliary and Containment Buildings

UFSAR 5.2.2 (CNP UFSAR, 2012):

*"The Containment Structure is inherently safe with regards to common hazards such as fire, flood and electrical storm." "The Underground area of the auxiliary and containment buildings have been waterproofed by means of a PVC 40 mil thick membrane. This membrane extends at least 5 feet above the maximum known GW level. The water-proofing used provides adequate protection against flooding of areas below the highest GW level."*

#### Protection of safety-related components in the Screenhouse and Turbine Building:

UFSAR 10.6.2 (CNP UFSAR, 2012):

*"Since the essential service water pumps are located in the screen house, the entire foundation and masonry portions of the circulating water pump house structure are designed to Seismic Class I. Concrete barriers are provided to protect the essential service water pumps against*



*turbine missiles and from fires or other accidents in the adjacent essential service water pump compartments. In addition, the essential service water pump compartments are designed to withstand tornado-wind effects and tornado-borne missiles. The essential service water pump motors are above Elev. 594.6' and therefore are adequately protected from the maximum flood condition anticipated due to a seiche or surge phenomenon."*

*UFSAR Questions and Answers (CNP UFSAR Q&R, 1971):*

*In response to UFSAR Questions 2.2.1 through 2.2.8, and Question 2.23, Cook Plant responded that all accesses to the interior of the turbine and auxiliary buildings are protected against a water level elevation of 594.6'. Furthermore, Cook Plant stated that all accesses between the circulating pump room and turbine building are flood protected, and that the Turbine Room Sump Emergency Overflow Vault emergency overflow line to the screenhouse has a flapper type check valve to prevent any backflow due to high water levels in the screenhouse.*

*ESW Pump motors and all vital motor controls are located above elevation 594.6'. All accesses to the interior of the turbine building and auxiliary building are protected against a water elevation of 594.6'.*

*All access between the circulating water pump room and turbine building are flood protected. The personnel access between the screenhouse and turbine building is through stairways which are above 594.6' elevation. The Turbine Room Sump Emergency Overflow Vault emergency overflow line to the screenhouse has a flapper type check valve to prevent any backflow due to high water levels in the screenhouse. All piping penetrating the screenhouse-turbine building interface below the elevation of 594.6' is embedded.*

A seiche is assumed to be the only mechanism accounted for in the CNP plant CLB. Impact of storm surge is assumed to be less than that for the seiche. Flooding due to Probable Maximum Precipitation and Local Intense Precipitation impacts are assumed to have minimal impact on the site due to the rapid infiltration of rainwater into the natural soils which consist of highly permeable dune sands.

Flood barrier features inspected for current licensing and design basis flood levels for the Cook Nuclear Plant (CNP) site are based on: the current licensing basis (Sections 2.6.2.3, 2.8.7, 5.2.2, 10.6.2 of CNP UFSAR, 2012 and Questions and Responses to UFSAR Questions 2.2.1 through 2.2.8, and Question 2.23 (CNP UFSAR Q&R, 1971).

The mechanism for the maximum flood for the CNP is a seiche to an elevation of 594.6 ft.

Potential for groundwater ingress was considered for the design but is not considered to be a credible flooding mechanism for flooding of site structures.

Coincidental damage from the effects of natural phenomena (seismic activity (earthquakes), tornadoes, lightning, hurricanes (winds) and wave damage or other flooding conditions is not assumed in the current licensing basis; therefore, it assumed that flood barriers and seals are intact to protect against any external flooding event. Additionally, flooding and other external events are not considered concurrently for the CLB.



### 3.2 Requested Information Item 2(b)

**Describe protection and mitigation features that are considered in the licensing basis evaluation to protect against external ingress of water into SSCs important to safety.**

The CLB flood level due to seiche flooding is not impacted by the mode of operation of the CNP, nor is mode of plant operation considered in the CLB external flood levels.

Flood protection for the CNP was established in the UFSAR and in CNP UFSAR Q&R, 1971. CLB flood protection requirements and supporting elements for the current licensing basis, for a flood elevation of 594.6', are as follows with component classification indicated per NEI 2012:

1. Seiche flood waters reach a maximum elevation of 594.6 feet. Validated assumptions supporting that flood elevation include a lake level equal to the maximum monthly mean Lake Michigan high water level of 583.6' NGVD plus 11 feet (surge due to seiche above that elevation): 594.6' (CNP UFSAR, 2012).
2. Flood water is assumed to enter the Screenhouse via its direct connection to Lake Michigan.
3. Flood water access to the Turbine Building from the Screenhouse and is prevented by:
  - a. Stairway access from the Screenhouse to the Turbine Building above 594.6' in elevation, an Incorporated Passive component
  - b. A check valve in the Turbine Room Sump overflow line, an Incorporated Active component
  - c. The Turbine Room Sump access hatch cover (CLB supporting element: assuming failure of check valve) , an Incorporated Passive component
  - d. All piping penetrating the Screenhouse-Turbine Building interface below the elevation of 594.6' is embedded in concrete, those seals being Incorporated Passive components
  - e. The integrity of the foundation concrete grade beam of the west side of the Turbine Building (CLB supporting element), an Incorporated Passive component
4. All vital safety-related equipment (e.g., diesel generators, spray pumps) housed at lower elevations within the Turbine Building and Auxiliary Buildings are suitably protected against a flood elevation of 594.6 feet by virtue of protection from elevation, building walls, and/or permanent flood protection barriers, all , an Incorporated Passive components
5. Diesel Fuel Oil Storage Tanks are vital safety systems components located outside the Turbine Building however, those tanks are buried below the 609' grade elevation at a distance of approximately 200 feet distant from the lake shore, providing substantial flood protection with the plant grade acting as Incorporated Passive protection
6. Essential Service Water Pumps and their motor controls are vital safety systems components located inside the Screenhouse. Pump motors and all vital controls are installed above elevation 594.6', the maximum flood elevation, acting as Incorporated Passive protection.
7. The structural concrete walls of the safety-related Auxiliary Building and Containment structures are incorporated passive features, acting as Incorporated Passive protection. They are assumed to be capable of withstanding any impacts of the design basis flood level of 594.6 feet (CNP UFSAR, 2012) as a direct result of their inherent design and the elevation of plant grade at 609 feet around those buildings, 14.4 feet above the maximum flood level.





Relative to flood protection component classification indicated in NEI 2012, there are no temporary flood protection features for the CNP, either active or passive. There is a plant procedure (CNP, 2010) initiated as a result of a report of weather that could generate a seiche, however the procedure is not a part of the CLB.

Weather conditions that generate a seiche for Lake Michigan consist of an intense squall line, generally moving northwest to southeast, with a large atmospheric-pressure gradient and high winds. The 11 foot seiche is assumed to occur when the lake level is at an elevation equal to the maximum monthly mean Lake Michigan high water level of 583.6' NGVD.

The seiche flood level is not associated with an expressed time duration. However, the nature of the seiche as a flood mechanism and a study referenced in the CNP UFSAR, 2012 as a basis for the seiche mechanism allows the inference of an 11 minute average duration. The duration of the seiche does not have an adverse impact on the current protection methodology, and it does not have an adverse impact on flood protection components; therefore, for the purposes of this walkdown, the flood duration is determined to be inconsequential.

### **3.3 Requested Information Item 2(c)**

#### **Describe any warning systems to detect the presence of water in rooms important to safety.**

There are no external flooding warning systems installed in rooms important to safety at the CNP. A flood protection procedure (CNP, 2010) is implemented, based on routine weather reports received in advance of a potential seiche for personnel safety, but only to further enhance plant protection beyond design levels.

### **3.4 Requested Information Item 2(d)**

#### **Discuss the effectiveness of flood protection systems and exterior, incorporated, and temporary flood barriers. Discuss how these systems and barriers were evaluated using the acceptance criteria developed as part of Requested Information Item 1.h [in Enclosure 4 of the March 12, 2012, 50.54(f) letter: NRC, 2012]**

CNP is protected from the external design basis flood due to seiche flooding from Lake Michigan. The flood protection features were inspected to the following acceptance criteria / inspection guidance. Flood protection features included incorporated active and passive features as defined by NEI, 2012; there are no temporary flood protection features, either active or passive, for the plant and there are no CLB credited operator actions.

Acceptance criteria for the walkdown were provided by reference to NEI, 2012, as follows: Flood protection features were considered acceptable if no conditions adverse to quality were identified during walkdowns, verification activities, or program reviews as determined by the licensee's Corrective Action Program. Conditions adverse to quality are those that prevent the flood protection feature from performing its credited function during a design basis external flooding event and are "deficiencies."

All flood barriers were evaluated by visual means and dimensional verification of feature configurations were made against configuration control documents. All potential issues identified during the walkdown were discussed with site engineering representative at the time of discovery. Action Reports were generated by site engineering representative as necessary. The Action Report numbers were incorporated into the walkdown record forms. All Action Reports related to the flooding walkdown have



been evaluated, and no deficiencies exist. The walkdown found that all CNP flood protection features are in conformance with the plant's CLB.

#### Evaluation of the overall effectiveness of the plant's flood protection features

Structures with a surrounding plant grade of 609 feet, 14.4 feet above the maximum flood level fully protect most site safety-related structures and components (the Containment, Auxiliary Building and safety-related features and components in the Turbine and Screenhouse Buildings) from the impacts of a seiche flood. In addition, a foundation membrane provides a barrier to groundwater entry into those buildings due to flooding, an improbable condition even at the maximum seiche flood condition due the local plant grade. In addition, the walkdown found all barrier systems are functional.

The Turbine Building's safety-related components are effectively protected from a maximum flood by barriers that prevent flow in through external doors and permanent engineered barriers that isolate it from the Screenhouse.

The Screenhouse floods as a result of a maximum seiche flood due to its direct connection with Lake Michigan. The safety-related components in the Screenhouse are effectively protected by their designed elevations, above the maximum flood level as defined by the CLB. The CNP design does not include any temporary flood protection barriers.

Additional plant features and conditions not credited in the CLB may also mitigate the effects of a seiche flood:

- A seiche can be anticipated based on reports Lake Michigan meteorological conditions from the weather authorities providing some preparation time for the plant
- CNP, 2010 is a procedure designed to prepare the site for a potential seiche occurrence. It provides for manual closing a backup valve (backup to the check-flapper valve) to prevent flooding of the Turbine Room Sump Emergency Overflow Vault, providing defense-in-depth flooding protection for the Turbine Building.
- The sheet pile wall used to establish site grade above the lake front beach could diminish wave height, reducing the elevation of a flood. Concrete security barriers along the fence line above the wall could also impede a seiche wave.
- Some internal flood protection components, such as barriers to flood flow from the Turbine Building into the Emergency Diesel Generator areas, serve as mitigation for beyond-design-basis flooding.

### **3.5 Requested Information Item 2(e)**

**Present information related to the implementation of the walkdown process (e.g., details of selection of the walkdown team and procedures) using the documentation template discussed in Requested Information Item 1.j [in Enclosure 4 of the March 12, 2012, 50.54(f) letter] (NRC, 2012), including actions taken in response to the peer review.**

The walkdowns were conducted in accordance with guidance contained within NEI, 2012. The walkdown team comprised experienced AREVA personnel (2 to 3 at a time) and was assisted by CNP staff (1 to 3 at a time). There were at least 2 qualified walkdown team members present during the





walkdowns. The AREVA personnel have varied backgrounds and experiences (relevant engineering and science degrees, more than 10 years, generally more than 20 years of nuclear experience, nuclear power plant construction, decommissioning and walkdown experience).

The AREVA walkdown personnel are trained for the flooding related guidance in NEI, 2012 and all the walkdown team members had completed the NAntel training (trained to NEI, 2012) prior to conducting the flooding walkdowns (inspections) at CNP. Site Specific preparation for NTF Recommendation 2.3 Flooding Walkdown was also conducted prior to conducting the flooding walkdowns at CNP. The site specific preparation assured that the walkdown team members were knowledgeable of the site current licensing basis regarding flooding issues and layout of CNP as well as the references that described all aspects of flood protection conditions and components. Daily pre-job briefs were conducted before the flooding walkdowns. The pre-job briefs laid out which areas of the plant were to be included in the walkdown and provided familiarization with basis for the walkdown scope and items to be inspected and preliminary analysis activities related to the features to be inspected; they also provided a forum for questions and responses from knowledgeable plant personnel to the walkdown team. The AREVA Walkdown personnel were accompanied and supported by CNP personnel during the performance of the flooding walkdowns.

NRC resident inspectors observed one of the pre-job briefs and a flooding walkdown (inspection) as well as inspecting one or more of the examined features of the walkdown guided by written walkdown results in accordance with the NRC Inspection Manual Temporary Instruction 2515/187.

No exceptions are taken to the guidance provided in NEI, 2012 Sections 5.3, 5.7, and Appendix B. The Appendix B walkdown record forms were liberally enhanced with detailed field notes, as necessary to represent field conditions. The NEI, 2012 Appendix B walkdown record forms will be retained and are available for NRC audits and inspections. A full report of all walkdown details (AREVA, 2012) was prepared. That report includes all details of components inspected, measurements made and photographs taken during walkdowns including for components and items that address issues outside the CLB.

### 3.6 Requested Information Item 2(f)

**Results of the walkdown including key findings and identified degraded, non-conforming, or unanalyzed conditions. Include a detailed description of the actions taken or planned to address these conditions using the guidance in Regulatory Issues Summary 2005-20, Rev 1, Revision to NRC Inspection Manual Part 9900 Technical Guidance, "Operability Conditions Adverse to Quality or Safety," including entering the condition in the corrective action program.**

Per Section 3.8 of NEI, 2012, a deficiency exists when a flood protection feature is unable to perform its intended flood protection function when subject to a design basis flooding hazard. This condition may also lead to compromising the overall ability of the feature to provide protection or mitigation. During the flooding walkdowns, observations that may be potential deficiencies were entered to the corrective action program (Action Reports were generated) and have been evaluated in accordance with the station processes. The Action Reports have been dispositioned, and no deficiencies exist. The flooding walkdown observations are recorded on the Appendix B walkdown record forms with corresponding detailed photographs of the walkdown observations.

The following flood protection feature, a supporting element for the CLB, could not be inspected during the flooding walkdowns:



Inaccessible Equipment (equipment disassembly required for access):

Turbine Room Sump - underside of the sump hatch cover and underlying check valve

- Recent maintenance information (CNP WO, 2012) was used as a substitute for walkdown observation
- There are no plans for an additional flood protection inspection as the features are included in the CNP Preventative Maintenance Program.

A minor observation was made for the Turbine Building foundation grade beam. One small diameter hole through the beam, and below the maximum seiche flood level, was found plugged with wood. Appropriate action was taken to assure repairs to the wall through the AR process.

**3.7 Requested Information Item 2(g)**

**Document any cliff-edge effects identified and the associated basis. Indicate those that were entered into the corrective action program. Also include a detailed description of the actions taken or planned to address these effects.**

Cliff edge conditions are defined as “conditions where the safety consequences of a flooding event may increase sharply with a small increase in the flooding level”. No such conditions were observed during the walkdown. Walkdown results identified several instances of small Available Physical Margin (APM) for flood protection components. However, the walkdown observed no instances of small AMP where safety consequences of a flooding event may increase sharply as a result of flooding at these locations. Cliff Edge effects will be fully determined during the integrated assessment.

The Available Physical Margins (APMs) have been collected and documented in the Appendix B walkdown record forms. This information will be used in the flood hazard reevaluations performed in response to Item 2.1 and will be retained and are available for NRC audits and inspections. No actions have been taken or planned at this time to address the APM items.

**3.8 Requested Information Item 2(h)**

**Describe any other planned or newly installed flood protection systems or flood mitigation measures including flood barriers that further enhance the flood protection. Identify results and any subsequent actions taken in response to the peer review.**

No changes to the CNP flood protection features were determined to be necessary during the flooding walkdowns.

All the Appendix B walkdown record forms (Part A through E) were peer reviewed by a team member who was part of the flooding walkdown team. All peer reviewer comments were resolved and the Appendix B walkdown record forms were revised to reflect these changes. The peer review encompassed but is not limited to the following:

- No errors in the paperwork
- Work is technically accurate
- Comments, conclusions, and explanations are clearly stated
- Answers to questions do not result in conflicting information



- The conclusions are technically justified and supported by sound reasoning.

Participation of station staff in all walkdown work and their review of the walkdown documentation and response to any related issues provided an overall evaluation of the walkdown results. This review and resulted in both individual ARs and an aggregate summary to assure that all actions can be completed as required. This review as well as the reviews required for the walkdown itself satisfies the "peer review" activities requested in NRC, 2012, Enclosure 4.

#### 4.0 CONCLUSIONS

The flooding walkdown procedure provided in NEI, 2012, Guidelines for Performing Verification Walkdowns of Plant Flood Protection Features, Revision 0-A, which was endorsed by the NRC in a letter dated May 31, 2012 (NRC, 2012a) was used as the basis for the flooding walkdowns at the D. C. Cook Nuclear Plant (CNP). NEI, 2012 Appendix B walkdown forms were used during the flooding walkdowns.

The Appendix B walkdown record forms were completed for all the relevant flood protection features. Available physical margins for the flood protection features were identified as applicable during the flooding walkdowns and recorded on the Appendix B walkdown record forms. Acceptance criteria were developed based of the information in NEI 12-07 Appendix A. All observations were recorded on the flooding walkdown record forms and photographs were incorporated as appropriate into the forms to document the as-found conditions. All potential issues were discussed with site engineering representative at the time of discovery. Action Reports were generated by a site engineering representative, as necessary. The AR numbers were incorporated into the Appendix B walkdown record form documentation.

All flood protection features were assessed either by direct examination or review of preventative maintenance work packages. The only inaccessible features for the walkdown were the Turbine Room Sump access hatch cover and the sump discharge line check valve. No additional examinations are required to be completed for the walkdown.

No deficiencies or conditions that would impact the safety of the CNP were identified. The plant meets the all requirements of the current licensing basis.