NLS2012124

ENCLOSURE

COOPER NUCLEAR STATION FLOODING WALKDOWN REPORT

Nebraska Public Power District
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CNS Memo 12-0002

To: Cooper Nuclear Station Licensing Department

From: Cooper Nuclear Station Design Engineering Department

CC: N/A

Date: 11/26/2012

Re: Response to 10 CFR 50.54(f) Section 2.3 Flooding

Validation and Acceptance of Vendor Provided Evaluations

In response to the nuclear fuel damage at Fukushima Daiichi due to earthquake and subsequent tsunami, the United States Nuclear Regulatory Commission (NRC) is requesting information pursuant to Title 10 of the Code of Federal Regulations, Section 50.54 (f). As part of this request which is as defined in the Recommendation 2.3, Flooding, Enclosure 4 of the 50.54(f) Letter dated March 12, 2012, CNS was required to perform walkdowns to verify that plant features credited in the current licensing basis (CLB) for protection and mitigation from external flood events is available, functional, and properly maintained. In addition, the purpose of the walkdowns was to identify and address plant-specific degraded, non-conforming, or unanalyzed conditions (through the corrective action program) and associated APM (Available Physical Margin) and verify the adequacy of monitoring and maintenance procedures. This information was obtained in accordance with NEI 12-07, "Guidelines for Verification Walkdowns of Plant Flood Protection Features". This memo is being written for CNS Design Engineering to formally accept the walkdown packages, and final walkdown report as being technically accurate.

The walkdowns were developed with APM determined from 906', which is what CNS is committed to the NRC to protect up to. CNS licensing basis is 903'.

During the walkdowns many features were found to be non-conforming to the design basis. CR's were written for all non-conforming features as is stated in the NEI 12-07 guidance. DED determined whether the feature was deficient or not. If a feature was determined deficient, a recovery plan was created to correct the deficiency. These deficiencies are included in the Final Walkdown Report.

The attached walkdown packages and final walkdown report are found technically accurate with the CNS design and licensing bases and will be appropriate for a response to Recommendation 2.3, Flooding, Enclosure 4 of the 50.54(f) Letter dated March 12, 2012. The information collected in this evaluation will not impact the existing design basis as recommendation 2.3 is a review of current CNS flood mitigation strategies. Any change to the licensing basis will come out of Recommendation 2.1 which will reference the material from Recommendation 2.3.

ATTACHMENTS:

Final walkdown report

Walkdown packages

Walkdown team credentials

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Flooding Walkdown Submittal Report for Resolution of Fukushima Near-Term Task Force 10 CFR 50.54 (f) Section 2.3 Flooding Response

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LIST OF ACROMYMS

Abbreviation	Description
AEC	Atomic Energy Commission
APM	Available Physical Margin
B&R	Burns and Roe
CA	Corrective Action
CAP	Corrective Action Program
CED	Change Evaluation Document
CFR	Code of Federal Regulation
CLB	Current Licensing Basis
CNS	Cooper Nuclear Station
COE	Corps of Engineers(USACE)
CR	Condition Report
DB	Design Basis
ECCS	Emergency Core Cooling System
EE	Engineering Evaluation
ERP	Elevated Release Point
FSAR	Final Safety Analysis Report
HPCI	High Pressure Core Injection
IPEEE	Individual Plant Examination of External Events
IER	INPO Industry Event Report
MPF	Multi-Purpose Facility
MSL	Mean Sea Level (based on NGVD29)
NGVD29	National Geodetic Vertical Datum of 1929
NEI	Nuclear Energy Institute
NPPD	Nebraska Public Power District
NRC	Nuclear Regulatory Commission
OWC	Optimum Water Chemistry
PM	Preventative Maintenance
PMF	Probable Maximum Flood
PMP	Probable Maximum Precipitation
PRA	Probabilistic Risk Assessment
RCA	Radiological Controlled Area
RCIC	Reactor Core Injection Cooling
RHR	Residual Heat Removal
RPS	Reactor Protection System
SER	Safety Evaluation Report
TRM	Technical Requirements Manual
TLCO	Technical Requirements Manual Limiting Conditions of Operation
URT	Unit Reliability Team
USACE	United States Army Corps of Engineers
USAR	Updated Safety Analysis Report
USNRC	United States Nuclear Regulatory Commission

TABLE OF CONTENTS

1 SCOPE AND OBJECTIVE 5
2 DESIGN BASIS FLOOD HAZARD LEVEL 6
2.1 Probable Maximum Flood (PMF) 6
2.2 Postulated Dam Failure 6
2.3 Probable Maximum Precipitation (PMP) 7
2.4 Other Evaluated Flooding Events 8
2.5 Original Supporting Evaluations and Methodology 8
2.6 Other Analysis and Evaluations 9
2.7 CLB Flooding Summary Table 11
3 EXTERNAL FLOOD PROTECTION AND MITIGATION FEATURES 12
3.1 Flood Licensing Basis and Protected SSCs 12
3.2 Plant Operation During Flooding 13
3.3 Flood Duration 14
3.4 Flood Protection Features 15
3.5 Procedures 16
3.6 Adverse Weather Conditions 17
3.7 Groundwater Ingress 17
4 INTERNAL WARNING SYSTEMS 18
5 EFFECTIVENESS OF FLOOD PROTECTION SYSTEMS 22
5.1 Acceptance Criteria 22
5.2 Overall Effectiveness of Plant Flood Protection Features 23
5.3 Other Existing Plant SSCs and Procedures that May Provide Flood Mitigation 23
6 IMPLEMENTATION OF WALKDOWNS 24
6.1 Walkdown Package Development 24
6.2 Team Organization 24
6.3 Training Approach 25
6.4 Peer Review Process 25
7 WALKDOWN RESULTS 26
7.1 Incorporated or Exterior Passive Features 26
7.2 Incorporated or Exterior Active Features 27
7.3 Temporary Passive Features 27
7.4 Temporary Active Features 27

7.5 Procedural Review 28
7.6 Inaccessible Features 29
7.7 Deficient Features 29
7.8 Delayed Inspection Features 32
8 AVAILABLE PHYSICAL MARGIN 33
9 NEW FLOOD PROTECTION SYSTEMS 34
10 REFERENCES 35
10.1 Regulatory Documents, Codes and Guidance 35
10.2 NPPD Documents 35

1 SCOPE AND OBJECTIVE

This Flooding Walkdown Report is prepared in accordance with the request from the U.S. Nuclear Regulatory Commission as defined in the Recommendation 2.3, Flooding, Enclosure 4 of the 50.54(f) Letter dated March 12, 2012.

In response to the nuclear fuel damage at Fukushima Daiichi due to earthquake and subsequent tsunami, the United States Nuclear Regulatory Commission (NRC) is requesting information pursuant to Title 10 of the Code of Federal Regulations, Section 50.54 (f). As part of this request, CNS was required to perform walkdowns to verify that plant features credited in the current licensing basis (CLB) for protection and mitigation from external flood events is available, functional, and properly maintained. In addition, the purpose of the walkdowns was to identify and address plant-specific degraded, non-conforming, or unanalyzed conditions (through the corrective action program) and associated APM (Available Physical Margin) and verify the adequacy of monitoring and maintenance procedures.

This information obtained and presented in this report is in accordance with NEI 12-07, "Guidelines for Verification Walkdowns of Plant Flood Protection Features" (Ref. 10.1.2) with no exceptions to the guidance. The scope of the report is further described in the subsequent sections of this document.

2 DESIGN BASIS FLOOD HAZARD LEVEL

The CNS USAR (Ref. 10.2.2) Vol. II, Station Site and Environs, Hydrology Section 4.2.2.1 states that the maximum river level established by studies by the Corps of Engineers was at 899 ft MSL during the flood of record in 1952 prior to the installation of the upstream river controls. The USAR projected upper limit of elevation for a 1,000-year flood discharge is 900 ft MSL and for a 10,000-year flood discharge is 902 ft MSL.

2.1 Probable Maximum Flood (PMF)

The CNS USAR Section 4.2.2.1 states "*....The Probable Maximum Flood (PMF) is established at 903 feet MSL with a projected return frequency estimated to be in excess of 1,000,000 years. The PMF is derived by centering a probable maximum rainstorm critically over the drainage area above Brownville. The Corps of Engineers has estimated that the peak discharge for the PMF is 600,000 cubic feet per second. This estimate is based on a qualitative judgment that the peak of a PMF event should be between two to three times the peak of a standard project flood. Preliminary estimates of standard project conditions on the Missouri and Platte Rivers were used in estimating the probable maximum flood peak of 600,000 cfs at CNS.*"

CNS USAR Vol. II - Section 4.2.2.2 states; " *the station site grade level of 903 feet MSL has been raised 13 feet above the natural grade level of 890 feet MSL, in order to bring final grade one foot above the existing 902 feet MSL levee constructed by the Corps of Engineers. This levee was raised above its original design level and presently has a three foot minimum free board over the 1952 flood of record (899 feet MSL). Flooding of the station is considered to be extremely unlikely due to the combination of upstream Missouri River flood control and the high final site grade. With respect to the 1,000 year, 10,000 year and 1,000,000 year (PMF) floods, these water levels will provide 3 ½ feet, 1½ feet, and 6 inches of freeboard respectively below the 903'6" grade floor elevation of the principle structures.......*"

"*.....The wave action discussed within Subsection 4.2.2.1 (6.7 feet on a smooth vertical wall and 4.8 feet on a riprapped slope), in conjunction with a PMF will not affect the plant proper since the nearest building is located about 200 feet from the river edge and is surrounded by grade to elevation 903'-0". Wave energy would be dissipated before reaching any of the main buildings. Wave action at the Intake Structure will not affect the safe shutdown of the plant since the Service Water pumps and controls are protected by massive reinforced concrete walls and slab up to elevation 919'-0".......*"

"*....The Atomic Energy Commission (AEC) staff independently evaluated the flooding potential at CNS. They estimated PMF to be 901.2 feet MSL, which concurrent with wind effects would result in a maximum water level on the outside of the Intake Structure at 909.2 feet MSL (PMF plus wave effects) and 905 feet MSL (PMF plus surge effects) on other exposed safety related structures. The AEC staff required protection of safety related structures and systems against these levels in order to ensure the capability to place and maintain the plant in a safe shutdown under the flooding conditions described above....*"

2.2 Postulated Dam Failure

CNS USAR Section 4.2.2.1 states "..... *The failure of a large upstream dam is not considered probable. These dams are massive earth structures with impervious core walls,* *large freeboard for wave action, and adequate spillways. The dams are located in a zone of low seismic activity. The Gavins Point Dam, closest to the site is over 275 miles upstream. It is approximately 8,100 feet long with a height of 74 feet. It is 35 feet wide at the top and up to 850 feet wide at the base. The top of the dam is at 1,234 feet MSL with a water level of 1,205 feet MSL indicating a freeboard of 29 feet. Its storage capacity is approximately 500,000 acre feet. These dams are under constant inspection by local Corps of Engineers personnel and are inspected once a year by a team of professionals. If seismic failure occurred in spite of these circumstances, the failure would most probably be other than instantaneous failure of a major portion of the dam. Under these circumstances, overtopping of Gavins Point Dam, although conceivable, is not likely to occur.*

"..... The 901.2 foot MSL water surface elevation and the 905 foot MSL (PMF plus surge effects for safety related structures other than the Intake Structure) estimated by the AEC staff are below the 906 foot MSL projected for the unlikely combination of an upstream dam failure concurrent with the maximum natural flood.... "

2.3 Probable Maximum Precipitation (PMP)

CNS USAR Vol. II - Section 3.0 Meteorology, Sub-Section 3.1.3 Precipitation states "*.....U.S. Department of Commerce - Weather Bureau and U.S. Department of Army Corps of Engineers, Hydrometeorological Report No. 33 dated April, 1956, from which it was determined that the "probable maximum precipitation" for the site area, 23.5 inches total rainfall for a 24-hour period. This value has been determined from Figure 17 (August) of the aforementioned report. Converting this value to a rate equivalent to a one-hour rainfall, by using the Civil Engineering Bulletin No. 52-8, revised March, 1965, published by the Department of the Army, office of the Chief of Engineers which determines a rainfall rate per hour from a 24-hour period, the "probable maximum precipitation" for the site area was conservatively determined to be 3.56 inches per hour for a ten year return period.... "*

In addition, CNS USAR Vol. II - Section 3.0 Meteorological Design Bases, sub-section 3.2.3 Precipitation states; "*......Class I and Class II buildings are protected from the effects of precipitation through the use of roof drains and overflow scuppers. The Reactor Building, Diesel Generator Building, and Control Building use 4 inch roof drains and 6 inch scuppers. Using the discharge rates in drains provided in the 1971 issue of the National Standard Plumbing Code, with full flow from the vented systems, the roof drainage and overflow capacity from these buildings can sustain a rainfall rate of over 10 inches of water per hour. The roof drains are designed to eventually be carried through underground piping into the Missouri River. The remaining local site drainage is designed such that any excess rainfall not immediately absorbed into the ground will flow away from the buildings to be discharged into drywells or low lying areas adjacent to the plant site. Accordingly, these designs can safely remove the accumulated water from the probable maximum precipitation rate described in Section II-3.1.3, and can also accommodate the AEC's estimated 9.7 in./hr in one hour rainfall rate without adverse effects on the safety-related systems necessary for safe shutdown.* "

2.4 Other Evaluated Flooding Events

The CNS USAR and associated original FSAR question responses evaluated several other flooding events which were concluded as bounded by the establish PMF. These included:

- **Ice Blockage or Damming** – The USAR Section 4.2.2.1 states "*....Flooding caused by ice blockage is considered credible only at river levels significantly lower than the PMF. Flooding caused by ice blockage would cause water surface elevations below those of the PMF.*"
- **River Diversion Due to Flooding** – USAR Vol. II, Section 4.2.3.2 states; "*...a failure of the Oahe or Ft. Randall flood control dams is the most likely initiator of a river diversion. The closer of the two, Fort Randall, is almost 350 miles upstream from the plant site and there would be a three day warning before the river reaches a peak flood stage at CNS. During this peak flood stage, shutdown procedures to the reactor could begin and continue as the flood waters slowly recede. After the river diversion occurs, the resulting isolated body of water in the vicinity of the site, fed by ground water inflow, would retain essentially the same stage characteristics that apply to the present open river as long as the main channel was retained in the existing valley. Minor variations resulting from elimination of some bends would be of no consequence to the safe operation of the plant. Extreme low water stages which might be attained in the natural channel would not occur under these circumstances because of the lag in response of groundwater to short term changes in the river channel. It is concluded, therefore, that there would be an adequate supply of water to effect a safe shutdown of the plant.*"

2.5 Original Supporting Evaluations and Methodology

Various supporting analysis and evaluations were performed during development of the original FSAR and follow up responses to original AEC review questions through amendment.

Corps of Engineers Study - According to FSAR Question No. 2.1 (Ref. 10.2.3) the USACE estimated a Probable Maximum Flood (PMF) elevation between 902-ft and 903-ft Mean Sea Level (MSL), in practice CNS typically regards 903-ft MSL as its PMF value. The USACE also calculated wave heights occurring coincident with the 903-ft MSL PMF event. It estimated a shallow water "significant wave height" of 4-ft, a "one-percent wave height" of 6.7-ft, and the "wave run-up" against a vertical wall (Intake Structure) of 6.7-ft. The calculation used a wind speed of 45 mph as prescribed by the NRC in FSAR Question No. 2.2 (Ref. 10.2.3). The response to FSAR Question No. 2.2 noted that the relationships used to estimate these wave heights were derived from studies made on lakes and oceans, and that it is not believed that waves of this magnitude could be generated in a river flood setting. The FSAR Question No. 2.2 response noted that waves could only impact the intake structure, with the run-up reaching an elevation of 909.7 ft MSL. The response states that wave energy would be dissipated before reaching the other Class I Buildings (Main Building Complex). The Main Building Complex is approximately 200' away from the river channel edge, with the surrounding grade elevated to 903 +/- ft MSL.

The USACE had reported (stated in CNS USAR Section 4.2.2.2) that a major dam break coincident with a PMF event was not credible; however, a maximum flow rate for a dam break event and resulting surface water elevation was estimated. As described in the USAR, the maximum natural flood combined with a "...failure of a major flood control dam – either Oahe or Fort Randall" could produce river flows of 1,250,000 cfs. A water surface elevation based on this flow rate was predicted to reach elevation 906 ft MSL. The evaluation did not consider wave action coincident with a 906 ft MSL flood event.

Atomic Energy Commission Study – As previously outlined in the USAR Section above, the Atomic Energy Commission reported in the Safety Evaluation Report (SER) (Ref. 10.2.7) that its conservative estimation of the PMF Elevation at CNS was 901.2 ft MSL, based on a River flow rate of 1,000,000 cfs. AEC calculated coincident wave crests could reach an elevation of 909.2 ft MSL at the intake structure, and 905 ft MSL at the other structures across the site (located away from the river channel). The AEC also concluded that seismically induced dam failure coincident with a PMF is not credible but did consider a dam break concurrent with a ½ PMF event. Their results indicated that the resulting flood elevation was lower than the PMF event alone.

2.6 Other Analysis and Evaluations

IPEEE -Individual Plant Examination of External Events

In 1991, in accordance with 10CFR50.54(f), the NRC issued Generic Letter 88-20, Supplement 4 based on staff and industry experience with plant-specific probabilistic risk assessments (PRAs), that systematic examinations are beneficial in identifying plant-specific vulnerabilities to severe accidents which could be fixed with low-cost improvements. The supplement was focused on external events that could be significant contributors to core damage in some instances. Section 5 of the CNS IPEEE report (Ref. 10.2.9) submitted to the NRC addresses the occurrence of high winds, floods, and other weather related events with regard to probability of beyond design basis effects.

Potential Dam Failures – This section of the report states " *The location of the upstream dams are listed together with their river mile in Table 5.8. Section II-4.2.1 of the CNS USAR provides a discussion of dam failure scenarios. An analysis of the Fort Randall Dam failure showed that waters released would require at least four days to reach the CNS site. If this event occurs, river elevations of 904 feet MSL would be expected, a maximum of 0.5 ft above the ground floor elevation of 903.5 feet MSL. An emergency procedure is in place to install sandbags and wood planks to combat the flood. Such actions are effective to protect the plant to water levels up to 907.6'. The procedure was successfully implemented at CNS during the flood in 1993. As such there is confidence in the ability of the plant staff and personnel to mitigate the flood event. The elevation of 906 feet MSL is calculated by postulating a dam failure concurrent with the maximum natural flood. The effects of wind generated wave action in the determination of the water level at the plant site were not considered.*

This is acceptable from previous discussions on the wave height development which concluded that wave height would substantially dissipate prior to reaching the plant structures.

Failure of the Oahe Dam upstream from the Fort Randall Dam is discussed in NUREG/CR-4767. According to a recent study, the U.S. Army Corps of Engineers *has estimated that a peak-water surface elevation of 922 feet MSL (18.5 feet above ground floor) will be reached if the Oahe Dam fails. It would take approximately 3.5 days for the first floodwave resulting from the dam failure to reach CNS.*

NUREG/CR-4767 based the failure frequency estimate for the Oahe Dam on historical data for internal failures of earth dams. Studies suggested that earth dams fail due to internal events with a frequency from 1.0E-05/yr to 1.0E-04/yr. The NUREG analyses used 5.0E-05 per year as a best estimate. The District reviewed the supporting COE analyses and noted that a 100 year return frequency flood event at the Oahe dam site was assumed coincident with dam failure. Assuming that these independent events would have to occur during the same seven day period and based on the conclusion that core damage would result from a flood to elevation 922 feet MSL, the contribution to core damage frequency due to the Oahe Dam failure was estimated as 9.0E-09/yr.

In the NUREG estimate it was conservatively assumed that the dam was completely full at the time of the failure (concurrent with a spillway design flood) and that the dam was assumed to fail catastrophically. These two assumptions are very unlikely. Additionally, the Oahe Dam and reservoir level is closely managed by the COE. Therefore, it is judged that this event can be screened per NUREG-1407 and no further actions to reduce the CNS vulnerability to the Oahe Dam failure are warranted...."

<u>NPPD Calculation NEDC 11-076</u>
In preparation for the NRC 50.54(f) response, CNS has directly developed and/or contracted the services of vendors to perform various evaluations and analysis of current potential flooding impact on the plant. These analyses do not change the plant's CLB but serve to provide significant information in support of the established PMF going forward.

<u>Calculation NEDC 11-076</u> (Ref. 10.2.11) was developed for informational use only, to evaluate issues regarding CNS external flooding events as initiated by and described in condition report CR-CNS-2010- 01630. It was also utilized in the disposition of the CR's associated corrective actions CA-6, CA-8, CA-10, and CA-11. The calculation evaluated against the hydraulic (i.e. stage discharge) of three scenarios including (1) an estimated 500-year event based on the peak flow reported in the Corps of Engineers 2004 Upper Mississippi Flood Frequency Study, (2) the Probable Maximum Flood event established in the CNS USAR, and (3) a Ft. Randall Dam Break Event at the Maximum High Pool Condition as provided by the Corps of Engineers. The calculation assumes that no levees failed during each flood scenario considered. CNS grade is elevated above the tops of adjacent levees, a conservative assumption in terms of maximum flood height (much larger flood area would be available behind the levees resulting in a lower flood level).

The calculation concluded that the predicted stage of the Missouri River estimated in the calculation compared favorably with the river stages determined during the stations original design. It was concluded that the river stage (water level) discussed in the USAR remains a conservative estimate for the flow scenarios considered with respect to this methodology. However, the flow scenarios themselves, while not discounted, could not be verified. A new PMF hydrologic study using current methodology was recommended and is currently being performed in response to Recommendation 2.1, Flooding enclosure of the 50.54(f) Letter. This effort will also include reevaluation of the current site drainage when subjected to a PMP event. The PMP study is due to be completed before the end-of-year.

2.7 CLB Flooding Summary Table

The below table summarizes the CNS CLB based upon the information as presented in this report.

CONDITION	CNS CLB	COMMENTS
PMF Peak Flow Rate[1]	600,000 CFS	PMP Event centered above Brownville, NE
PMF Still Water Surface Elevation	903 ft MSL[2]	Plant site elevated 903 +/- ft MSL. First Floor of all Class I building at 903.5 ft MSL.
PMF + Wave Run Up at Intake Structure	909.7 ft MSL	Flood Barriers not needed at intake since critical equipment is elevated above 906 ft and protected from wave impacts.
PMF + Wave Action Main Plant Complex	No Impact	Class I buildings grade level openings at 903.5 ft MSL, Protected by Flood Barriers from standing water to elevation 906 ft

Notes:

1. The USACE estimated a higher river stage during the PMF than the AEC, despite the fact it used a lower flow rate (600,000 cfs vs. 1,000,000 cfs). Details of the methodology utilized by the AEC to develop its stage-flow relationship were not described, except for a statement in the SER text that the AEC constructed an "Analytical Model". The analysis conducted by CNS in 2011 is consistent with the USACE estimates stage-discharge estimates - see NEDC 11-076 (Ref. 10.2.11).
2. This elevation is based on a steady flow Rate of 600,000 cfs
3. This elevation is based on a peak flow rate of 1,000,000 cfs.

Therefore in summary, the Current Licensing Basis as stated in the CNS USAR provides for a value of **903.0 MSL** for the Maximum Probable Flood.

3 EXTERNAL FLOOD PROTECTION AND MITIGATION FEATURES

3.1 Flood Licensing Basis and Protected SSCs

The general ground elevation surrounding CNS Class I Structures is elevated 13-ft above the natural floodplain to 903 ft MSL. The finished floor elevation of all Class I Structures is placed at elevation 903.5 ft MSL, or 1/2 ft above the PMF event. These structures were designed for a hydraulic load equivalent to a groundwater elevation of 903-ft and reviewed for integrity for a river elevation up to 906 ft MSL. Grade level openings on exterior walls of the buildings (except for the intake structure) are protected from wave effects and water surface elevations up to 906 ft MSL with flood barriers erected per CNS Procedure 7.0.11 (Ref. 10.2.14) and 5.1 Flood (Ref. 10.2.13).

The following CNS safety-related plant structures have been identified as protected from flooding as noted:

Intake Structure - As stated in the USAR; the service water motors and controls in the Intake Structure are located above elevation 908-ft MSL. These motors and controls are protected from the predicted wave effects by 24-in thick concrete walls extending up to elevation 919-ft MSL. The Intake Structure need not be isolated due to the fact that there is no essential equipment located there at or below 906 ft MSL that will be adversely affected in performance of a safe shutdown function in the event of flooding.

Reactor Building – Protected from wave effects and flood water by grade level building walls and by temporary flood barriers to elevation 906 ft MSL

Emergency Diesel Generator Building - Protected from wave effects and flood water by grade level building walls and by temporary flood barriers to elevation 906 ft MSL

Radwaste Building - Protected from wave effects and flood water by grade level building walls and by temporary flood barriers to elevation 906 ft MSL

Control Building - Protected from wave effects and flood water by grade level building walls and by temporary flood barriers to elevation 906 ft MSL

Controlled Corridor - Protected from flood water by grade level Reactor and Turbine Building walls to elevation 906 ft MSL

Turbine Building - Protected from wave effects and flood water by grade level building walls and by temporary flood barriers to elevation 906 ft MSL

Z-Sump (Below ERP Tower) – As stated in the USAR; the top of floor drain sump Z, at the base of the Elevated Release Point tower, is located at 891ft MSL and therefore is within postulated flood levels. The Z Sump contains equipment essential to the operation of SGTS (Standby Gas Treatment System), and therefore the sump must remain functional whenever Secondary Containment is required. Although the ground elevation at the sump is only 890 ft MSL, the Z Sump will not be affected by flooding since the sump penetrations are sealed and the proper functioning of the sump is monitored when flood levels reach 890 ft MSL.

Diesel Fuel Storage Tanks - As stated in the USAR; there is sufficient fuel in the Diesel Oil Storage Tanks to assure seven days of operation of a single diesel generator powering a single critical division of safe shutdown loads. This time duration is sufficient to obtain more fuel, if needed. The two storage tanks are buried and their appendages are protected by a substantial cover. The manholes providing access to the Diesel Oil Transfer Pumps, the capped fill connections and the tank vents are all located above 906 ft MSL. The design and installation of the tanks assure flotation does not occur when empty during the PMF.

The following CNS plant structures have been identified as important to the protection of the various safety-related structures and equipment and are also protected from flooding as noted:

Augmented Radwaste Building - Protected from wave effects and flood water by grade level building walls and by temporary flood barriers to elevation 906 ft MSL

Boiler Room - Protected from wave effects and flood water by grade level building foundation walls and by temporary flood barriers to elevation 906 ft MSL

Fan Room - Protected from wave effects and flood water by grade level building foundation walls and by temporary flood barriers to elevation 906 ft MSL

Water Treatment Plant - Protected from wave effects and flood water by grade level building foundation walls and by temporary flood barriers to elevation 906 ft MSL

Tool Crib - Protected from wave effects and flood water by grade level building foundation walls and by temporary flood barriers to elevation 906 ft MSL

Machine Shop - Protected from wave effects and flood water by grade level building foundation walls and by temporary flood barriers to elevation 906 ft MSL

MPF Building - Protected from wave effects and flood water by grade level building foundation walls and by temporary flood barriers to elevation 906 ft MSL

Other Site Structures – Various site out buildings and structures classified as not important to safe operation and shutdown of the plant are located at base elevations lower than the PMF elevation of 903 ft MSL. CNS Procedure 5.1FLOOD, evaluation of the protection these assets is determined by NPPD plant management by implementing actions based on various parameters including; plant safety, asset value, importance to overall long term power generation, etc.

3.2 Plant Operation During Flooding

The operation of the plant based on a forecasted or eminent flooding event is addressed by CNS TRM (Technical Requirements Manual) Section T 3.7 Plant Systems, sub-section T3.7.1 River Level, limiting condition of operation TLCO 3.7.1. TLCO 3.7.1 states, "The River Level shall be < 895 ft MSL and not forecast to be ≥ 902 ft MSL" at all times.

The conditions are set as follows:

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. River level is ≥ 895 ft MSL	A.1 Implement CNS Site Flood Procedure 5.1 FLOOD	Immediately
B. River Level is ≥ 902 ft MSL or forecast ≥ 902 ft MSL within the next 36 hours.	B.1 Implement CNS Site Flood Procedure 5.1 FLOOD. <u>AND</u> B.2 Be in MODE 3 (Hot Shutdown) <u>AND</u> B.3 Be in MODE 4 (Cold Shutdown)	Immediately 12 hours 36 hours

<u>The TRM BASES states:</u>

The river level of the Missouri River is controlled by the U.S. Army Corps of Engineers using dams. The closest upstream major flood control dam is approximately 350 miles upstream. The use of these dams reduces the possibility of a site flood. However, should a dam break or in case of a river level of 895 ft MSL, the CNS Site Flood Procedure will be put into effect.

Should the level reach 902 ft MSL or a forecast issued by the official government agency indicates expected levels of 902 ft MSL or greater within the next 36 hours, the reactor will be shutdown and vented to atmosphere.

A plant shutdown is initiated under any of the following conditions:

1. Floodwaters either reach 902 ft MSL, or are forecast to reach 902 ft MSL within the next 36 hours (as from the 10,000 year flood or an upstream dam failure).
2. Floodwater accumulates in either Diesel Generator Room, any of the four Reactor Building Quads, or the Control Building Basement.
3. Plant conditions warrant reactor to be shut down.

3.3 Flood Duration

There is no specifically stated time(s) associated with the PMF event provided within the CNS CLB. CNS USAR Figure II-4-7, Platte Plus Missouri River (s) Hydrograph, displays the projected river discharge at Cooper Nuclear Station for the PMF in Time in Days versus CFS. Inspection of the hydrograph indicates an approximate duration of 5 ½ days of flood conditions may be expected from a river flow of 200,000 CFS peaking to 600,000 CFS and back down to 200,000 CFS. Initial inspection of USAR Figure II-4-8, Estimated Stage Discharge Relation Missouri River at Brownville Nebraska, would correlate to an approximate minimum flood level of 895 ft MSL to the maximum projected PMF value at CNS.

3.4 Flood Protection Features

Various methods of protection are specifically detailed within the CNS USAR Section 4.2.2.2 as to the plant's response to an imminent flooding event. The USAR states that material and equipment necessary to perform these protective measures are available at CNS and inventoried on an annual basis. As an example; special equipment includes; two portable gasoline powered pumps and 100 ft minimum (per pump) of 2 ½-inch non-collapsible hose.

The CNS USAR specifically addresses various actions that will be taken to protect safety related SSCs located below the PMF plus wave effects level of 905 ft MSL. The original response to FSAR Question 2.34, Amendment 17 (Ref. 10.2.5) identified specific equipment and components to be protected including the:

- RHR Service Water Booster pumps located at Elevation 882'-6" MSL in the Control Building basement.
- RHR pumps 1A and 1C in the northwest quadrant room of the Reactor Building at Elevation 859-'9" MSL.
- RHR pumps IB and ID in the southwest quadrant room of the Reactor building at Elevation 859-'9" MSL.
- RCIC turbine pump set in the northeast quadrant room of the Reactor building at Elevation 859-'9" MSL.
- Diesel generator water tight junction boxes at Elevation 904' MSL.
- D.C. switchgear and battery chargers in Control Building 903'-6" level at less than 905' MSL.
- ECCS system logic panels on the Control Building 903'-6" level at less than 905' MSL.
- RPS M-G set at the 903'-6" level of the Control Building.

<u>Building Features</u>

A comprehensive review of all potential CNS external flood barriers and features as originally defined in Regulatory Guide 1.102 (Ref. 10.1.3) was performed by reviewing all available plant drawings and documentation and performing initial walk downs of all accessible plant areas. These barriers/features include the permanent flood protection provided by the structural walls, penetrations, doors, hatches, water-stops incorporated in the construction of the penetrations and construction joints, special rubber boots, and other related barriers. Temporary flood protection, such as sand bagging, stop logs for specific areas and openings as needed were also included.

The following is a breakdown by area of the number of flood barriers/features identified during the development of the features database contained in the Flood Walkdown CNS DED Correspondence 12-0002 (Ref. 10.2.19) and confirmed by the formal feature walkdown process:

- Turbine Building – 22 Exterior building walls and 76 piping and conduit penetrations
- Radwaste Building – 11 Exterior building walls and 32 piping and conduit penetrations

- Augmented Radwaste Building – 13 Exterior building walls and 27 piping and conduit penetrations
- Reactor Building – 12 Exterior building walls and 15 piping and conduit penetrations
- Control Building – 9 Exterior building walls and 65 piping and conduit penetrations
- Machine Shop – 2 Exterior building walls and 6 piping and conduit penetrations
- Water Treatment Building – 2 Exterior building walls and 23 piping and conduit penetrations
- Exhaust Fan Room – 2 Exterior building walls and 2 piping penetrations
- Heating Boiler Room- 1 Exterior building walls and 8 piping penetrations
- Emergency Diesel Generator Rooms – 8 Exterior building walls and 31 conduit penetrations
- Intake Structure – 4 Building walls
- Site:
  - Manholes – 9 conduit penetrations
  - Z Sump – 1 conduit penetration
- Temporary Features:
  - Exterior barrier walls/stop logs - 44
- Site Drainage System:
  - Dry Wells – 11
  - Catch Basins – 7
  - Area Inlets - 20

3.5 Procedures

CNS has established two primary procedures for guidance in the station's response to an external flooding event.

5.1FLOOD – This is the primary procedure used for response to river level increase and is entered at a rising river level of greater than or equal to 895 ft MSL, notification of upstream dam failure and/or the river level is forecast to rise above a greater than or equal to value of 902 ft MSL within the next 36 hours. The procedure invokes numerous flood response measures and activities in addition to the other main response procedure 7.0.11 Flood Control Barriers (Ref. 10.2.14) which directs the CNS Maintenance department in the installation of temporary flood control barriers and features.

This procedure requires specific review during formal Flooding Walkdown Inspections performed in accordance with NEI 12-07 activities to evaluate the practicality of the associated actions performed by site personnel with regard to response timing and equipment staging and implementation.

7.0.11, FLOOD CONTROL BARRIERS – As mentioned previously this Maintenance Procedure directs the CNS maintenance personnel in the installation of temporary flood control barriers and features. The procedure provides a system of primary barriers at the openings of the outside walls of the main buildings complex to seal the buildings up to elevation 906 ft MSL. Secondary barriers are provided strategically inside the buildings to control any minor leakage past the primary barriers and to break the building complex up into small areas that can be more easily protected.

3.6 Adverse Weather Conditions

Emergency Procedure 5.1FLOOD and other supporting procedures and documents do not specifically address the intensity of potential adverse weather conditions on the execution or deployment of external flood mitigation activities. The procedures do however provide for the assessment of the severity of conditions which may lead to immediate actions to bring the plant to cold shutdown in a timely manner.

Adverse weather is not an aspect of CNS site design basis. The worst expected weather would be heavy rainfall which will not be a hindrance to stop log barrier construction. These activities are well established and practiced using procedures and standard physical measures (addressed further in Section 7.5) that can be implemented based on their simplistic nature and design.

3.7 Groundwater Ingress

The CNS CLB does not specifically address or quantify ground water inleakage from the site subsurface water table. Groundwater level is monitored/logged once per shift based on level indication located within site well(s) providing plant water supply. According to CNS OPS personnel, site groundwater level normally fluctuates between 875' MSL to 885' MSL with the highest recorded level of 900.8' during the 2011 May flooding event.

USAR Section XII-2.4.4.2 (Ref. 10.2.20) Design Considerations, Statement 5 second to last paragraph states, "....*Where penetrations enter buildings through sleeves; details relating to the methods of waterproofing and maintaining building integrity have been developed.*".

The above statement is based on CNS original response to FSAR Question/Answer 12.2 Amendment #9 (Ref. 10.2.21) which states, "........*Membrane waterproofing material used on the exterior foundation walls of the Reactor, Turbine, Control and Radwaste Buildings is the same as described in the answer to Question 12.1 with the exception that integrally molded protrusions were used to obtain a cast-in-place barrier with the concrete foundation wall. This barrier was sealed at the top just below grade into a reglet, and at the bottom was sealed to the mat material by the same adhesives and tape strips outlined in the answer to Question 12.1. With respect to in-service inspection of the vertical water proofing barrier the same controlled application as described in the answer to Question 12.1 is applicable, except that the 2 inch protective cover has been deleted. Therefore, no provisions have been made to check the integrity of the membrane during the life of the plant. Drains are provided in the base slab of all buildings to collect any water which may accumulate on the slab for any reason*...
Where penetrations enter buildings through sleeves, details relating to the methods of waterproofing and maintaining building integrity have been developed and are shown in Figure 12.2-1."

(Note: Figure 12.2-1 is CNS B & R Drawing 2299 (Ref. 10.2.22).)

4 INTERNAL WARNING SYSTEMS

Currently there are no official plant internal warning systems dedicated specifically to detection of water infiltration related to an External Flooding Event in the current licensing basis. However various level alarms are provided for sumps, low building elevations and yard manholes which provide annunciation in the CNS Control Room (Panel B-3 and S-1 annunciator windows). These include the following: (Note: All reactor building and turbine building sumps are HI-HI alarms which signal the control room at the setpoint when one pump is overloaded and will concurrently call the second pump into service)

Reactor Building Sumps – EL. 859'-9"

- Sump 1-A: is located in the RHR Pump Room in northwest Quad of the Reactor Building at elevation 859'-9". The sump receives discharge from various plumbing fixtures and floor drains located on multiple elevations of the Reactor Building, noted in CNS Procedure 2.2.27 "Equipment, Floor, and Chemical Drain System", Attachment A. The sump contains dual sump pumps (1-SP- 1A1 & 1-SP- 1A2) which controls sump water level with discharge to the radioactive floor drain line (FDR-1). Setpoint is 34" of water in the sump.
- Sump 1-B: is located in the Core Spray Pump Room in northeast Quad of the Reactor Building at elevation 859'-9". The sump receives discharge from various plumbing fixtures and floor drains located on multiple elevations of the Reactor Building, noted in CNS Procedure 2.2.27 "Equipment, Floor, and Chemical Drain System", Attachment A. The sump contains dual sump pumps (1-SP- 1B1 & 1-SP- 1B2) which controls sump water level with discharge to the radioactive floor drain line (FDR-1). Setpoint is 34" of water in the sump.
- Sump 1-C: is located in the RHR Pump Room in southeast Quad of the Reactor Building at elevation 859'-9". The sump receives discharge from various plumbing fixtures and floor drains located on multiple elevations of the Reactor Building, noted in CNS Procedure 2.2.27 "Equipment, Floor, and Chemical Drain System", Attachment A. The sump contains dual sump pumps (1-SP- 1C1 & 1-SP- 1C2) which controls sump water level with discharge to the radioactive floor drain line (FDR-1). Setpoint is 34" of water in the sump.
- Sump 1-D: is located in the Core Spray Pump Room in southeast Quad of the Reactor Building at elevation 859'-9". The sump receives discharge from various plumbing fixtures and floor drains located on multiple elevations of the Reactor Building, noted in CNS Procedure 2.2.27 "Equipment, Floor, and Chemical Drain System", Attachment A. The sump contains dual sump pumps (1-SP- 1D1 & 1-SP- 1D2) which controls sump water level with discharge to the radioactive floor drain line (FDR-1). Setpoint is 34" of water in the sump.
- Sump 1-E: is located in the Core Spray Pump Room in southeast Quad of the Reactor Building at elevation 859'-9". The sump receives discharge from various plumbing fixtures and floor drains located on multiple elevations of the Reactor Building, noted in CNS Procedure 2.2.27 "Equipment, Floor, and Chemical Drain System", Attachment A. The sump contains dual sump pumps (1-SP- 1E1 & 1-SP- 1E2) which controls sump water level with discharge to the radioactive floor drain line (PW-1). Setpoint is 24" of water in the sump.

Turbine Building Sumps – Basement (EL. 882'-6")

- Sump 1M: is located in the northeast corner of the Turbine Generator Equipment Area at elevation 882'-6" in the bay between column lines 14-E and 14-F. The sump receives discharge from various plumbing fixtures and floor drains located on multiple elevations of the Turbine Building , noted in CNS Procedure 2.2.27 "Equipment, Floor, and Chemical Drain System", Attachment A. The sump contains dual sump pumps which controls sump water level with discharge to the non-radioactive floor drain line (FDN-1). Setpoint is at 3'6" of water in the sump.
- Sump 1P: is located in the northwest corner of the Turbine Generator Equipment Area at elevation 882'-6" in the bay between column lines 14-F and 14-G. The sump receives discharge from various plumbing fixtures and floor drains located on multiple elevations of the Turbine Building , noted in CNS Procedure 2.2.27 "Equipment, Floor, and Chemical Drain System", Attachment A. The sump contains dual sump pumps which controls sump water level with discharge to the radioactive floor drain line (PW-2). Setpoint is at 3'6" of water in the sump.
- Sump 1Q: is located in the northeast corner of the Turbine Generator Equipment Area at elevation 882'-6" in the bay between column lines 14-E and 14-F. The sump receives discharge from various plumbing fixtures and floor drains located on multiple elevations of the Turbine Building , noted in CNS Procedure 2.2.27 "Equipment, Floor, and Chemical Drain System", Attachment A. The sump contains dual sump pumps which controls sump water level with discharge to the radioactive floor drain line (FDR-2). Setpoint is at 3'6" of water in the sump.
- Sump 1R: is located in the northeast corner of the Turbine Generator Equipment Area at elevation 882'-6" in the bay between column lines 14-C and 14-D. The sump receives discharge from various plumbing fixtures and floor drains located on multiple elevations of the Turbine Building , noted in CNS Procedure 2.2.27 "Equipment, Floor, and Chemical Drain System", Attachment A. The sump contains dual sump pumps which controls sump water level with discharge to the radioactive floor drain line (FDR-2). Setpoint is at 3'6" of water in the sump.
- Sump 1S: is located in the southwest corner of the Turbine Building Hold-up Decontamination & Sample Room at elevation 882'-6" in the bay between column lines 7-G and 7-F. The sump receives discharge from various plumbing fixtures and floor drains located on multiple elevations of the Turbine Building , noted in CNS Procedure 2.2.27 "Equipment, Floor, and Chemical Drain System", Attachment A. The sump contains dual sump pumps which controls sump water level with discharge to the radioactive floor drain line (FDR-2). Setpoint is at 3'6" of water in the sump.
- Sump 1T: is located in the southwest corner of the Turbine Generator Equipment Area at elevation 882'-6" in the bay between column lines 7-C and 7-D. The sump receives discharge from various plumbing fixtures and floor drains located on multiple elevations of the Turbine Building , noted in CNS Procedure 2.2.27 "Equipment, Floor, and Chemical Drain System", Attachment A. The sump contains dual sump pumps which controls sump water level with discharge to the radioactive floor drain line (PW-2). Setpoint is at 3'6" of water in the sump.

- Sump 1U: is located in the southeast corner of the Turbine Building Equipment Area at elevation 882'-6" in the bay between column lines 5-C and 6-C. The sump receives discharge from various plumbing fixtures and floor drains located on multiple elevations of the Turbine Building , noted in CNS Procedure 2.2.27 "Equipment, Floor, and Chemical Drain System", Attachment A. The sump contains dual sump pumps which controls sump water level with discharge to the non-radioactive floor drain line (FDN-1). Setpoint is at 3'6" of water in the sump.
- Sump 1V: is located in the southeast corner of the Turbine Building Equipment Area at elevation 882'-6" in the bay between column lines 5-G and 6-G. The sump receives discharge from various plumbing fixtures and floor drains located on multiple elevations of the Turbine Building , noted in CNS Procedure 2.2.27 "Equipment, Floor, and Chemical Drain System", Attachment A. The sump contains dual sump pumps which controls sump water level with discharge to the non-radioactive floor drain line (FDN-1). Setpoint is at 3'6" of water in the sump.

Diesel Building Sumps – EL. 903'-6"

- Sump DG-1: is located in the northeast corner of the Diesel Generator Equipment Room at elevation 903'-6" in the bay between column lines 15.5-B and 15.5-B.4. The sump receives discharge from various plumbing fixtures and floor drains located on the main floor of the Diesel Generator Building. The sump contains a single sump pump which controls sump water level with discharge to the non-radioactive floor drain line (FDN-1). Setpoint is at 30" of water in the sump.
- Sump DG-2: is located in the northeast corner of the Diesel Generator Equipment Room at elevation 903'-6" in the bay between column lines 12.8-B and 12.8-B.4. The sump receives discharge from various plumbing fixtures and floor drains located on the main floor of the Diesel Generator Building. The sump contains a single sump pump which controls sump water level with discharge to the non-radioactive floor drain line (FDN-1). Setpoint is at 30" of water in the sump.

Control Building Sumps – Basement (EL. 882'-6")

- Sump 1L: is located in the northeast corner of the Emergency Condensate Storage Area at elevation 877'-6" in the bay between column lines 15.4-J.8 and 16.2-J.8. The sump receives discharge from various plumbing fixtures and floor drains located on multiple elevations of the Control Building , noted in CNS Procedure 2.2.27 "Equipment, Floor, and Chemical Drain System", Attachment A. The sump contains dual sump pumps which controls sump water level with discharge to the non-radioactive floor drain line (FDN-1). Setpoint is at 3'6" of water in the sump.
- Sump 1X: Control Building Electrical Vault Sump is located in the southeast corner of manhole C2 sump of the Control Building at elevation 882'-6". The sump receives discharge from the adjacent electrical vaults (P2, C3, & P3). The sump contains a single sump pump (1-X) which controls sump water level with normal discharge to the non-radioactive floor drain line (FDN-1). Setpoint is at 2' of water in the sump.

Yard Manhole Sumps –EL. 903'-6"

- Sump 1W: is located along the east side of the Diesel Generator Building at elevation 903'-6". The sump is located at the base of electrical manhole C3 and receives discharge from the adjacent electrical manhole P3. The sump contains a single sump pump (1-W) which controls sump water level with normal discharge to the roof drain line (RD-2). Setpoint is at 2' of water in the sump.
- Sump 1Y: is located along the east side of the Diesel Generator Building at elevation 903'-6". The sump is located at the base of electrical manhole C4 and receives discharge from the adjacent electrical manhole P4. The sump contains a single sump pump (1-Y) which controls sump water level with normal discharge to the roof drain line (RD-2).

Reactor Building Torus Area – EL. 859'-9"
Level alarm / indication is located at the basement elevation of the Torus area to indicate water accumulation. The alarm will sound in the control room when 4" have accumulated.

Control Building Level – Basement (EL. 882'-6")
Level alarm / indication is located at the basement elevation of the Control Building to indicate water accumulation. Alarms are sent to the control room at 2", 5" and 8".

Z-Sump Trouble (EL. 890'-0")
Z-sump is located at 890' at the base of the ERP tower. Setpoint is at 3' - 9" of water in the sump or loss of power to Z1 sump pump and essential controls or loss of power to Z2 sump pump and essential controls.

Operator Rounds
Normal plant operator rounds also provide for detection of water inleakage within the various areas of the plant. This is being a manual mechanism in the overall effort of providing warning of external water inleakage or potential flooding.

5 EFFECTIVENESS OF FLOOD PROTECTION SYSTEMS

As outlined previously, the various CNS flood protection systems are comprised of numerous features including the building external structural walls, penetrations, doors, hatches, water-stops incorporated in the construction of the penetrations and construction joints, special rubber boots, and other related barriers. Temporary flood protection, such as sand bagging, aluminum stop logs for specific areas and openings, as needed, are also utilized for the mitigation of external flooding. The purpose of the flood features walkdown was to verify the conformance of external flood features with the CLB. In addition to visual inspection of features, a review of their associated preventative maintenance and surveillance programs was performed as applicable in all to determine overall effectiveness of the CNS to external flooding.

5.1 Acceptance Criteria

The acceptance criteria for the walkdowns are described in Section 6 of the NEI 12-07 guidance. This approach is consistent with Requested Information Item 1.h. from the Recommendation 2.3 Flooding Enclosure of the 50.54(f) Letter. Acceptance Criteria was delineated within each associated CNS Walkdown Package specific to the features addressed for that plant area.

The detailed Inspection Methodology & Acceptance Criteria Checklist included the following:

<u>Incorporated or Exterior Passive Features</u>

- Penetration Seal
- Concrete or Steel Barrier Bldg. Structures
- Piping and Cable Manholes/Vaults/Tunnels
- Earthen Exterior Site Barrier
- Site Area Drainage Systems and Catch Basins

<u>Incorporated or Exterior Active Features</u>

- Flood Barrier Doors
- Pumps
- Water Level Indication
- Back Flow Valves

<u>Temporary Passive Features</u>

- Portable Flood Barriers

<u>Temporary Active Features</u>

- Pumps and Related Accessories

The specific acceptance criteria associated with each of the above categories was listed directly across for each feature type within the checklist. The criteria considered the following:

- Flood protection configuration is in accordance with as-built drawings, as-built installation records, inspection records, vendor documents, etc.
- Visual inspection does not identify any material degradation

In addition, the specific licensing and design basis information required to support evaluation of the various features was also included within each applicable Walkdown Package.

Observations that identified various features as having potential deficiencies were evaluated in accordance with the CNS Corrective Action Program (CAP). A CNS condition report (CR) was assigned to each specific feature as identified. The CR process provides for an assessment of the features condition to determine whether the feature can meet its required licensing / design basis function(s). Features determined by the CAP to be deficient are presented in Section 7.7 of this report.

5.2 Overall Effectiveness of Plant Flood Protection Features

Overall assessment of the current CNS external flood protection system included the features as previously noted. The general ground elevation surrounding the CNS Class I Structures is elevated 13-ft above the natural floodplain to 903 feet MSL. The finished floor elevation of all Class I Structures is placed at elevation 903.5 feet MSL, or 1/2 feet above the PMF event. These structures were designed for a hydraulic load equivalent to a groundwater elevation of 903-ft and reviewed for integrity for a river elevation up to 906 feet MSL. Grade level openings on exterior walls of the buildings (except for the intake structure) are protected up to 906 feet MSL. In addition to permanent features, temporary harden flood barriers (aluminum stop logs, etc.) are also erected per CNS Procedure to protect doorways and normal access opening within structures from a PMF.

Recent flooding experienced by CNS during the 2011 overflow of the Upper Mississippi River Basin including the Missouri River (approximately 901 ft MSL) has provided significant evidence as to the effectiveness of the current level of protection at CNS.

Section 7 of this report provides a detailed discussion of the results from the flood features and procedures walkdown assessment.

5.3 Other Existing Plant SSCs and Procedures that May Provide Flood Mitigation

The current basis for protection and mitigation of an external flooding event, including plant equipment, structures, and procedures, is discussed in Section 3 of this report. No other existing plant equipment, structures, or procedures were identified as being able to mitigate an external flooding event than that which are not already credited in the CLB.

It is important to note however that various other features not credited by CNS for mitigation during a PMF provide protection from flooding. These features include rejection of ground water infiltration within the lower elevations of the Class I and II structures by sump pumps (previously described in Section 4) and various berms / levees located within the perimeters of the site boundaries.

6 IMPLEMENTATION OF WALKDOWNS

Implementation of the Flooding Inspection Walkdowns was performed in accordance with NEI-12-07, Rev 0-A Guidance with no exceptions.

6.1 Walkdown Package Development

Documentation for conducting the Walkdowns was developed in accordance with NEI 12-07 to incorporate both generic and site-specific information. The Walkdown Packages were developed specific to various areas of the plant considering; building area and elevation, accessibility during plant operation, radiological conditions, procedure or barrier/feature, active versus passive, and permanent versus temporary.

The following elements were addressed and/or included as part of the Walkdowns packages in accordance with NEI 12-07 Guidance Document:

- Pre-Job Training and Brief – As outlined in Section 5.4 of the guidance
- Walkdown Guidance and Acceptance Criteria – Guidance and documentation for the conduct of the Walkdowns developed to incorporate both generic and site-specific information. The technical members of the Walkdowns teams first performed reviews of design and licensing documents and site procedures directly provided or referenced in each specific Walkdown Package to establish the flood protection CLB for the subject items identified.
- Walkdown Record - Part A and B of the Walkdown Record Form (NEI 12-07, Appendix B) was prepared for all flood protection features that fell within the scope of the guidance were and completed prior to the actual physical Walkdowns inspections. The balance of the form Parts C & E were completed during the walkdown process.
- Design Drawings and General Arrangement Drawings – This information was obtained from the original CLB and design basis scoping efforts and development of an Adobe Drawing Navigation File. Specific drawing close-ups and details of the subject flood barrier/penetration/feature were included in each package.
- Flood Protection Strategy Implementation Procedures - Part D of the Walkdown Record Form (NEI 12-07, Appendix B) was prepared for all applicable procedural documents.
- Inclusion of digital photos and other field obtained information - A minimum of 1 photograph was provided for each penetration/ barrier/feature along with various observation notes and sketches as applicable to the detail require for any specific feature.

The results of all final Walkdown Package information were electronically scanned and provided as a Quality record within the CNS engineering document files and Engineering Memo 12-002 (Ref. 10.2.19).

6.2 Team Organization

The Walkdown Teams were formed based on Section 5.3 of the guidance in NEI 12-07. Two sets of walkdown teams were assembled in order to more effectively inspect (within a reasonable time period) all identified Flood Features, totaling approximately 450 in number.

The teams were composed of the following:

- Technical Team Members –Civil and Mechanical Professional Engineers and a Civil support engineer (Note: Resumes, qualifications, and training are documented in CNS engineering records.)
- CNS OPS team member
- CNS Radiation Protection personnel as needed within RCA areas
- CNS maintenance and craft personnel as needed to obtain access to features for inspection (i.e., electrical cabinets, manhole and ladder deployment, scaffolding erection, etc.)

6.3 Training Approach

The Technical Team Members obtained further Flood Walkdown Training (through INPO's NANTEL website) developed by the NEI Fukushima Flooding Task Force. The technical team members also attended Site Specific Training in order to:

- Become knowledgeable of site current licensing basis and site specific flood protection features
- Information required to locate existing preventive maintenance (PM) for SSCs credited in the CLB for flood protection
- Information required to locate existing periodic Record Form tests that may include a SSCs credited in the CLB for flood protection.
- Expectations for the review of PMs and periodic tests to ensure flood protections features are adequately tested.
- Expectations and methods to be followed when recording observations and findings during visual inspections
- Quality expectations for documentation associated with NEI 12-07 0-A, Appendix B, Walkdown Record Forms.

6.4 Peer Review Process

Following completion of each specific Walkdown Package, all non-conformances and potential deficiencies were evaluated through the CNS CAP system, including the aggregate effect on CNS plant operations and technical walkdown team reviews (performed by NPE Consultants) which satisfied the "peer review" activities requested by the NRC in Reference 10.1.1 and as outlined in NEI 12-07, (Ref. 10.1.2)

7 WALKDOWN RESULTS

As described in Section 5, results of the assessment revealed various non-conforming penetration seals that were identified and documented. These features included; open penetrations, significantly degraded to the point of evidenced and/or quantifiable water inleakage seals having undocumented changes per their original design basis configurations, negative APM by design and open pathways through piping systems which communicate with building and site areas unprotected from flood waters. All deficiencies are summarized in Section 7.7 including initial associated recommendations for repair or correction.

A total of 479 flood protection features (477 physical features and 2 procedures) were identified and evaluated. The results of the flooding walkdown inspections and evaluations revealed that various external flood protection features (penetration seals) within the majority of the CNS essential plant structures were identified as nonconforming or deficient overall in meeting their CLB function based upon the defined acceptance criteria stated within the walkdown package. In those cases where observations suggested that acceptance criteria were not met or required further evaluation, the potential issues were captured in the CNS CAP to determine what actions are to be taken.

7.1 Incorporated or Exterior Passive Features

Penetration Seals and Walls - The majority of the incorporated passive features at CNS are pipe penetrations, conduit penetrations and exterior walls within the subject Class I and II structures. The following is a summary of the walkdown inspection results by essential structure:

Various non-conforming penetration seals were identified and documented within the inspection record forms during the flooding walkdowns. These penetration seals included; open conduit penetrations, significantly degraded (to the point of evidenced and/or quantifiable water inleakage), undocumented per their original design basis configurations, negative APM by design and open pathways through piping systems which communicate with building and site areas unprotected from flood waters.

Site Drainage System - A walkdown of the site yard was performed to identify overall changes to site building elevations and site layout including buildings that were added or modified or significant changes to land use (e.g., additional paved areas) since the most recent licensing basis flood evaluation was completed. A review of the current site topography and any changes that may have affected the topography was performed. A detailed review of the original site drainage system design basis calculation developed by Burns & Roe and found in Civil Book 88 (Ref. 10.2.10) was also performed.

Walkdown observations indicate that the current site elevations and features have changed to some extent since the original flood analyses were performed. These changes include:

- Drop Inlets No. 1, No. 2, and No. 3 in front of the Administration Building were found to have concrete security barriers placed over the grates. The barriers restrict the inlets ability to convey storm water into the storm sewer pipes.
- Concrete barriers have also been placed over Catch Basins 3, 4, 5 and 6 south and east of the Reactor Building, as well as over several drop inlets in the former parking lot south of the Training Center.

- The engineering walkdown also found that a number of physical changes to the plant yard are not reflected on the Civil Paving, Grading, and Drainage Plans (Burns & Roe drawings 4004, 4005, 4006, 4007, & 4045) have not been routinely updated to reflect all changes in the plant yard

These observations have been previously captured within CNS Condition Reports CR 2011-03751 and CR 2011-02507 and evaluated in Corrective Action CA11of CR 2011-02507. The CR action plan analyses concluded that based on the available information reviewed on current drawings, and the visual observations made of the site conditions, the potential for significant storm water to enter buildings during a local intense rainfall event is very low. The concrete barricades over the drop inlets and catch basins do reduce their capacity to collect storm water; however, surface overflow paths are available to convey storm water away from CNS structures. Corrective Action CA18 of CR 2011-02507 was generated to address as-built current CNS topographic information. This is necessary to fully evaluate the conditions and to positively identify and quantify flow paths away from the main buildings. This as-built effort in conjunction with the re-analysis of the site drainage system is currently being performed by CNS in conjunction with vendor assistance and is scheduled for completion before the end-of-year 2012.

7.2 Incorporated or Exterior Active Features

The Z Sump was identified as the only active feature required to function during a postulated PMF. As previously described, the sump contains equipment essential to the operation of the SGTS (Standby Gas Treatment System), and therefore must remain functional whenever Secondary Containment is required. Although the ground elevation at the sump is only 890 ft MSL, the Z Sump was determined by Walkdown Inspection not be affected by flooding since the sump penetrations were verified as sealed and the proper functioning of the sump was verified to be monitored by current PM and surveillance procedures.

These procedures include:

- Surveillance Procedure 6.SUMP.101; "Z Sump and Air Ejector Holdup Line Drain Operability Test (IST)"
- System Operating Procedure 2.2.27; "Equipment, Floor, and Chemical Drain System"

7.3 Temporary Passive Features

As previously described, temporary harden flood barriers (aluminum stop logs, etc.) and secondary protection through the deployment of sand bags are erected per CNS Procedure 7.0.11 (Ref. 10.2.14) to protect doorways, normal access openings within structures and other critical site assets from a PMF. The results of these walkdown inspections are discussed further in Section 7.5 of this report.

7.4 Temporary Active Features

Temporary active features and methods of protection are specifically mentioned within the CNS USAR Section 4.2.2.2 as to the plant's response to an imminent flooding event. The USAR states that material and equipment necessary to perform these protective measures are available at CNS and inventoried on an annual basis. As an example; special equipment includes; two portable gasoline powered pumps and 100 feet minimum (per pump) of 2 ½-inch non-collapsible hose. These components are currently stored within an ISO container on site near the L.L.R.W. facility at CNS. The results of walkdown inspections and reasonable simulation in the deployment of these temporary active features are discussed further in Section 7.5 of this report.

7.5 Procedural Review

CNS has established two primary procedures for guidance in the station's response to an external flooding event. These procedures are intended to prevent or mitigate the effects of an external flooding event through various operations and maintenance actions performed in advance of and/or during flooding conditions.

5.1FLOOD, "FLOOD"

As previously described, this is the primary (high level) procedure used for response to river level increase and is entered at a rising river level of greater than or equal to 895 ft MSL, notification of upstream dam failure and/or the river level is forecast to rise above a greater than or equal to value of 902 ft MSL within the next 36 hours. The procedure invokes numerous flood response measures, actions and activities in addition to the other main response procedure 7.0.11 Flood Control Barriers

Reasonable Simulation

Credit was taken for the recent previous performance of this procedure during CNS response to the May 2011 major flooding of the Missouri River and associated upper Mississippi River System. Review of the procedure revealed several stated actions which require verification including:

- Section 1 Entry Conditions – Notification of Upstream Dam Failure requires further action to ensure established protocol is in place.
- Section 4.8.3 – Verification that subsections 4.8.3.2 and 4.8.3.3 Protection of Main Transformer Yard, including; Main Power Transformer Oil Pumps, Main Power Transformer Control Cabinets, Normal Transformer Control Cabinet and Powerformer Transformer (northwest corner of NSST), Startup and Emergency Transformer Yard, including; TB-YD-122 (east side of ESST) can be executed in a timely manner.

A CR was generated to address these issues within the CNS CAP and assigned various corrective actions (CAs).

7.0.11, "FLOOD CONTROL BARRIERS"

As previously described, CNS Maintenance Procedure 7.0.11 (Ref. 10.2.14) provides a system for installing temporary flood barriers at strategic locations in and around the Reactor Building, Turbine Building, Diesel Generator Building, Control Building, Radwaste Building, and the Multi-Purpose Facility (MPF. These barriers protect safety related systems and components up to elevation 906 feet Mean Sea Level (MSL). These flood barriers were originally constructed of sandbags, plywood, and plastic. Recent implementation of CNS CED 6033644 (Ref. 10.2.12) replaces the existing sandbag and plywood flood barriers with engineered flood barriers that are easier to deploy, remove and maintain, are more reliable, and safer to implement.

Reasonable Simulation

The results of walkdown inspections associated with simulation in the deployment of these temporary passive features were documented by CNS work order (Ref. 10.2.18). This simulation work plan was a representative check of each type of flood door barrier s to the time associated with installation/deployment. Observational records indicated an implementation time range of as short as 3.5 minutes to as long as 20 minutes for the total of 42 barriers deployed. Two barriers R115 and R109 were unable to be deployed due to outage restraints requiring continuous temporary hoses running through the access opening. These two features / barriers are identical to N103 and T111 which were timed during the test (Ref. 10.2.18) at 4 minutes and 3.5 minutes respectively. Based on this comparison it was therefore determined they could also meet the reasonable simulation criteria as established. Information obtained from this testing will be used by CNS to determine the person loading needed to deploy all barriers within the required procedural time / action period.

7.6 Inaccessible Features

A significant amount of flood features (penetration seals) could only be partially inspected based on the fact that their primary water sealing feature (elastomer boot and sealing clamps) is located exterior to the building foundation wall buried underground within the soil. These features were evaluated based on visual inspection of the condition of the interior building sleeve and seal face and the lack or presence of water leakage.

A total of 14 features (12 pipe penetration seals and two wall surfaces) within the Radwaste Building - Waste Sludge Tank Room Elevation 877'-6" was determined to be inaccessible for walkdown inspections. The room is congested and the last dose rates on the tank were measured in excess of 3 Rem/hr. The room is also classified as a "Highly Contaminated Area" and has the potential to be an airborne area when entered as well. The 12 penetrations located in the room are the same construction and age as other external wall penetrations in the Radwaste Building and therefore should be in the same condition, i.e. some of them are assumed to be non-conforming due to indications of minor ground water in-leakage. This minor leakage is acceptable since it is well within the capabilities of installed plant systems to handle, i.e sump pumps, and there is no safe-shutdown equipment located in the area.

7.7 Deficient Features

Flood features were evaluated with regard to being categorized as deficient in accordance with NEI 12-07 (Ref. 10.1.2) guidance criteria. NEI Section 3.8 states, "*...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 to provide protection or mitigation. This concept includes non-conforming conditions as defined in NRC Inspection Manual Part 9900. Observations that may be potential deficiencies will be evaluated in accordance with station processes and entered into the Corrective Action Program.*"

Based on the above criteria all non-conforming flood features identified during the walkdown inspections were entered into the CNS CAP program by initiation of a CR (Condition Report). As part of the CR process, the feature was evaluated with regard to meeting its design basis function and subsequent impact on plant operability. Several features were determined to be deficient based on presenting an open pathway for flooding (absence of sealing device) and/or having a potential impact on an SSC required for safe shutdown by the effects of water infiltration / accumulation. These features are list in Table 7.7.1 below.

CNS CR#	MATRIX FEATURE NUMBER	DESCRIPTION OF FEATURE	ELEVATION	NON CONFORMING CONDITION	RECOMMENDED ACTION	REPAIR ACTION	Anticipated Completion Date
TURBINE BUILDING							
CNS-CR-2012-07799	T5-07-W	Turbine Bldg. Drainage Sump TT	882'-6"	Discovery of open pathway (4" drain line) from OWC to Turbine Building Sump TT resulting in potential flooding of TB.	Add barriers for OWC building or install an isolation valve in the drain line.	Modify procedures 5.1 FLOOD	completed
AUGMENTED RADWASTE BUILDING							
CNS-CR-2012-07628	B10-03-N	MPF floor drains and piping to Sump CC	877'-6"	A potential open external flooding pathway was discovered from MPF floor drain system into the ARW Building through uncontrolled discharge into Sump CC. Valve RW-1164, "MPF Floor Drain to ARW Chemical Sump CC Shutoff", requires further procedural guidance	Tie CR to modification of applicable procedures which control the position of valve RW-1164. These include CNS procedures 5.1FLOOD, 2.2.27 and 2.2.27A	Modify procedures 5.1 FLOOD, 2.2.27, & 2.2.27A	completed
CNS-CR-2012-07666	B10-04-N	Sump AA - Augmented Radwaste Bldg.	877'-6"	The bathroom in the old EOF has a lavatory and floor drain that go to Sump AA in ARW with no isolation valve. If river level were to exceed 903'6" water would enter the sump and possibly overwhelm the sump pumps.	Short term: revise 5.1Flood to include plugging or blocking off (PIG blanket) the floor drain. Long term: install a valve in the vertical ('4') run of pipe that enters the top of the sump.	Modify procedures 5.1 FLOOD, 2.2.27, & 2.2.27A	completed

Table 7.7.1

CNS CR #	MATRIX FEATURE NUMBER	DESCRIPTION OF FEATURE	ELEVATION	NON CONFORMING CONDITION	RECOMMENDED ACTION	REPAIR ACTION	Anticipated Completion Date
WATER TREATMENT BUILDING							
CNS-CR-2012-07545	K100-27-F	Main Sump Water Treatment Facility	903'-6"	Sump gravity drains straight to site the sludge pond. There is no check valve, back flow preventer or isolation valve to prevent flooding above 903'-6" elevation	Short term: revise 5.1Flood or MP 7.0.11 to include some sort of dam or bladder to prevent water entry. Long term: install a valve in the line to the sludge pond	Generate and execute a new CED	RE 28
OUTFALL STRUCTURE							
CNS-CR-2012-07894	C1-12-E	Outfall vertical drain valve 002C in the headwall	890'-0"	Degraded outfall vertical drain gate valve bypasses primary flood barriers	Perform maintenance on gates to free them up, suggest hydrolyze, clean and lubricate. Institute a PM to maintain them.	WO 4919665	10/14/2013
DIESEL GENERATOR FUEL STORAGE TANKS							
CNS-CR-2012-09278	C1-10-S	Diesel Fuel Tank 1A Manhole, South of Machine Shop, Conduit D342	899'-4"	Conduit penetration seal D342 was found to be non-conforming based on lack of waterproof seal.	Tie CR to a Global CR which addresses complete extent of condition of seals within DG Storage Tank and associated interface systems/components.	Prepare and implement conduit CED	RE 28
CNS-CR-2012-09342	C1-11-S	Diesel Fuel Tank 1B Manhole, South of Machine Shop, Conduit D345	899'-10'	Conduit penetration seal D345 was found to be non-conforming based on lack of waterproof seal.	Tie CR to a Global CR which addresses complete extent of condition of seals within DG Storage Tank and associated interface systems/components.	Prepare and implement conduit CED	RE 28

Table 7.7.1 (continued)

7.8 Delayed Inspection Features

A list of features that were inaccessible during the period of time in which the walkdown inspections were performed (both non-outage and outage periods) are listed in Table 7.8.1 below along with a justification and scheduled period for inspection.

DELAYED INSPECTION FEATURES				
MATRIX FEATURE NUMBER	SHORT DESCRIPTION OF JUSTIFICATION	CNS WORK NO.	ANTICIPATED COMPLETION DATE	REMARKS
DELAYED				
WALKDOWN PACKAGE DG-1	The PT cabinets associated with EG-I have penetrations in the floor that need to be inspected. In order to access these penetrations the back panel will need to be removed. Per discussion with Electrical Maint. Supt, the buss between EG-I and IFE will need to be de-energized to do this safely. This will occur during the R28 cycle when 4160v SWGRDG-I is inspected.	WO 4911449 is in NPLN status to perform the SWGR inspection.	R28	This package includes Features located in Diesel Generator #1, Rm N100. Total number of features = 3 conduits
WALKDOWN PACKAGE DG-2	The PT cabinets associated with EG-2 have penetrations in the floor that need to be inspected. In order to access these penetrations the back panel will need to be removed. Per discussion with Electrical Maint. Supt, the buss between EG-2 and IFE will need to be de-energized to do this safely. This will occur during the R28 cycle when 4160v SWGRDG-2 is inspected.	WO 4911449 is in NPLN status to perform the SWGR inspection.	R28	This package includes Features located in Diesel Generator #2, Rm N101. Total number of features = 3 conduits

Table 7.8.1

8 AVAILABLE PHYSICAL MARGIN

Available Physical Margins (APMs) have been collected and are documented on the individual Flooding Walkdown Record Forms contained within CNS engineering file records. Condition Reports were generated for items/features identified with indeterminate or negative APMs. A significant number of plant features were found to be indeterminate with regard to defining a specific APM value based on the presence of current or past water leakage/seepage. The original design basis for the various features was determined based on the following:

Exterior Building Walls

The NPPD Engineering Criteria Document for Cooper Nuclear Station (Ref. 10.2.8), Section 5.16.2, Hydraulic Loads – Flood, states, "......*All structures shall be designed for a hydraulic load equivalent to a groundwater elevation of **903** and reviewed for integrity for a river elevation of **906**.*"

This statement is supported by the various original structural design calculations for the walls and structures of the various CNS buildings developed by Burns & Roe with the exception of the Intake Structure walls which were additionally analyzed for wave effects up to elevation 919-ft MSL.

Piping Penetration Seals

The design criteria for the installed external piping penetration seals was established by the vendor who provided the original boot seals Fuller-Austin Insulation Co. A letter of verification (Ref. 10.2.23) states,

"..

1. *All boots were installed under the close supervision and were inspected by our Project Superintendent Mr. Scott Ross.*
2. *The black boots are identical in materials and installation technique to the boots tested by Bechtel at Arkansas Nuclear One.*
3. *The red boots were installed in the same fashion, the difference being one of temperature limit.*
4. *Based upon previous tests we do not see any difficulty in these boots withstanding a **20 foot head** with less than one gallon per day water leakage each.................................* "

Conduit Penetration Seals

CNS contract document (Ref. 10.2.24) for underground conduits states,"......*Special attention shall be given to the installation at the manholes and at the entrances through building wall.*"

In addition, a Burns & Roe Inc. transmittal (Ref. 10.2.25) indicates that the open ends of conduits were sealed with CPR Upjohn Urethane. A hydraulic rating for the capability of this seal material was not provided or determined and therefore an associated APM cannot be determined for the existing installed conduit seal features.

APMs for the various features evaluated during the inspection walkdowns were assessed based on the above design basis criteria as applicable.

9 NEW FLOOD PROTECTION SYSTEMS

CNS has recently completed the design of a plant modification described in CED 6033644 - External Flood Barriers, (Ref. 10.2.12) which evaluates the replacement of the sand bag and plywood barrier construction method with a system of removable pre-engineered aluminum stop log beams at various exterior doors located at ground level. The Modification also includes constructing a reinforced concrete flood wall around the HPCI Access hatch in the plant yard, which historically had also been flood protected by sandbags and plywood. This plant modification is currently being implemented and is expected to be complete by year end (2012).

The new engineered barriers will be installed in the same locations as the previous sandbag and plywood barriers as well as at doors H100 and H114 of the MPF building. The installation of the engineered flood barriers is initiated through CNS Emergency Procedure 5.1Flood based on existing and projected river elevations. The procedure identifies the measures to be taken based on the potential for flooding at the site. The use of engineering flood barriers in place of sandbag and plywood barriers does not have an adverse impact on the implementation of this procedure.

In addition to implementation of the above mentioned CED, other plant flood protection changes are currently being implemented or analyzed including:

- CNS Fire Pump House Building temporary external flood barrier system and other flood protection modifications including construction of a permanent building located above flood level to house the SAMG Diesel Generator and associated equipment. (This is a result of CNS response actions to IER11-4, "Extended Loss of Power").
- Modification of various existing leaking piping penetrations located within Class I and II Building Structures with new internal seals in accordance with specific developed CEDs and work orders identified previous to this inspection walkdown. (This is a result of current 50.54 (f) Recommendation 2.3 walkdown inspections findings).
- Initiation of maintenance work orders to correct non-conformances associated with site manholes, their associated conduit seals, manhole lids, and the seals on manholes lids. (This is being tracked by URT items for RE28).
- Water level monitoring instrumentation is being installed in Manholes 6 and 6A which will be completed during the next operational cycle. (This is being tracked by URT items for RE27).

10 REFERENCES

10.1 Regulatory Documents, Codes and Guidance

10.1.1 USNRC Letter Dated March 12, 2012, Addressed To All Power Reactor Licensees, "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".

10.1.2 NEI 12-07, Rev. 0-A, "Guidelines for Verification Walkdowns of Plant Flood Protection Features", dated May 2012.

10.1.3 Regulatory Guide 1.102, Rev. 1, September 1976, "Flood Protection for Nuclear Power Plants".

10.2 NPPD Documents

10.2.1 CNS Updated Safety Analysis Report (USAR), Volume II, Section 3.0, Meteorology.

10.2.2 CNS Updated Safety Analysis Report (USAR), Volume II, Section 4.0, Hydrology.

10.2.3 Original Final Safety Analysis Report (FSAR) Question 2.1, 2.2, 2.3, 2.6, 2.7, and 2.8 Response, Amendment 9.

10.2.4 Original Final Safety Analysis Report (FSAR) Question 2.4 and Response, Amendment 11.

10.2.5 Original Final Safety Analysis Report (FSAR) Question 2.33, 2.34, and 2.36 Response, Amendment 17.

10.2.6 Original Final Safety Analysis Report (FSAR) Question 2.35 Response, Amendment 16.

10.2.7 CNS Safety Evaluation Report (SER), Docket 50-298, February 14, 1973.

10.2.8 NPPD Engineering Design Criteria Document for Cooper Nuclear Station, June 3, 1970, Updated, March 15, 1972.

10.2.9 Cooper Nuclear Station, IPEEE "Individual Plant Examination of External Events - For Severe Accident Vulnerabilities" - 10CFR 50.54(f).

10.2.10 B & R Civil Structural Calculation, Book No. 88, "Yard Site Drainage & Paving".

10.2.11 CNS Calculation, Rev.2, Status 2, NEDC 11-076, "External Flood Hazard Event Review".

10.2.12 CNS, Change Evaluation Document, CED 6033644, External Flood Barriers.

10.2.13 CNS Emergency Procedure 5.1Flood, Revision 13, "Flood".

10.2.14 CNS Maintenance Procedure 7.0.11, Revision 26, "Flood Control Barriers".

10.2.15 CNS Technical Requirements Manual, T3.7.1, "River Level", Dated 01/08/2009.

10.2.16 CNS Condition Report 2012-6131, Corrective Action CA-2, CAT C "Fix" Evaluation, Dated 10/16/2012.

10.2.17 CNS Condition Report 2012-7428, Corrective Action CA-1 Dated 10/18/2012.

10.2.18 CNS Mechanical Work Plan 4833277 Operation 0070, "Flood Barriers and Acceptance Testing, Dated 05/31/2012.

10.2.19 CNS Design Engineering Department Correspondence Number: 12-0002, "Response to Recommendations 2.3, Flooding, Enclosure 4 of the 50.54(f) Letter Dated March 12, 2012", Dated 11/21/2012.

10.2.20 CNS Updated Safety Analysis Report (USAR), Volume XII, Section 2.0, Structural Design.

10.2.21 Original Final Safety Analysis Report (FSAR) Question 12.2 Response, Amendment 9

10.2.22 B&R Drawing 2299, Rev. N01, "Cooper Nuclear Station Water Seals for Exterior & Torus Wall Sleeve Details and Schedules.

10.2.23 Letter Fuller-Austin Insulation Co. from Mr. William. A. Lotz to Mr. Ed Kuchera/Mr. Lee Howell of Burns and Roe Inc., dated January 9, 1974.

10.2.24 Cooper Nuclear Station Contract Document E-69-17, Electrical Power Installation Section 3.2, "Underground Ducts"

10.2.25 Burns & Roe Inc. Transmittal "W.O. 2593 NPPD Cooper Nuclear Station Sealing Materials" dated March 25, 1975.