UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION IV
612 EAST LAMAR BLVD, SUITE 400
ARLINGTON, TEXAS 76011-4125

August 26, 2010

David J. Bannister, Vice President
and Chief Nuclear Officer
Omaha Public Power District
Fort Calhoun Station FC-2-4
P.O. Box 550
Fort Calhoun, NE 68023-0550

SUBJECT: SUMMARY OF MEETING WITH OMAHA PUBLIC POWER DISTRICT REGARDING A PRELIMINARY SUBSTANTIAL FINDING

Dear Mr. Bannister:

This refers to the public regulatory conference meeting conducted at Arlington, Texas on August 18, 2010, between the NRC and your staff. The participants discussed the circumstances associated with a preliminary finding with substantial safety significance regarding the mitigation of a potential flood at the Fort Calhoun Station.

This meeting was classified as a Category 1 public meeting, as communicated in the meeting notice (ADAMS ML102160648). This provided an opportunity for members of the public to discuss regulatory issues with the NRC after the business portion of the meeting, but before the meeting adjourned. No comments were brought forward by the public.

The attendance list for the meeting is enclosed with this summary (Enclosure 1). A copy of the Omaha Public Power District presentation slides is also enclosed (Enclosure 2). A copy of the Omaha Public Power District meeting minutes for the external flooding expert panel for sandbagging effectiveness which was referred to during the meeting is enclosed (Enclosure 3).

In accordance with 10 CFR 2.390 of the NRC's "Rules of Practice," a copy of this letter, and its enclosures, will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records component of NRC's document system (ADAMS). ADAMS is accessible from the NRC Web Site at http://www.nrc.gov/reading-rm/adams.html (the Public Electronic Reading Room).

Should you have any questions concerning this matter, we will be pleased to discuss them with you.

Sincerely,

/RA/

Thomas R. Farnholtz, Chief
Engineering Branch 1
Division of Reactor Safety

Dockets: 50-285
Licenses: DPR-40

Enclosures:
1. Attendance List
2. OPPD Presentation Slides
3. Meeting Minutes – External Flooding Expert Panel for Sandbagging Effectiveness

cc w/enclosures:

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R:\REACTORS\FC MS Reg Conf 8-18-19 ADAMS ML

ADAMS: ☐ No ☒ Yes	☒ SUNSI Review Complete	Reviewer Initials: GAG
	☒ Publicly Available	☒ Non-Sensitive
	☐ Non-publicly Available	☐ Sensitive
KEYWORD: Fort Calhoun Station Regulatory Conference August 2010		

RI:DRS/EB1	C:DRS/EB1		
GGeorge	TFarnholtz		
/RA/	***/RA/***		
08/24 /2010	08/26 /2010		

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REGULATORY CONFERENCE WITH FORT CALHOUN STATION

August 18, 2010

U.S. Nuclear Regulatory Commission Region IV Office
612 East Lamar Blvd Arlington TX 76006

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John Kirkland	NRC Region IV
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REGULATORY CONFERENCE WITH FORT CALHOUN STATION

August 18, 2010

U.S. Nuclear Regulatory Commission Region IV Office
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REGULATORY CONFERENCE WITH FORT CALHOUN STATION

August 18, 2010

U.S. Nuclear Regulatory Commission Region IV Office
612 East Lamar Blvd Arlington TX 76006

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William Schaup	NRC Region IV

Fort Calhoun Station Regulatory Conference

External Flooding
August 18, 2010

Fort Calhoun Station Regulatory Conference

Opening Remarks
Jeff Reinhart – Site Vice President

Agenda

- Introductions
- Key Points and Objectives
- Performance Deficiency Corrective Actions
- Root Cause Analysis Results
- Extent of Condition Review
- Risk Significance Considerations
- Closing Remarks

Introductions

- Jeff Reinhart - Site Vice President
- Harry Faulhaber - Division Manager Engineering
- Mike Ferm - Shift Manager/Manager System Engineering
- Joe McManis - Manager Projects
- Tim Miller - Superintendent Maintenance
- Alan Hackerott - Supervisor PRA
- Kevin Hyde - Supervisor Design Engineering
- Susan Baughn – Manager Nuclear Licensing
- Donna Guinn – Supervisor Regulatory Compliance
- Allen Berck - Supervisor Emergency Planning

Key Points and Objectives

- Protection against and mitigation of external flooding is of utmost importance to OPPD
- Although the USAR is not clear, OPPD is protecting to 1014 feet
- Actions completed to address deficiencies in procedures, equipment and training
- Additional actions are in progress to update station design basis
- Causal analysis completed to identify root and contributing causes
- Actions assigned to address causes and extent of condition
- OPPD requests consideration of additional information regarding risk

Fort Calhoun Station Regulatory Conference

Performance Deficiency Corrective Actions
Harry Faulhaber – Division Manager Engineering

Procedures to Protect Plant From External Flooding

- AOP-1, Acts of Nature
- AOP-30, Emergency Fill of Emergency Feedwater Storage Tank
- AOP-38, Blair Water Main Trouble
- EPIP-TSC-2, Catastrophic Flooding Preparations
- GM-RR-AE-1002, Flood Control Preparedness for Sandbagging
- PE-RR-AE-1000, Floodgate Inspection and Repair
- PE-RR-AE-1001, Floodgate and Floodplate Installation and Removal
- PE-RR-AE-1002, Installation of Portable SG Makeup Pumps

Corrective Actions Completed

- Implemented external flooding action plan (Dec 2009)
- Short-term and long-term actions identified
- Project Manager assigned (Jan 2010)
- Project team assigned (Jan 2010)
- Action plan reviewed and updated routinely
- Procedures and equipment have been upgraded to enhance protection of vital structures to 1014 feet

Corrective Actions Completed

- Purchased four additional gasoline powered steam generator feed make-up pumps
  - Verified readiness of pumps and associated equipment
  - Upgraded implementing procedure (PE-RR-AE-1002)
- Verified readiness of equipment and materials
  - Fire water storage tank cross-connect to emergency feedwater storage tank
  - Filling emergency feedwater storage tank
- Upgraded or verified implementing procedures
  - AOP-30/AOP-38
  - EPIP-TSC-2

Corrective Actions Completed

- Verified readiness of floodgates and associated equipment
  - Upgraded implementing procedure (PE-RR-AE-1001)
- Verified readiness of sandbagging equipment and materials
  - Upgraded sandbagging machine and purchased additional machine
  - Upgraded implementing procedure (GM-RR-AE-1002)
- Fabricated new floodplates to protect to 1014 feet
  - Updated implementing procedure (PE-RR-AE-1001)

Corrective Actions Completed

- Verified the Intake Structure cell water level can be maintained using a raw water pump
- Verified preventive maintenance tasks for flood protection equipment
- Conducted ERO drill to demonstrate ERO decision making and sandbag berm construction

ERO Demonstration July 16, 2010

- Primary objectives of the scenario were to demonstrate, evaluate and validate the following:
  - Decision making
  - Procedures and methods
  - Practical demonstration of sandbagging

ERO Demonstration Results July 16, 2010

- ERO was conservatively activated
- Demonstrated ability to construct a sandbag berm
- Demonstrated use of procedures
- Demonstrated protection for levels greater than 1009.5 ft
- Maintained effective decay heat removal and core cooling

ERO Demonstration Results July 16, 2010

- Maintained Command & Control of ERO activities
- TSC decision making was rigorous and conservative
- Effective use of external resources
  - Design Engineering
  - Substation maintenance personnel
  - Corporate resources supported sandbagging
  - Prompt delivery of additional equipment
- Lessons learned collected in drill critique

Corrective Actions In Progress

- Implement design change to improve efficiency of floodgate installation
  - Includes associated procedures changes
- Conduct maintenance refresher training on sandbagging and floodgate installation
- Review Probable Maximum Flood (PMF) in accordance with RG 1.59
- Update station external flooding design basis as required

Historical Improvements

- 1992
  - AOP-01, "Acts of Nature" issued, including steps to sandbag entrances of the plant to 1014 ft when river level reached 1007.5 ft
  - AOP-01 and PE-RR-AE-1000, "Floodgate Installation and Repair" revised to improve guidance on flood control and annual inspection of response equipment
- 1993
  - Engineering Analysis Request, EAR-93-020, determines that external flooding caused by catastrophic flooding (1029 ft) dominates CDF. Portable pumps purchased and procedure written for use
- 1995
  - GM-RR-AE-1002, "Flood Control Preparedness for Sandbagging" is issued for installing sandbags to protect FCS from a Missouri River flood
  - OPPD letter LIC-95-0130 -"IPEEE Submittal for Fort Calhoun Station IPEEE" is transmitted. Includes the results of the investigation of external flooding

Fort Calhoun Station Regulatory Conference

Root Cause Analysis Results

Harry Faulhaber – Division Manager Engineering

Root Cause Analysis Results

- Root Cause
  - USAR commitment to protect to 1014 ft not clear
- Contributing Causes
  - USAR not updated in 1997 due to misinterpretation of RG 1.59
  - Erroneous belief that "incredible" meant beyond design basis
  - 1998 USAR verification project was not rigorous in clarifying maximum river level

Root Cause Analysis

Extent of Cause

- Potential for other commitments/design basis not clearly translated into the FSAR/USAR

Extent of Condition

- Potential for other commitments/design basis not adequately implemented in procedures
  - External flooding
  - Design changes not evaluated in view of new data

RCA Corrective Actions

- Review 1998 USAR verification project database items for proper condition reporting threshold
- Focused and prioritized comprehensive review of USAR
  - to ensure adequate implementation into procedures
  - to ensure commitments and requirements are clearly translated in the USAR

Additional Extent of Condition Review

- Reviewed corrective actions from previous 95002 inspection for applicability
  - Causal analysis process improvements
  - Rigor in NRC violation corrective actions
- Reviewed Corrective Action program for similar issues as noted in inspection report

Fort Calhoun Station Regulatory Conference

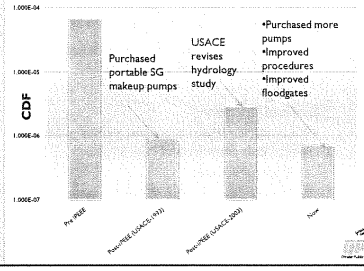
Risk Significance Considerations

Harry Faulhaber – Division Manager Engineering

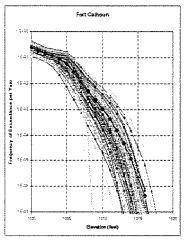
Risk Significance Considerations

- Historical Risk Perspective
- Frequency of Flooding
- Timeline for Response to Flooding
- Ability to Protect Vital Structures
- Steam Generator Make-up Reliability
- Base Case Selection

Summary of FCS External Flood CDF



Frequency of Flooding

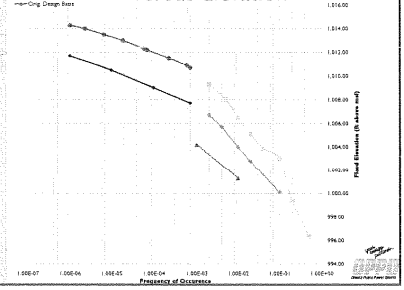


Uncertainty of Flood Exceedance Frequency Studied by Jack Benjamin and Associates

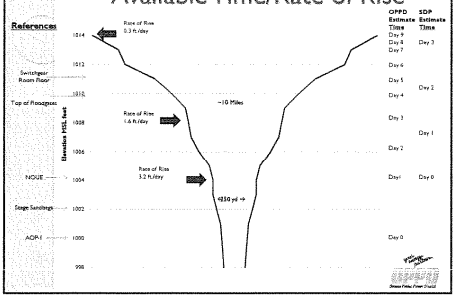
At lower frequencies river flooding exceedance distributions have a high degree of uncertainty

Mean value of exceedance for floods > 1010 ft is about 25% lower than FCS estimates

Flooding Frequency versus Elevation



Available Time/Rate of Rise



Recent Operating Experience

- FCS has entered AOP-1 several times this year
  - Control Room received early and accurate information
  - Station practice is early entry into AOP-1
  - Site personnel responded with urgency and diligence
- FCS has demonstrated Command and Control and early decision making

Ability To Protect Vital Structures

- Doors could have been protected with sandbags or steel plates above existing floodgates
- Sandbags and steel plates were available on-site
- Additional supplies readily available nearby
- Priorities
  1. Auxiliary Building
  2. Intake Structure

Auxiliary Building Protection

Room 66 to Diesel Generator at 1013 ft
only 1 ft of sandbag protection needed

5- Doors Turbine to Switchgear Entrance (Aux. Bldg)

1014 ft

1011 ft

Floor elevation higher than 1010.8 ft

Auxiliary Building Protection

Gate(s) in upper position

1014 ft

1009.5 ft

2 doors –Auxiliary Building to Radwaste Building and Truck Bay are guillotine gates to 1009.5 ft

1010.8 ft

1007 ft

Door to Radwaste Building

Chemistry Door protects to 1014 ft with existing door caulked

Auxiliary Building Protection

Auxiliary Building Entrance-Floodgate

1014 ft

Protects to 1009.5 ft

1010.8 ft

1009.5 ft

1007 ft

8

Sandbagging Expert Panel – Auxiliary Building to 1010.8'

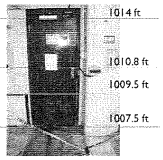
Building	Elevation	Door	ETP Likeliness	% Success	Failure Probability	To Level	Comments
Aux	1007	1007-1A 1B	Very Likely	90%	1.00E-01	1010.8	Sandbag from floor 3.8' pyramid spanning Radwaste and Corridor 26 w/ floodgate
Aux	1007	1007-9	Extremely Likely	95%	5.00E-02	1010.8	Close and caulk door
Aux	1007	1007-19	Very Likely	90%	1.00E-01	1010.8	Floodgate and sandbag from floor 3.8' pyramid
Aux	1007	Truck Bay	Extremely Likely	95%	5.00E-02	1010.8	Add 8.25' x 1.3' plate above existing floodgate, channel exists to support plate, easy access to sandbags if needed

Sandbagging Expert Panel – Auxiliary Building to 1014'

Building	Elevation	Door	ETP Likeliness	% Success	Failure Probability	To Level	Comments
Aux	1007	1007-1A 1B	Very Likely	90%	1.00E-01	1014	Floodgate and sandbag 7' pyramid (4.5' above gate) spanning Radwaste and Corridor 26
Aux	1007	1007-9	Extremely Likely	95%	5.00E-02	1014	Close and caulk door
Aux	1007	1007-19	Very Likely	90%	1.00E-01	1014	Floodgate and sandbag 7' pyramid (4.5' above gate)
Aux	1007	Truck Bay	Extremely Likely	95%	5.00E-02	1014	Add 8.25' x 4.5' above existing floodgate, easy access to sandbags if needed
Aux	1011	1011-1	Extremely Likely	95%	5.00E-02	1014	Weld 3' x 3' plate
Aux	1011	1011-2	Extremely Likely	95%	5.00E-02	1014	Weld 3' x 3.24' plate
Aux	1011	1011-3	Extremely Likely	95%	5.00E-02	1014	Weld 3' x 4.24' plate
Aux	1011	1011-4	Extremely Likely	95%	5.00E-02	1014	Weld 3' x 4.34' plate
Aux	1011	1011-11	Extremely Likely	95%	5.00E-02	1014	Weld 3' x 8.5' plate
Aux	1013	1013-4	Extremely Likely	95%	5.00E-02	1014	Sandbags for 1' of protection
Aux	1013	Room 66	Likely	75%	2.50E-01	1014	3'x3' Plate on floor of Equipment Hatch 1013' to stressing gallery requires sandbags

Intake Structure Protection

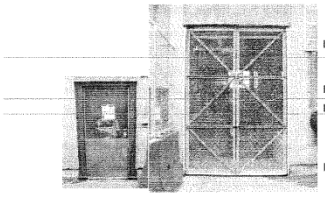
Intake Structure:
3 Personnel Doors at 1007.5 ft



Intake Structure Protection

Intake Structure Trash Trough at 1007.5 ft

Intake Structure Protection

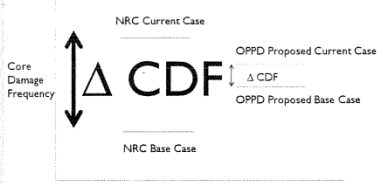


Intake Structure
Truck Bay and Personnel Door

Plant Protection Summary

- Protection of buildings through sandbagging and other means directed by the ERO
- Intake and Aux Buildings protected within 20 hours
- On site personnel support (many more available)
- Ample material and tools available

Risk Significance Considerations



Overall Risk Assessment

NRC Raport Values

Elevation (ft MSL)		Lambda	CCDP Current	CCDP Base	$P_{gas\ pump\ fail}$	Delta CDF/bin
1008	1009.5	3.20E-03	1.25E-03	1.01E-03	2.56E-02	1.91E-08
1009.5	1010	4.00E-04	1.25E-03	1.05E-03	2.56E-02	2.09E-09
1010	1010.8	8.00E-04	1	1.04E-03	2.56E-02	2.05E-05
1010.8	1014	5.00E-04	1	1.10E-01	2.56E-02	1.14E-05
					Total Delta CDF	3.19E-05

PCS Risk Assessment — Maintain DHR — Steam Generator Cooling

Elevation (ft MSL)		Lambda	CCDP Current	CCDP Base	$P_{gas\ pump\ fail}$	Delta CDF/bin
1008	1009.5	3.20E-03	1.25E-03	1.01E-03	4.00E-03	2.98E-09
1009.5	1010	4.00E-04	1.25E-03	1.00E-2	4.00E-03	-1.40E-08
1010	1010.8	8.00E-04	0.19	1.00E-2	4.00E-03	5.76E-07
1010.8	1014	5.00E-04	0.235	1.00E-1	4.00E-03	2.70E-7
					Total Delta CDF	8.35E-7

Risk Parameter Differences

Elevation (ft MSL)		Lambda	CCDP Current	CCDP Base	$P_{gas\ pump\ fail}$	Delta CDF/bin
1008	1009.5	3.20E-03	1.25E-03	1.02E-03	4.00E-03	2.98E-09
1009.5	1010	4.00E-04	1.25E-03	1.00E-2	4.00E-03	-1.40E-08
1010	1010.8	8.00E-04	0.19	1.00E-2	4.00E-03	5.76E-07
1010.8	1014	5.00E-04	0.235	1.00E-01	4.00E-03	2.70E-7
					Total Delta CDF	8.35E-7

CCDP composite of refilling EFWST and protecting Aux building to 1010.8 ft
- CCDP= 1 – (refill of EFWST success)x(protection of Aux building success)
- 0.19= 1-(.9)x(.9)

Refill of EFWST
- Crosstie to fire water tank using AOP-38 step or reference drawing
- Blair water post-flood restoration
- Suggest overall success of 90%

Risk Parameter Differences

Elevation (ft MSL)		Lambda	CCDP Current	CCDP Base	$P_{gas\ pump\ fail}$	Delta CDF/bin
1000	1009.5	3.20E-03	1.25E-03	1.02E-03	1.00E-03	2.98E-09
1009.5	1010	4.00E-04	1.25E-03	1.00E-2	4.00E-03	-1.40E-08
1010	1010.8	8.00E-04	0.19	1.00E-2	4.00E-03	5.76E-07
1010.8	1014	5.00E-04	0.235	1.00E-01	4.00E-03	2.70E-7
					Total Delta CDF	8.35E-7

Protection of Auxiliary Building 1010.8 ft
- 90% success
- Expert technical panel
  - Ample time, manpower, equipment, materials
  - Sandbagging and other means to 1010.8 ft
- Precipitation based
  - Early warning from USACE and NWS
  - Flooding levels are accurately forecasted
  - Declining rate of rise

Risk Parameter Differences

Elevation (ft MSL)		Lambda	CCDP Current	CCDP Base	$P_{gas\ pump\ fail}$	Delta CDF/bin
1008	1009.5	3.20E-03	1.25E-03	1.02E-03	4.00E-03	2.98E-09
1009.5	1010	4.00E-04	1.25E-03	1.00E-2	4.00E-03	-1.40E-08
1010	1010.8	8.00E-04	0.19	1.00E-2	4.00E-03	5.76E-07
1010.8	1014	5.00E-04	0.235	1.00E-01	4.00E-03	2.70E-7
					Total Delta CDF	8.35E-7

CCDP is a composite of refilling EFWST and protecting Aux building to 1014 ft
- CCDP= 1 – (refill of EFWST success)x(protection of Aux building success)
- 0.235= 1-(.9)x(.85)

Refill of EFWST
- Crosstie to fire water tank using AOP-38 steps or reference drawing
- Blair water post-flood restoration
- Method established proactively
- Suggest overall success of 90%

Risk Parameter Differences

Elevation (ft MSL)		Lambda	CCDP Current	CCDP Base	$P_{gas\ pump\ fail}$	Delta CDF/bin
1008	1009.5	3.20E-03	1.25E-03	1.02E-03	4.00E-03	2.98E-09
1009.5	1010	4.00E-04	1.25E-03	1.00E-2	4.00E-03	-1.40E-08
1010	1010.8	8.00E-04	0.19	1.00E-2	4.00E-03	5.76E-07
1010.8	1014	5.00E-04	0.235	1.00E-01	4.00E-03	2.70E-7
					Total Delta CDF	8.35E-7

Protection of Auxiliary Building 1014 ft
- 85% success
- Expert technical panel
  - Ample time, manpower, equipment, materials
  - Floodgates and sandbagging to 1014 ft
- Precipitation based
  - Early warning from USACE and NWS
  - Flooding levels accurately forecasted
  - Declining rate of rise
  - Early activation of ERO

Risk Parameter Differences

Elevation (ft MSL)		Lambda	CCDP Current	CCDP Base	$P_{gas\ pump\ fail}$	Delta CDF/bin
1008	1009.5	3.20E-03	1.25E-03	1.02E-03	4.00E-03	2.98E-09
1009.5	1010	4.00E-04	1.25E-03	1.00E-2	4.00E-03	-1.40E-08
1010	1010.8	8.00E-04	0.19	1.00E-2	4.00E-03	5.76E-07
1010.8	1014	5.00E-04	0.235	1.00E-01	4.00E-03	2.70E-7
					Total Delta CDF	8.35E-7

- Suggested NRC human error probability is 4.00E-03
- Equipment unreliability negligible
  - A pump failure would be addressed
  - One pump is sufficient for steam generator supply and EFWST makeup
  - Pre-staged pumps are a "starter kit" and would be supplemented by others
  - Could be obtained late in the flood
  - 50 GPM required
  - Steam generator depletion time is longer than 15 hours

Risk Parameter Differences

Elevation (ft MSL)		Lambda	CCDP Current	CCDP Base	$P_{gas\ pump\ fail}$	Delta CDF/bin
1008	1009.5	3.20E-03	1.25E-03	1.02E-03	4.00E-03	2.98E-09
1009.5	1010	4.00E-04	1.25E-03	1.00E-2	4.00E-03	-1.40E-08
1010	1010.8	8.00E-04	0.19	1.00E-2	4.00E-03	5.76E-07
1010.8	1014	5.00E-04	0.235	1.00E-01	4.00E-03	2.70E-7
					Total Delta CDF	8.35E-7

- Suggest IPEEE values for the base case
- These values are consistent with our historic IPEEE published capability of mitigating a flood
- Based on a capability that was as acceptable evaluation at the time
- The NRC base case does not represent an OPPD self-imposed standard or a regulatory requirement

Overall Risk Assessment

NRC Raport Values

Elevation (ft MSL)		Lambda	CCDP Current	CCDP Base	$P_{gas\ pump\ fail}$	Delta CDF/bin
1008	1009.5	3.20E-03	1.25E-03	1.02E-03	2.56E-02	1.91E-08
1009.5	1010	4.00E-04	1.25E-03	1.05E-03	2.56E-02	2.09E-09
1010	1010.8	8.00E-04	1	1.04E-03	2.56E-02	2.05E-05
1010.8	1014	5.00E-04	1	1.10E-01	2.56E-02	1.14E-05
					Total Delta CDF	3.19E-05

RCS Risk Assessment		Maintain DHR		Steam Generator Cooling		
Elevation (ft MSL)		Lambda	CCDP Current	CCDP Base	$P_{gas\ pump\ fail}$	Delta CDF/bin
1008	1009.5	3.20E-03	1.25E-03	1.02E-03	4.00E-03	2.98E-09
1009.5	1010	4.00E-04	1.25E-03	1.00E-2	4.00E-03	-1.40E-08
1010	1010.8	8.00E-04	0.19	1.00E-2	4.00E-03	5.76E-07
1010.8	1014	5.00E-04	0.235	1.00E+1	4.00E-03	2.70E-7
					Total Delta CDF	8.35E-7

Closing Remarks

- Protection against and mitigation of external flooding is of utmost importance to OPPD
- Actions completed to address the performance deficiency
- Protection is provided for vital structures up to 1014 ft
- RCA completed and corrective actions are in progress
- Extent of cause/condition reviews have been completed
- The ERO is a significant factor in protecting the health and safety of the public
- The risk created by the performance deficiency is low
- We respectfully request reconsideration of risk

External Flooding Expert Panel for Sandbagging Effectiveness

Date:
August 2, 2010

Facilitators:
Joe McManis

Participants:

Chris Moeller	Senior Emergency Planning Representative
Sondra Bowser:	Working Crew Leader - SFM
Tim Miller:	Superintendent Maintenance - FCS
Alexander Peters:	Control Room Supervisor
David Haas:	Senior Nuclear Design Engineer - Mechanical
Anthony Filips:	Nuclear Engineer
Rob Swerczek:	PRA Representative
Nik Vassios:	Field Engineer
Carl Nielsen:	Project Manager

Guests:

Donna Guinn:	Supervisor Regulatory Compliance
Justin Wiemer:	PRA Co-op
Brian Chee:	PRA Co-op

Purpose

The purpose of this expert panel is to establish an approximate sandbagging success likelihood profile that represents, in a quantitative manner, the degree of confidence FCS has in the ability to protect the auxiliary building and intake structure for Missouri River floods in excess of 1010 ft up to floods of 1014 ft and the basis for that confidence level.

Background

The FCS USAR states (or at least implies) that OPPD will protect the auxiliary building and the intake structure via use of floodgates and sandbags. FCS procedures rely on sandbags for building protection above 1009.5. The guidance for implementing sandbagging protection is contained in GM-RR-AE-1002 (see attached). However, the guidance is very limited when floods are expected to exceed 1009.5 ft. Specifically, procedure GM-RR-AE-1002 calls for draping sandbags over the floodgates.

Based on NRC review of the procedure, it was concluded that there was essentially zero likelihood that sandbag berms could be constructed. Their assessment did not credit any other procedure or organization. The actual SDP assumed that even at flood levels as low as 1010 ft elevation; the credit for sandbagging was set to zero.

Issue Definition

Given a flooding event is predicted to occur on the Missouri River it is important that OPPD confidently defines the sandbagging success profile. In establishing this profile the expert panel participants should consider the actual state of the plant at the time the violation was cited. Specifically,

- One sandbagging motor was missing
- Sand on site was limited
- The procedures had not yet been revised
- General site awareness of potential flood hazards was not as great as it is now

Based on the drill of July 16, 2010, several observations are relevant:

- Overall staff available to fill sandbags is more than 70 people (35 per alternating shift)
- Sandbags can be filled via machine at a rate of 21 per minute
- Total number of sandbags required to protect to 1014' msl:
  - Auxiliary Building: 6,500
  - Intake Structure: 9,000
- Time for river rise is 45-210 hours. This affects preparation time available.
- River rise forecast is based on data from the USACE.
- Site begins to flood at 1004' msl, making movement around the site difficult. This is noted by NRC as a concern.
- Sandbag elevations necessary to protect various doors is attached

Summary

On Monday, August 2, 2010, the expert panel convened to discuss external flooding plant protection, procedures related to sandbagging and installation floodgates and the results of the July 16th drill. The expert panel discussed which actions would be needed to protect both the Intake Structure and Auxiliary Building. The sandbags would be pre-staged in the Intake Structure and Auxiliary Building (as mentioned in the procedure). Input was received from multiple participants for each door. Pros and cons were weighed by participating members and a consensus of likelihood was agreed upon and documented. The items discussed for the Intake Structure were doors IS-1, IS-2, IS-3, IS-4 and IS-5 and with additional discussion on a sandbag wall between the traveling screens and Raw Water vault openings. The items discussed for the Auxiliary Building were doors 1007-1A/1B, 1007-9, 1007-19, 1011-1, 1011-2, 1011-3, 1011-4, 1011-11, 1013-4, Corridor 26 and the Room 66 grating to the stressing gallery. For the Auxiliary Building, sandbags would be brought in through the roll-up door on the railroad siding to use for the Auxiliary Building entrance door first, and then the roll-up door and railroad siding with all materials inside.

There was some discussion by maintenance personnel about the manpower and time it takes to sandbag the doors. Maintenance personnel decided that welding plates to the door would be a better use of resources in some cases. An e-mail was sent from Maintenance to Licensing which documented the welding resources available (welders, welding machines, etc.) to FCS and the ERO if needed. Maintenance mentioned that there are enough steel plates on site for flooding protection. Maintenance mentioned that the time to weld a plate to a personnel door would take 4 hours or less and a large door would be 8 hours or less.

During the discussion, the likeliness of successful protection of each opening in the Intake Structure and Auxiliary Building was determined. Each likeliness ranking referred to the percent of success of protection. The success likeliness rankings are as follows: extremely likely = 95% success, very likely = 90%, likely = 75%, uncertain = 50%, doubtful = 25%, very doubtful = 10% and impossible = 0%.

DEN was tasked to determine the height at which the column between the personnel door, IS-4, and roll-up door, IS-5, would lose structural integrity. DEN calculated that the column is structurally sound up to a level of 1010.8' msl. The operations representative mentioned that the sluice gate/RW pumps would be used to control water level in the cells. The expert panel decided the intake structure protection was "extremely likely" to a level of 1010.8' msl including operating the sluice gates and RW pumps. The expert panel decided internal (protection from trash trough) intake structure protection was "impossible" above 1010.8' msl.

For the Auxiliary Building, the probability of success could be determined from the levels at which the doors would be challenged. For Auxiliary Building floods up to 1010.8', the protection would be "very likely", which corresponds to 90% success. For Auxiliary Building floods up to 1014', the protection were averaged over two levels, from 1010.8' to 1013', then from 1013' to 1014'. For floods between level 1010.8' and 1013', the protection would be "very likely", which corresponds to 90% success. For floods between 1013' to 1014', the protection would be "likely", corresponding to 75% success. To combine these values, success would be 90% for 2.2 feet, from 1010.8' to 1013', then success would be 75% for 1 foot, from 1013' to 1014'. When these values are combined for a level of protection between 1010.8' to 1014', the probability of success is 85%.

The following table documents the results of the expert panel discussion.

Building	Door	Likeliness	% Success	To Level	Comments
Aux	1007-1A 1B	Very Likely	90	1014	Floodgate and 2550 sandbag 7' (4.5' above floodgate) pyramid spanning Radwaste and Corr. 26 w/ floodgate
Aux	1007-9	Extremely Likely	95	1014	Close and caulk door
Aux	1007-19	Very Likely	90	1014	Floodgate and 1620 sandbag 7' (4.5' above floodgate) pyramid
Aux	RR Siding Cor. 26	Extremely Likely	95	1014	Add 8.25' x 4.5' plate above existing floodgate. Channel exists to support plate and easy access to sandbags if needed
Aux	1011-1	Extremely Likely	95	1014	Weld 3' x 3' plate
Aux	1011-2	Extremely Likely	95	1014	Weld 3' x 3.4' plate
Aux	1011-3	Extremely Likely	95	1014	Weld 3' x 4.4' plate
Aux	1011-4	Extremely Likely	95	1014	Weld 3' x 4.4' plate
Aux	1011-11	Extremely Likely	95	1014	Weld 3' x 8.5' plate
Aux	1013-4	Extremely Likely	95	1014	30 sandbags for 1' of protection
Aux	DG Room Plate	Likely	75	1014	3'x3' Plate on floor of Equipment hatch 1013' elev. to stressing gallery requires 60 sandbags
Intake	IS-1	Extremely Likely	95	1014	Install existing floodgate and weld 2' x 3' plate above gate
Intake	IS-2	Extremely Likely	95	1014	Install existing floodgate and weld 2' x 3.5' plate above gate
Intake	IS-3	Extremely Likely	95	1014	Install existing floodgate and weld 2' x 3.5' plate above gate
Intake	IS-4	Extremely Likely	95	1014	Install existing floodgate and weld 5' x 3' plate above gate
Intake	IS-5	Extremely Likely	95	1010.8	Install existing floodgate and weld (2) 2' x 6' plate above gate
Intake	IS-5	Impossible	0	1014	Install existing floodgate and weld (2) 6'x1.5' plates above gate

Building	Door	Likeliness	% Success	To Level	Comments
Intake	Screen Wall	Very Likely	90	1011.5	4’ x 8’ plywood wall with plastic sheet and sandbags placed behind. Need knee braces - using sluice gates and RW pumps to help control cell level, sandbag instrument trenches
Intake	Screen Wall	Doubtful	25	1014	4' wood wall no protection past 1011.5, requires sandbagging the trash chute, control of gates being on water side of the screen wall, throttle RW pumps

Expert Panel References Used or Discussed

- PE-RR-AE-1001 Floodgate Installation and Removal
- GM-RR-AE-1002 Flood Control Preparedness for Sandbagging
- Welder and welding e-mail from Maintenance to Licensing on April 28, 2010
- FCS Floodgate Strategy
- Expert Panel Guidance – WEC
- CEOG Guidelines for Using Expert Panels
- 1011’ Flood e-mail from DEN about load on Intake Structure column on August 9, 2010