GROUP B

FOIA/PA NO: _____2012-0235_____

RECORDS BEING RELEASED IN PART

The following types of information are being withheld:

Ex. 1: ☐ Records properly classified pursuant to Executive Order 12,958
Ex. 2: ☐ Records regarding personnel rules and/or human capital administration
Ex. 3: ☐ Information about the design, manufacture, or utilization of nuclear weapons
☑ Information about the protection or security of reactors and nuclear materials
☐ Contractor proposals not incorporated into a final contract with the NRC
☐ Other_____
Ex. 4: ☐ Proprietary information provided by a submitter to the NRC
☑ Other_Information that would decrease compliance and/or program effectiveness__
Ex. 5: ☑ Draft documents or other pre-decisional deliberative documents (D.P. Privilege)
☐ Records prepared by counsel in anticipation of litigation (A.W.P. Privilege)
☐ Privileged communications between counsel and a client (A.C. Privilege)
☐ Other_____
Ex. 6: ☐ Agency employee PII, including SSN, contact information, birthdates, etc.
☑ Third party PII, including names, phone numbers, or other personal information
Ex. 7(A): ☐ Copies of ongoing investigation case files, exhibits, notes, ROI's, etc.
☐ Records that reference or are related to a separate ongoing investigation(s)
Ex. 7(C): ☐ Special Agent or other law enforcement PII
☐ PII of third parties referenced in records compiled for law enforcement purposes
Ex. 7(D): ☐ Witnesses' and Allegers' PII in law enforcement records
☐ Confidential Informant or law enforcement information provided by other entity
Ex. 7(E): ☐ Law Enforcement Technique/Procedure used for criminal investigations
☐ Technique or procedure used for security or prevention of criminal activity
Ex. 7(F): ☑ Information that could aid a terrorist or compromise security

Other/Comments:_____
_____

Smith, Chris

From: Kirkland, John
Sent: Tuesday, May 31, 2011 10:49 AM
To: Clark, Jeff; Azua, Ray
Cc: Smith, Chris; Melfi, Jim
Subject: FW: River Level

From: GUINN, DONNA K [mailto:dguinn@oppd.com]
Sent: Tuesday, May 31, 2011 10:42 AM
To: Kirkland, John; Wingebach, Jacob
Cc: ACKER, RICHARD D; MATZKE, ERICK P; COOPER, MIKE
Subject: FW: River Level

FYI

Donna Guinn, PMP
Supervisor - Regulatory Compliance
dguinn@oppd.com
(402) 533-7337
(b)(6)
fax (402) 533-7291
****

From: NELLENBACH, TIMOTHY R
Sent: Monday, May 30, 2011 1:41 PM
To: NuclearBusinessUnit
Cc: REINHART, JEFFREY A; BANNISTER, DAVID J; GATES, GARY; HANSEN, JON T; DOGHMAN, MOHAMAD I; MINKS, ADRIAN J; BURKE, TIMOTHY J; EASTERLIN, EDWARD E
Subject: FW: River Level

Hello,

As you all know we are experiencing some of the highest river levels in the station's history. The current level is 1001 feet 11 inches. It is impossible to predict how high the river will get because we don't know how much rain will fall; however, we do know that the Army Corps of Engineers is planning to increase outflows from Gavins Point dam to unprecedented levels over the next several weeks. **We are preparing for the worst case, and we will be ready to handle it.**

We are currently implementing the following station procedures to deal with the high river level:

- AOP-01, Acts of Nature, Section 1 for Flooding
- PE-RR-AE-1001, Flood Barrier and Sandbag Staging and Installation

We have also been reviewing our emergency plan procedures (EPIP-TSC-2, Catastrophic Flood Protection) in the event that they are needed to help mitigate the effects of the high river level.

Items that we have either completed or started up to this point are:

- Staged equipment at our sandpile to fill sandbags.
- Filled more than 8,000 sandbags.
- Sandbagged the necessary items in the Intake Structure and stored additional sandbags there in the event they are needed.
- Staged sandbags in the Auxiliary Building.
- Staged sandbags near the Main Station transformer, T1, for use to protect the Turbine Building and other assets in the Protected Area.

21

- Staged our metal flood barriers.
- Sandbagged the Security Building doors.
- Commenced sandbagging in the Switchyard.
- Had additional sand delivered to the site.
- Making preparations to build a berm around our new demineralized water equipment near the Old Warehouse

I sincerely appreciate the efforts by all station personnel in getting the above activities accomplished. We still have a lot of work to do, and we will all need to pitch in during the next several weeks.

Going forward please do the following:

- The available parking has been reduced. Please be patient and do not park in standing water. Use the available dry spaces. If we run out of spaces additional parking and/or shuttle service will be provided to get the necessary people to work.
- Work with your supervision to make yourself available for sandbagging or other mitigation efforts.
- **Do not despair. We will continue to be successful in protecting FCS so that we can return to power operation.**

From a Nuclear Safety Culture perspective the below principles come to mind as they relate to our current situation.

Principle 1: Everyone is personally responsible for nuclear safety. (People and their professional capabilities, values, and experiences are regarded as the nuclear organization's most valuable assets. **We will continue to successfully mitigate the effects of the high water because we have great people that can get the job done. We also have solid station procedures and the full backing of OPPD to get any necessary resources.**

Principle 4: Conservative Decision Making (Decision making practices reflect the ability to distinguish between "allowable" choices and "prudent" choices.) **We will not startup the reactor until we know and understand the trends on river level**.

Principle 5: Nuclear Power is special and unique (Produces decay heat.) **Our nuclear fuel is in a safe condition and will remain in a safe condition regardless of how high the river level gets.** Our fuel is currently covered by more than 23 feet of water in both the Spent Fuel Pool and the Reactor Vessel. Our safety systems are fully able to remove decay heat and will continue to do so.

If you have questions or concerns, don't hesitate to contact your supervisor or manager.

Thank you.

Tim Nellenbach
Plant Manager
Fort Calhoun Nuclear Station
Omaha Public Power District
Phone: (402) 533-6625

Smith, Chris

From: Wingebach, Jacob
Sent: Wednesday, June 01, 2011 8:51 AM
To: Clark, Jeff
Cc: Melfi, Jim; Azua, Ray; Smith, Chris
Subject: FW: Update on Flood Protection Actions

From: GUINN, DONNA K [mailto:dguinn@oppd.com]
Sent: Wednesday, June 01, 2011 8:15 AM
To: Kirkland, John; Wingebach, Jacob
Subject: FW: Update on Flood Protection Actions

FYI

Donna Guinn, PMP
Supervisor - Regulatory Compliance
dguinn@oppd.com
(402) 533-7337
(b)(6)
fax (402) 533-7291
****

From: REINHART, JEFFREY A
Sent: Tuesday, May 31, 2011 6:52 PM
To: NuclearBusinessUnit
Cc: HANSON, JEFFREY J; JONES, MICHAEL R; OPPD SENIOR MANAGEMENT
Subject: Update on Flood Protection Actions

All—

Yesterday, Tim Nellenbach provided a detailed message regarding what we are doing to protect the plant from rising river levels. I wanted to provide an update on developments since then.

Currently the river level is 1002.3 ft. and rising slowly. **The plant is in a safe condition,** with fuel reloaded into the core and greater than 23 ft. of water covering the fuel in the refueling cavity, and in the spent fuel pool. Our direction is to reinstall the upper guide structure, and then suspend reactor reassembly activities until we have reliable information that the river level trend will remain below 1004 ft. and stay on a lowering trend. It is possible that we will not meet these conditions until later this summer. We will not start up the reactor until it is safe to do so. Meanwhile, our safety systems remain available to remove decay heat, and our procedures and flood protection equipment will keep the plant protected.

Currently, we are tracking the release rates from Gavins Point and other upstream dams and correlating the release rates to the expected rise in river level. Based on current best estimate predictions, river level will likely rise another 2.5 feet to 4.5 feet over the next two weeks due to the planned higher discharges from the Missouri River dams. This is only an estimate. Per AOP-1 we will implement the Emergency Plan prior to river level exceeding 1004 feet. The decision on specifically when we will implement the Emergency Plan will be made by the Shift Manager based on river level, the rate of rise and predicted/actual precipitation levels. We will ensure that the Emergency plan is implemented before 1004 ft.

In parallel with our actions to protect the plant from a nuclear safety perspective, we have also established a project team, led by John Brandeau, to ensure we take appropriate actions to protect OPPD assets that could be damaged by flood waters. Those assets include materials, equipment and buildings such as outage trailers,

B2

material stored on-site, the old Warehouse, the new Warehouse, the Administration Building, and the Training Center. By establishing a separate team for non-nuclear safety-related concerns, we enable the Operations Shift Manager and Plant Management to keep their primary focus on nuclear safety. The initial focus of the project team is to ensure we have an accurate and prioritized picture of the assets that need to be moved to higher ground or protected as river levels rise. We are also taking inventory of OPPD equipment available to Fort Calhoun Station, and ordering additional equipment as necessary to protect our OPPD assets. Our CEO, Gary Gates, and the OPPD senior management team remains committed to provide additional support to the FCS staff as we go forward.

We will keep you informed of new developments on a daily basis. Thanks for all of your support and concern.

Jeff

Jeff Reinhart
Site Vice President, Fort Calhoun Station
Omaha Public Power District
402-533-6611 (office)
402-533-7296 (fax)

Robles, Jesse

From: Robles, Jesse
Sent: Friday, June 03, 2011 1:44 PM
Subject: IOEB Clearinghouse Screening Summary for Friday, June 3, 2011

NOTE: THIS SUMMARY IS ~~OFFICIAL USE ONLY~~
*****MAY CONTAIN SENSITIVE/ PROPRIETARY OR NRC INTERNAL USE ONLY INFORMATION*****
DO NOT FORWARD ANY PORTIONS OUTSIDE OF NRC WITHOUT FIRST OBTAINING PERMISSION FROM ORIGINATOR

Issues for Resolution (IFR): None

OpE Forum Postings (COMMS): None

Management Requests: None

Follow-up/Other Tasks: Five (5)

[Note - The information in this part of the Summary is often preliminary in nature and is provided to help IOEB staff communicate and track noteworthy items being followed up by either the Regions or HQ staff.]

1) COOPER (INCL. FORT CALHOUN) – PROJECTED RISE IN MISSOURI RIVER LEVELS OVER NEXT TWO WEEKS (UPDATE)

The following summary details potential impacts to NRC facilities due elevated Missouri River levels. Missouri River Flooding. For Ft Calhoun at 1008 feet MSL, the transformers will be impacted resulting in the plant experiencing a loss of offsite power. The licensee's operational plan is to remain shutdown until the river crests and then recedes to below 1004 feet MSL with a decreasing trend. If the river level reaches 1004 ft and is expected to exceed 1006 ft, the licensee will transfer from the 4160 volt power to the Emergency Diesel Generators. Forward to TRG Lead for Flood Protection/Missiles (Edward Smith) and EP (Eric Schrader); assigned to Russ Haskell.

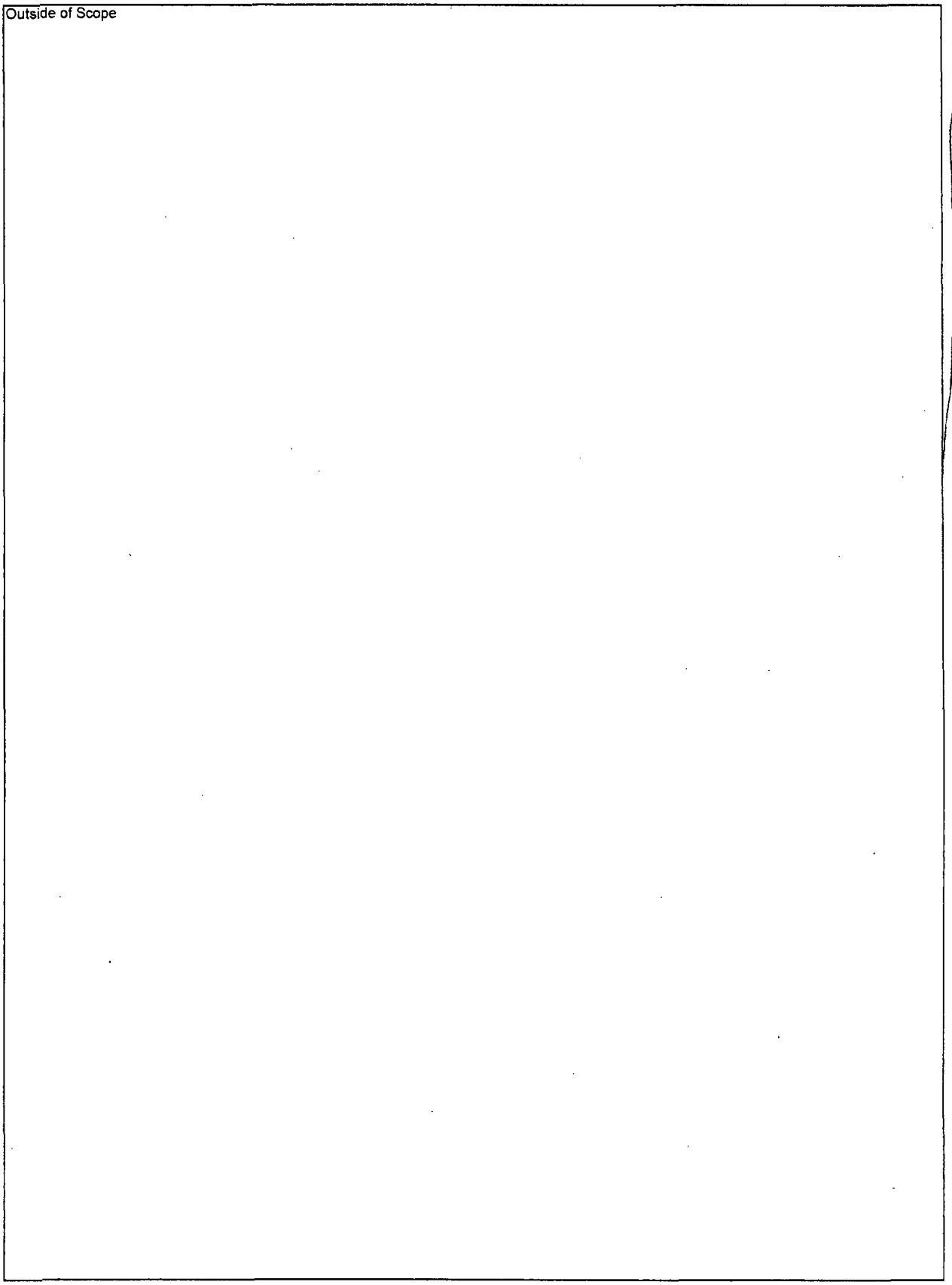
The US Army Corps of Engineers has indicated they will commence with staged water releases from upstream dams to manage rising Missouri River levels. Releases will be on the order of 80,000 to 150,000 cubic-feet/second (ft3/sec) between now and 6/15/2011. Releases of this magnitude could result in water levels at Cooper Nuclear Station reaching the 899' 5" elevation (NOUE is 899') by 6/15/2011. Station ALERT (SHUTDOWN) is 902'. The Army Corps of Engineers and National Weather Service are being consulted with regularly. Forward to TRG Lead for Flood Protection/Missiles (Edward Smith) and EP (Eric Schrader); assigned to Russ Haskell.

Outside of Scope

Outside of Scope

R3

OUTSIDE OF SCOPE



Azua, Ray

From:	Howell, Linda
Sent:	Saturday, June 04, 2011 12:23 PM
To:	Borchardt, Bill; Virgilio, Martin; Weber, Michael; Collins, Elmo; Howell, Art; Wiggins, Jim; Satorius, Mark; Pederson, Cynthia; Boland, Anne; McDermott, Brian; Moore, Scott; Carpenter, Cynthia; Morris, Scott; Thaggard, Mark; Bush-Goddard, Stephanie; Weil, Jenny; Markley, Michael; Giitter, Joseph; Lewis, Robert
Cc:	Kennedy, Kriss; Pruett, Troy; Vegel, Anton; Caniano, Roy; Campbell, Vivian; Dricks, Victor; Uselding, Lara; Erickson, Randy; Maier, Bill; Browder, Rachel; Clark, Jeff; Azua, Ray; Gaddy, Vincent; Marshall, Jane; Gott, William; HOO Hoc; Hay, Michael; Lynch, James; Dickson, Billy
Subject:	Missouri River Flooding - Status of Potential Impacts on NRC Facilities and Agreement State Licensees ~~OFFICIAL USE ONLY - SENSITIVE INTERNAL INFORMATION~~
Attachments:	Missouri River Flooding Potential Impact at NRC Facilities 6-4.docx
Importance:	High

Attached is a status report on the current and projected impacts at NRC-licensed facilities and materials licensees located in impacted Agreement States. Updated information is highlighted. We have removed the section on research and test reactors since there have been no impacts on these facilities and none is expected. Should that change, the reported will be updated appropriately.

We anticipate publishing the next update to this report on Monday morning and will likely resume daily updates next week.

Please noted that the report is now marked OFFICIAL USE ONLY. This is due to the level of detailed information concerning licensee actions. Please do not distribute outside NRC without letting us know. We want to ensure that information concerning planned actions that go beyond information in public records and plans is appropriately protected/controlled.

HOOS, should you receive a request for status information from DHS today, you may forward the same information provided on June 2-3. Please contact me if you receive a request for update on Sunday to assure that we have the current status.

If any recipient of this report believes others should be added to distribution, please let me know and the distribution list will be expanded accordingly.

V/R,
Linda

B4

Missouri River Flooding

Potential Impact at NRC Facilities

June 4, 2011

(Updated information is highlighted)

Due to greater than normal snow levels in the upper Missouri River Basin, the associated snowpack runoff and record level rainfall, the Missouri River Mainstem Reservoir System is experiencing flooding challenges. Rainfall in the northern areas of the Basin in the past few weeks has equaled what typically falls during an entire year, and snowpack runoff is expected to be 140% of the normal volume. The U.S. Army Corps of Engineers (USACE) has noted that this spring's flooding will be the most severe the region has seen since the reservoir system was constructed in the 1950's and 1960's. This has prompted USACE to release record volumes of water from each of the six major dams that make up the Missouri River Mainstem Reservoir System. Based on information provided by USACE, the current modeling and release plan call for achieving a 150,000 cubic feet per second release rate for five of the six dams by mid-June and continuing at that level through mid-July, and possibly into August, in order to maintain reservoir storage capacity. Missouri River levels are projected to crest as noted below and may remain at those levels through mid-July or into August.

A summary of potential impacts is provided below for NRC facilities located in areas that are or may be impacted by flooding. Region IV is coordinating with Agreement States in the flood impacted areas to verify the status of materials licensees.

Cooper Nuclear Station

Plant Elevation: 903 feet mean sea level (MSL)

Current river level: ~895.7 feet MSL (5:45 am, CD T, June 4)

Predicted max river level: 899.5 feet MSL predicted by mid-June (source is USACE)

Potential Impacts on Plant Equipment: There are no expected equipment impacts based on projected river levels. The licensee will commence a plant shutdown before the river level reaches 902 feet MSL at Cooper. At 898 feet MSL the flooding procedure directs licensee personnel to place sandbags on exterior doors. (b)(4),(b)(7)(F)

(b)(4),(b)(7)(F) Ex 4

The licensee has entered its flooding procedure and is conducting enhanced monitoring of the river levels and traveling screens. The licensee is also preparing barriers to protect buildings and structures from flooding. The licensee would declare a Notice of Unusual Event (NOUE) at 899 feet MSL. The licensee would declare an Alert at 902 feet MSL and initiate plant shutdown.

Potential Impact on Evacuation Routes: A portion of the normal plant access road is now closed as a result of flooding. The licensee has identified alternate routes that would allow

B5

access to and from the plant by personnel and diesel fuel delivery. The licensee is preparing to buildup this access point to protect it from flooding. There is currently no impact on evacuation routes.

Fort Calhoun Station

Plant Elevation: 1004 feet mean sea level (MSL)

Current river level: ~1003 feet MSL (5:15 am, CDT, June 4)

Predicted max river level: 1006.4 feet MSL predicted by mid-June (source is USACE)

Potential Impacts on Plant Equipment: (b)(4),(b)(7)(F) Ex.4
(b)(4),(b)(7)(F)
Ex4 (b)(4),(b)(7)(F) The licensee would normally commence plant shutdown when the river level reaches 1004 feet MSL at the Fort Calhoun Station. However, the licensee was nearing the end of a refueling outage. Currently the plant is shutdown with the core reloaded and flooded up to 23 feet above the vessel flange. The licensee's operational plan is to remain in this configuration until the river crests and then recedes to below 1004 feet MSL with a decreasing trend. (b)(4),(b)(7)(F)
(b)(4),(b)(7)(F)

The licensee has entered its flooding procedure and is conducting enhanced monitoring of the river levels. The licensee is leaning forward in completing actions prescribed in its flooding procedure and planned to have actions completed in advance of river levels reaching the trigger points identified in the flooding procedure.

The licensee has procured and is placing a 2000 foot long Aqua Berm (water-filled temporary levee) which is 8 feet tall and 16 feet wide at the base. This temporary berm will be installed at the perimeter of the protected area and is expected to protect up to a 1009 feet MSL level. The licensee is building earthen berms around the 161 KV and 345 KV switchyards and is planning to build them to a height to provide protection similar to the Aqua Berm. Additional berms and sandbags are being built or installed around the Training Center, Administration Building and the South Security Building. These are intended to protect facilities important to site staff and communications equipment.

All offsite power sources (161 KV and 345 KV) are available and both primary emergency diesel generators (EDG) are operable and available. The licensee is staging two additional fuel oil tanks within the Aqua Berm. These tanks will provide an additional two weeks of fuel (the fuel tanks presently onsite have a two week fuel capacity, resulting in a four week supply of fuel). The licensee is developing plans to replenish fuel oil if there is an anticipated need to run the EDGs greater than a four week period of time. (b)(4),(b)(7)(F) Ex4
(b)(4),(b)(7)(F) The licensee is also evaluating a process for refueling the tanks through the tank vents. The licensee also plans to

- stage an additional spare generator with an associated fuel tank and step-up transformer within the Aqua Berm.

The licensee is staging additional equipment and supplies within the Aqua Berm including, dewatering pumps, sandbagging equipment and supplies, gasoline supplies, food and water. The licensee has procured satellite phones which will be distributed to key staff as backup communication devices.

The licensee has ordered six boats for use onsite, if needed, since some parking areas are already under water. Offsite parking arrangements are in place for site staff, and the staff will be shuttled to and from the plant. The licensee is working with the National Guard to arrange for additional backup transportation provisions.

The licensee will declare a NOUE at 1004 feet MSL. The licensee's Emergency Plan would not call for an Alert declaration until the river level reaches 1009 feet MSL. The licensee would not plan to activate its emergency response facilities if a NOUE is declared. The licensee is presently planning to manage onsite activities through an Incident Command System structure using a model included in the OPPD Pandemic Plan as a template. At the current time, the licensee's Emergency Operations Facility (EOF) is not expected to be challenged by flooding. The Technical Support Center and Operations Support Center are located within the Aqua Berm.

Potential Impact on Evacuation Routes: The licensee has indicated that the only section of roadway that is projected to be impacted by rising river levels is a small section of Route 75 to the north of the town of Fort Calhoun (the actual river level at which this would occur is being researched at this time). The residents of Fort Calhoun have evacuation routes to the west and south that are expected to remain available. Evacuation routes for the town of Blair and other communities to the north are expected to remain available to the north and west.

Outside of Scope

NRC Region IV

Region IV staff continues to monitor the flooding conditions along the Missouri River and the potential impacts on Region IV plants and materials licensees located along the river. Region IV is monitoring potential impacts on evacuation routes and is coordinating with the power plant licensees, states and FEMA. Region IV has coordinated with the National Weather Service and USACE to confirm projected river levels.

- Region IV plans to augment the resident inspector staff at Fort Calhoun Station on Monday, June 6. Region IV is establishing a schedule for daily conference calls with Fort Calhoun Station managers to monitor the licensee's preparations and potential impacts on the plant. Region IV plans to initiate routine, periodic calls with FEMA Region VII, the states and local response organizations early next week.

NSIR has coordinated with FEMA Headquarters to ensure that they are aware of the potential impacts from river flooding at Fort Calhoun Station and Cooper Nuclear Station.

Elliott, Robert

From: Elliott, Robert
Sent: Monday, June 06, 2011 10:55 AM
To: Anderson, Shaun; Bucholtz, Kristy; Grover, Ravinder; Hamm, Matthew; Hemphill, Khadijah; Richards, Karen; Schulten, Carl; Singletary, Melana; Waig, Gerald
Subject: FW: Notes from Decision Makers' Conference Call -- NOUE Declaration at Ft Calhoun Due to River Water Level 0800 CDT 6 June 2011

FYI... Status at Fort Calhoun....

From: Brown, Frederick
Sent: Monday, June 06, 2011 10:51 AM
To: Ashley, MaryAnn; Cartwright, William; Elliott, Robert; Franovich, Rani; McHale, John; Shoop, Undine
Subject: FW: Notes from Decision Makers' Conference Call -- NOUE Declaration at Ft Calhoun Due to River Water Level 0800 CDT 6 June 2011

FYI

From: Thorp, John
Sent: Monday, June 06, 2011 10:02 AM
To: Leeds, Eric; Boger, Bruce; Grobe, Jack; Collins, Elmo; Skeen, David
Cc: Brown, Frederick; Pruett, Troy; Howe, Allen; Ruland, William; Giitter, Joseph; Nelson, Robert; Cheok, Michael; McGinty, Tim; NRR_DIRS_IOEB Distribution; Kobetz, Timothy; Kirkland, John
Subject: Notes from Decision Makers' Conference Call -- NOUE Declaration at Ft Calhoun Due to River Water Level 0800 CDT 6 June 2011

All,

I just sat in on the blast dial conference call with the Senior Resident at Ft Calhoun, John Kirkland, to listen to John's status briefing and participate in the discussion among decision makers Bruce Boger and Elmo Collins on the licensee's declaration of a Notification of Unusual Event for high river water level at 0800 CDT.

Other attendees on the call included NSIR Jane Marshall, and the HOO.

At 0920 EDT the decision was reached to remain in normal mode, with continued enhanced oversight and follow-up with the licensee by NRC staff, which has been in progress in anticipation of the rising river water level.

- The river water level as of the time of the call is 1003 feet, 2 inches. The plant is in Cold Shutdown, and does not plan to start up until the river water level (trend) is abated, and will not start up while they are in an Unusual Event (or higher) condition.
- The level at which an NOUE must be declared under the licensee's procedures (HU-1, EAL 5, Natural Phenomena Affecting the Protected Area) is 1004 feet.
- According to the Army Corps of Engineers, the river water level at the site should reach 1006 feet 6 inches in approximately 10 days.
- The next decision making call will be held when river water level reaches 1006 feet. (This is the level at which there is a potential for offsite power to be threatened.)
- At 1009 feet, the licensee's procedures call for declaration of an Alert, and this is the level at which a Shutdown is required if the plant were operating.

Licensee actions thus far:

- Over past week, Ft Calhoun has been preparing for the rising river level, and has put in place sandbagging and flood gates to protect the site up to 1007 feet river level.
- The licensee has materials staged to support protection up to 1014 feet, and they have procured and by end of day today will have installed an "aqua-berm" (design is similar to a large inner tube filled with water) to protect the entire protected area (with exception of the intake structure) up to 1012 feet of river level.
- The licensee is procuring another aqua-berm to allow protection of the Training Building and the simulator facility in that building.

During the days/weeks leading up to today's call, Region IV has been engaged and interacting with the licensee, FEMA, and state and local authorities, and the Region IV staff will continue with enhanced oversight and engagement with the licensee for this event, which has come about due to a combination of snow melt and heavy rains upriver, and attendant water releases from the associated dams.

Access to the site is thus far unaffected. Due to some of the employee parking lot already covered by water, the licensee is bussing in most employees, with essential employees in shift crews (and NRC residents) still able to drive in and use available parking, until parking on site is no longer available. Egress and evacuation routes remain available to the site. The Senior Resident Inspector and the Resident Inspector plan to make photos of the conditions at the site, currently only on their local network drives, available to NRC staff via a SharePoint link, when they are able to.

Please let me know if I've made any errors of fact or if I've omitted anything; I'll be happy to re-issue this status e-mail with any corrections.

John Thorp
NRR Daytime Emergency Officer
301-415-8508

Daytime EO Cell: (b)(6) (6)(b)
Personal Cell: (b)(6) (6)(C)

John Thorp
Chief, Operating Experience Branch
NRR/DIRS/IOEB

Tracking:

Recipient	Read
Anderson, Shaun	Read: 6/6/2011 10:59 AM
Bucholtz, Kristy	Read: 6/7/2011 7:40 AM
Grover, Ravinder	
Hamm, Matthew	
Hemphill, Khadijah	Read: 6/6/2011 10:55 AM
Richards, Karen	Read: 6/6/2011 10:55 AM
Schulten, Carl	Read: 6/6/2011 10:56 AM
Singletary, Melana	Read: 6/6/2011 12:22 PM
Waig, Gerald	Read: 6/6/2011 10:55 AM

Robles, Jesse

From: Bernardo, Robert (NRC)
Sent: Monday, June 06, 2011 3:03 PM
Subject: IOEB Clearinghouse Screening Summary for Monday, June 6, 2011

NOTE: THIS SUMMARY IS ~~OFFICIAL USE ONLY~~
*****MAY CONTAIN SENSITIVE/ PROPRIETARY OR NRC INTERNAL USE ONLY INFORMATION*****
DO NOT FORWARD ANY PORTIONS OUTSIDE OF NRC WITHOUT FIRST OBTAINING PERMISSION FROM ORIGINATOR

Issues for Resolution (IFR): None

OpE Forum Postings (COMMS): None

Management Requests: None

Follow-up/Other Tasks: Nine (9)

[Note - The information in this part of the Summary is often preliminary in nature and is provided to help IOEB staff communicate and track noteworthy items being followed up by either the Regions or HQ staff.]

1) FORT CALHOUN – PROJECTED RISE IN MISSOURI RIVER LEVELS OVER NEXT TWO WEEKS

A Notification of Unusual Event (NOUE) was declared for the site.

•The river water level as of the time of the call is 1003 feet, 2 inches. The plant is in Cold Shutdown, and does not plan to start up until the river water level (trend) is abated, and will not start up while they are in an Unusual Event (or higher) condition.
•The level at which an NOUE must be declared under the licensee's procedures (HU-1, EAL 5, Natural Phenomena Affecting the Protected Area) is 1004 feet.
•According to the Army Corps of Engineers, the river water level at the site should reach 1006 feet 6 inches in approximately 10 days.
•The next decision making call will be held when river water level reaches 1006 feet. (This is the level at which there is a potential for offsite power to be threatened.)
•At 1009 feet, the licensee's procedures call for declaration of an Alert, and this is the level at which a Shutdown is required if the plant were operating.

Licensee actions thus far:

•Over past week, Ft Calhoun has been preparing for the rising river level, and has put in place sandbagging and flood gates to protect the site up to 1007 feet river level.
•The licensee has materials staged to support protection up to 1014 feet, and they have procured and by end of day today will have installed an "aqua-berm" (design is similar to a large inner tube filled with water) to protect the entire protected area (with exception of the intake structure) up to 1012 feet of river level.
•The licensee is procuring another aqua-berm to allow protection of the Training Building and the simulator facility in that building.

During the days/weeks leading up to today's call, Region IV has been engaged and interacting with the licensee, FEMA, and state and local authorities, and the Region IV staff will continue with enhanced oversight and engagement with the licensee for this event, which has come about due to a combination of snow melt and heavy rains upriver, and attendant water releases from the associated dams.

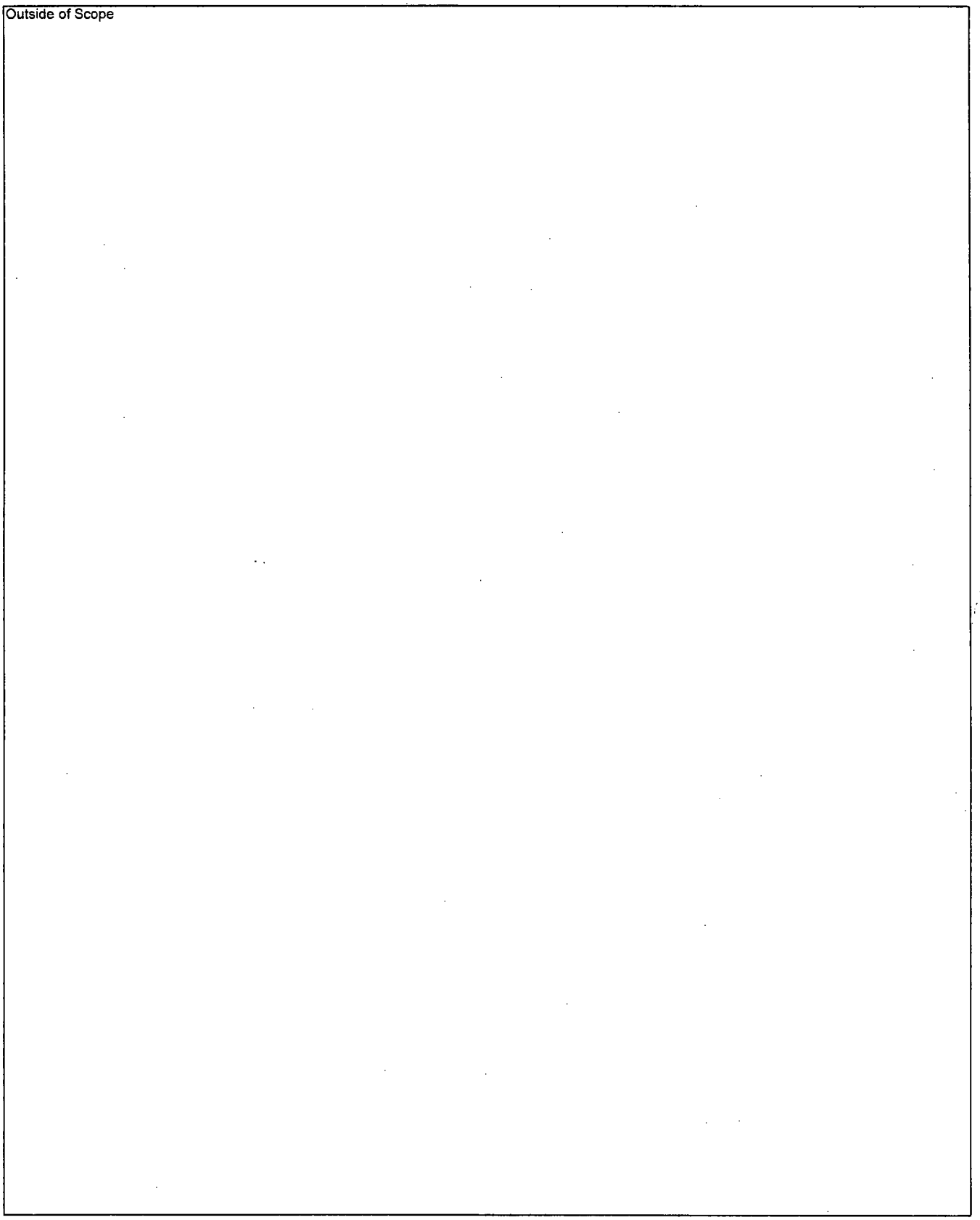
37

Access to the site is thus far unaffected. Due to some of the employee parking lot already covered by water, the licensee is bussing in most employees, with essential employees in shift crews (and NRC residents) still able to drive in and use available parking, until parking on site is no longer available. Egress and evacuation routes remain available to the site. The Senior Resident Inspector and the Resident Inspector plan to make photos of the conditions at the site, currently only on their local network drives, available to NRC staff via a SharePoint link, when they are able to. Forward to TRG Lead for Flood Protection/Missiles (Edward Smith) and EP (Eric Schrader); Assigned to Jesse Robles.

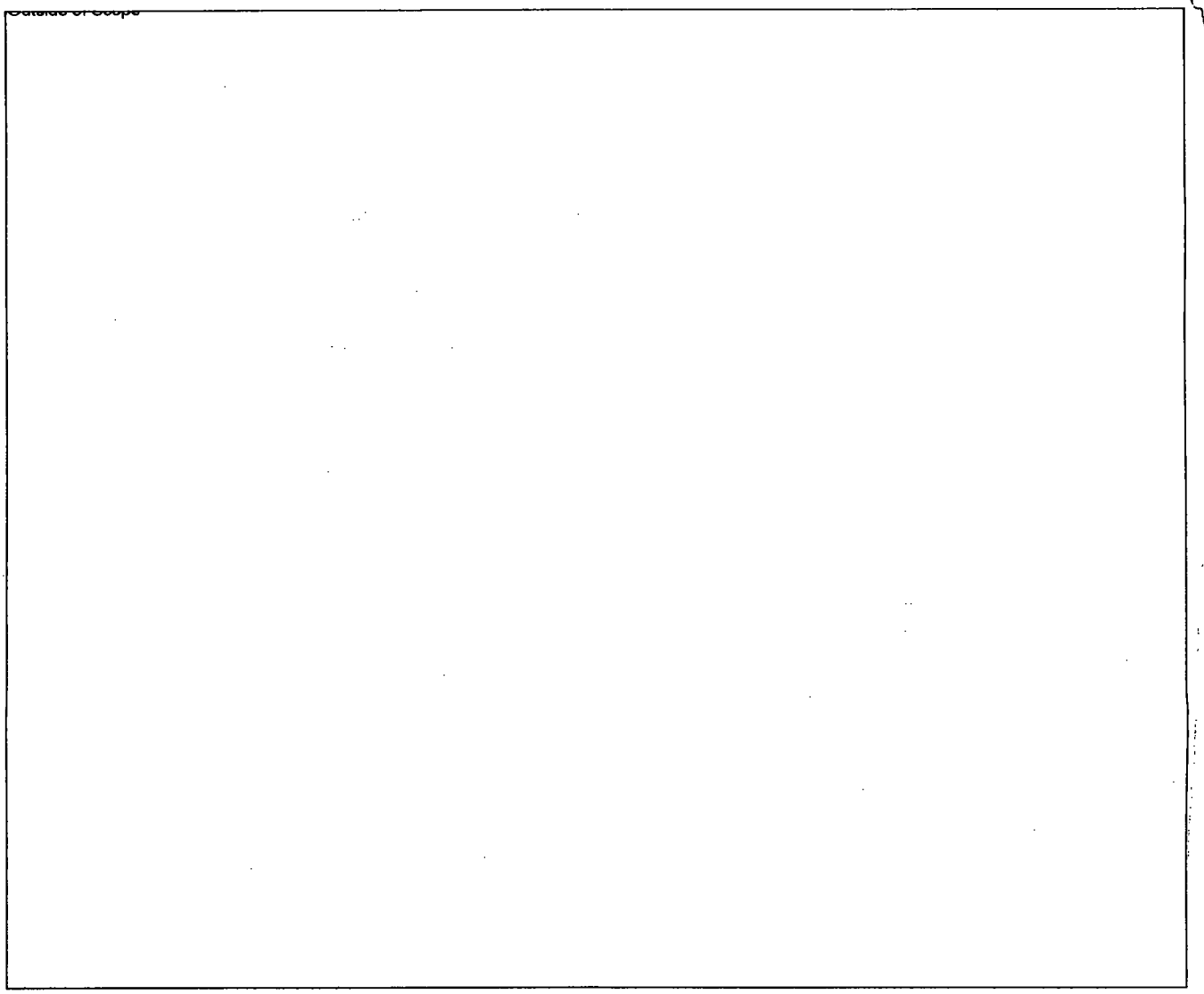
Outside of Scope

OUTSIDE OF SCOPE

OUTSIDE OF SCOPE



OUTSIDE OF SCOPE



Attendees at Screening Meeting:

Bob Bernardo
Jesse Robles
Adakou Foli
Rebecca Sigmon
Steve Pannier
Jay Patel - (NRO)
Mary Wegner- (RES) - by phone

Robles, Jesse

From: Thorp, John NRR
Sent: Tuesday, June 07, 2011 10:23 AM
To: NRR_DIRS_IOEB Distribution
Subject: FW: Missouri River Flooding - Status of NRC and Agreement State Licensees ~~OFFICIAL USE ONLY - SENSITIVE INTERNAL INFORMATION~~
Attachments: Missouri River Flooding Potential Impact at NRC Facilities 6-7.docx

Importance: High

FYI, more plant specific info on the Missouri river flooding situation at Ft Calhoun and Cooper Stations.

(Mark, Note the "sensitive internal information" nature of this document. I don't recommend putting a lot of this information, especially that which causes it to be sensitive internal info, into the Daily Screening Summary, but OK to discuss at the screening meeting and for use by our ET Briefer. A lot of what's in here has already been documented in the screening summary of yesterday, that used my EO summary report as an input.)

Thanks,

John

From: Pruett, Troy R4V
Sent: Tuesday, June 07, 2011 9:55 AM
To: Brown, Frederick; Thorp, John
Subject: FW: Missouri River Flooding - Status of NRC and Agreement State Licensees ~~OFFICIAL USE ONLY - SENSITIVE INTERNAL INFORMATION~~
Importance: High

FYI. Second report periodically provided by R4 with much more specific plant information on river level and impact.

From: Howell, Linda R4V
Sent: Tuesday, June 07, 2011 9:47 AM
To: Borchardt, Bill; Virgilio, Martin; Weber, Michael; Collins, Elmo; Howell, Art; Wiggins, Jim; Satorius, Mark; Pederson, Cynthia; Boland, Anne; McDermott, Brian; Morris, Scott; Thaggard, Mark; Carpenter, Cynthia; Lewis, Robert; Bush-Goddard, Stephanie; Weil, Jenny; Markley, Michael; Giitter, Joseph; Evans, Michele; Williams, Kevin
Cc: Kennedy, Kriss; Pruett, Troy; Vegel, Anton; Caniano, Roy; Campbell, Vivian; Dricks, Victor; Uselding, Lara; Erickson, Randy; Maier, Bill; Browder, Rachel; Clark, Jeff; Azua, Ray; Gaddy, Vincent; Marshall, Jane; Gott, William; HOO Hoc; Hay, Michael; Elkmann, Paul; Dickson, Billy; R4RCB
Subject: Missouri River Flooding - Status of NRC and Agreement State Licensees ~~OFFICIAL USE ONLY - SENSITIVE INTERNAL INFORMATION~~
Importance: High

Attached is the June 7 update on the Missouri River flooding. Ft. Calhoun Station remains in a NOUE and the agency remains in NORMAL mode. Please note that the attached document is marked OFFICIAL USE ONLY due to the level of detailed information concerning licensee actions. Please do not distribute outside NRC without letting us know.

Please let me know if you wish to have additional staff/managers added to this distribution list.

B8

Missouri River Flooding

Potential Impact at NRC Facilities

June 7, 2011

(Updated information is highlighted)

Due to greater than normal snow levels in the upper Missouri River Basin, the associated snowpack runoff and record level rainfall, the Missouri River Mainstem Reservoir System is experiencing flooding challenges. Rainfall in the northern areas of the Basin in the past few weeks has equaled what typically falls during an entire year, and snowpack runoff is expected to be 140% of the normal volume. The U.S. Army Corps of Engineers (USACE) has noted that this spring's flooding will be the most severe the region has seen since the reservoir system was constructed in the 1950's and 1960's. This has prompted USACE to release record volumes of water from each of the six major dams that make up the Missouri River Mainstem Reservoir System. Based on information provided by USACE, the current modeling and release plan call for achieving a 150,000 cubic feet per second release rate for five of the six dams by mid-June and continuing at that level through mid-July, and possibly into August, in order to maintain reservoir storage capacity. Missouri River levels are projected to crest as noted below and may remain at those levels through mid-July or into August.

A summary of potential impacts is provided below for NRC facilities located in areas that are or may be impacted by flooding. Region IV is coordinating with Agreement States in the flood impacted areas to verify the status of materials licensees.

Outside of Scope

Outside of Scope

Outside of Scope

Outside of scope

Fort Calhoun Station

Plant Elevation: 1004 feet mean sea level (MSL)

Current river level: ~1003.8 feet MSL (6:00 am, CDT)

Predicted max river level: 1006.5 feet MSL predicted by mid-June (source is USACE)

Potential Impacts on Plant Equipment: At 1008 feet MSL, the transformers will be impacted resulting in the plant experiencing a loss of offsite power. Barring any actions by the licensee, the raw water pumps will also be lost at this river level. The licensee would normally commence plant shutdown when the river level reaches 1004 feet MSL at the Fort Calhoun Station. However, the licensee was nearing the end of a refueling outage. Currently the plant is shutdown with the core reloaded and flooded up to 23 feet above the vessel flange. The licensee's operational plan is to remain in this configuration until the river crests and then recedes to below 1004 feet MSL with a decreasing trend. If the river level reaches 1004 ft and is expected to exceed 1006 ft, the licensee will transfer from the 4160 volt power to the Emergency Diesel Generators.

The licensee has entered its flooding procedure and is conducting enhanced monitoring of the river levels. The licensee is leaning forward in completing actions prescribed in its flooding procedure and planned to have actions completed in advance of river levels reaching the trigger points identified in the flooding procedure. With a few exceptions, actions to protect vital structures to 1007 feet MSL have been completed. The exceptions involve actions that are "on hold" until needed for personnel safety reasons. These actions will be completed when the river level reaches 1006 feet MSL.

Installation of a 2000 foot long Aqua Berm around the perimeter of the power block (with exception of the intake structure) is complete. This temporary water-filled berm is 8 feet tall and 16 feet wide at the base. This berm will provide protection for up to 6 feet of water (equates to 1010 feet MSL). The majority of the switchyard is protected by an earthen berm to a level of approximately 1011 feet MSL. This does not include the 161 KV structures which are currently being protected by sandbag berms to a level of approximately 1009 feet MSL. The licensee is working to enhance protection of the 161 KV structure through a combination of earthen and sandbag berms. The intake structure is currently protected to a level of approximately 1007.5 feet, and with additional actions, can be protected to a level of 1014. The ISFSI is built at a level of 1009 feet, no additional protective measures have been taken at this time.

Additional berms and sandbags are being built or installed around the Training Center, Administration Building and the South Security Building. These are intended to protect facilities important to site staff, the simulator and communications equipment. Once actions to protect vital structures are fully completed, the licensee plans to install Aqua Berms around these

facilities. The licensee is brining additional overhead power lines to these facilities as a backup to underground power supplies.

All offsite power sources (161 KV and 345 KV) are available and both primary emergency diesel generators (EDG) are operable and available. The licensee is staging two additional fuel oil tanks within the Aqua Berm. These tanks will provide an additional two weeks of fuel (the fuel tanks presently onsite have a two week fuel capacity, resulting in a four week supply of fuel). The licensee is developing plans to replenish fuel oil if there is an anticipated need to run the EDGs greater than a four week period of time. Refueling hookups for the fuel tanks are located at an elevation above the anticipated flood level (~1006 feet MSL). The licensee is also evaluating a process for refueling the tanks through the tank vents. The licensee also plans to stage an additional spare generator with an associated fuel tank and step-up transformer within the Aqua Berm.

The licensee is staging additional equipment and supplies within the Aqua Berm including, dewatering pumps, sandbagging equipment and supplies, gasoline supplies, food and water. The licensee has procured satellite phones which will be distributed to key staff as backup communication devices.

The licensee has ordered six boats for use onsite, if needed, since some parking areas are already under water. Offsite parking arrangements are in place for site staff, and the staff will be shuttled to and from the plant. The licensee is working with the National Guard to arrange for additional backup transportation provisions.

The licensee's procedures and Emergency Plan call for the declaration of a NOUE at 1004 feet MSL. At 0800 CDT on June 6, the licensee declared a NOUE, in advance of the river level reaching 1004 feet MSL. The licensee's Emergency Plan would not call for an Alert declaration until the river level reaches 1009 feet MSL. A response mode decision making conference call was held following the NOUE declaration with Region IV, NRR and NSIR managers present. The agency currently remains in NORMAL mode. This response mode decision will be re-visited if river levels approach 1006 feet MSL or if the licensee's protective actions are challenged or fail and systems are at risk of flooding.

The licensee is presently planning to manage onsite activities through an Incident Command System structure using a model included in the OPPD Pandemic Plan as a template. At the current time, the licensee's Emergency Operations Facility (EOF) is not expected to be challenged by flooding. The Technical Support Center and Operations Support Center are located within the Aqua Berm.

Potential Impact on Evacuation Routes: Currently, there are no impacts on evacuation routes. The licensee has indicated that the only section of roadway that is projected to be impacted by rising river levels is a small section of Route 75 to the north of the town of Fort Calhoun (the actual river level at which this would occur is being researched at this time). The residents of Fort Calhoun have evacuation routes to the west and south that are expected to remain available. Evacuation routes for the town of Blair and other communities to the north are expected to remain available to the north and west.

Materials Licensees

RIII and RIV are coordinating with affected Agreement States to monitor potential impacts on materials licensees. There are currently no known impacts on NRC or Agreement State materials licensees. The Agreement States have provisions in place to maintain contact with their licensees as conditions change. Region III and Region IV will continue to coordinate with affected NRC licensees and the affected Agreement States to monitor potential impacts on materials licensees and update this section of the report as appropriate.

NRC Region IV

Region IV staff continues to monitor the flooding conditions along the Missouri River and the potential impacts on Region IV plants and materials licensees located along the river. Region IV is monitoring potential impacts on evacuation routes and is coordinating with the power plant licensees, states and FEMA. Region IV has coordinated with the National Weather Service and USACE to confirm projected river levels.

Region IV has augmented the resident inspector staff to provide 24 hour coverage at Fort Calhoun Station. Region IV is conducting daily conference calls with Fort Calhoun Station managers to monitor the licensee's preparations and potential impacts on the plant. Region IV has conducted an initial coordination call with FEMA Region VII and plans to establish coordination calls with FEMA Region VII, states and local response organizations early next week.

NSIR has coordinated with FEMA Headquarters to ensure that they are aware of the potential impacts from river flooding at Fort Calhoun Station and Cooper Nuclear Station.

Robles, Jesse

From: King, Mark
Sent: Tuesday, June 07, 2011 2:08 PM
Subject: IOEB Clearinghouse Screening Summary for Tuesday, June 7, 2011

NOTE: THIS SUMMARY ~~IS OFFICIAL USE ONLY~~
*****MAY CONTAIN SENSITIVE/ PROPRIETARY OR NRC INTERNAL USE ONLY INFORMATION*****
DO NOT FORWARD ANY PORTIONS OUTSIDE OF NRC WITHOUT FIRST OBTAINING PERMISSION FROM ORIGINATOR

Issues for Resolution (IFR): None

OpE Forum Postings (COMMS): None

Management Requests: None

Follow-up/Other Tasks: Five (5)

[Note - The information in this part of the Summary is often preliminary in nature and is provided to help IOEB staff communicate and track noteworthy items being followed up by either the Regions or HQ staff.]

1) EN 46929 - FORT CALHOUN - UNUSUAL EVENT DECLARED DUE TO RIVER LEVEL

See EN Text. Send to TRG Lead for EP (Eric Schrader) and Missiles/Flood Protection (Ed Smith). Assigned to Jesse Robles.

2) PNO-IV-11-003 - FORT CALHOUN STATION - PNO REGARDING DECLARATION OF A NOTIFICATION OF UNUSUAL EVENT DUE TO HIGH RIVER LEVEL

See PNO Text. Send to TRG Lead for EP (Eric Schrader) and Missiles/Flood Protection (Ed Smith). Assigned to Jesse Robles.

3) FORT CALHOUN - ALERT DECLARED DUE TO FIRE IN SWITCHGEAR ROOM. NRC IN MONITORING MODE

From the HOO: At about 0940 CDT on 6/7/11, Ft. Calhoun declared an Alert emergency condition based on a fire in a switchgear room (not the flooding). The unit remains in cold shutdown. The agency entered Monitoring Mode at 1056 EDT to respond to this event. We will follow with more information after we get the report from the licensee. Continue to follow. Pass to TRG Lead for Electrical Power (Roy Mathew), EP (Eric Schrader), Fire Protection (Brian Metzger). Assigned to Jesse Robles.

Outside of Scope

OUTSIDE OF SCOPE

OUTSIDE OF SCOPE

Outside of Scope

Attendees at Screening Meeting:

Bob Bernardo
Jesse Robles
Mark King
Steve Pannier
Jay Patel - (NRO)

OUTSIDE OF SCOPE

Mary Wegner- (RES) - by phone

Elliott, Robert

From: Brown, Frederick NRR
Sent: Wednesday, June 08, 2011 11:20 AM
To: Elliott, Robert; Franovich, Rani; Kobetz, Timothy; McHale, John; Shoop, Undine; Thorp, John
Cc: Pruett, Troy; Kennedy, Kriss; Croteau, Rick; Holahan, Patricia; Andersen, James; Cartwright, William; Ashley, MaryAnn; Westreich, Barry; Bahadur, Sher; Blount, Tom; Cheok, Michael; Evans, Michele; Ferrell, Kimberly; Galloway, Melanie; Giitter, Joseph; Givvines, Mary; Hiland, Patrick; Holian, Brian; Howe, Allen; Lee, Samson; Lubinski, John; McGinty, Tim; Nelson, Robert; Ruland, William; Skeen, David; Thomas, Brian
Subject: FW: REQUEST FOR ASSISTANCE

We got this as a cc:, but if you have inspector qualified or nearly qualified folks available to support Region IV, you can probably contact the BCs listed below.

We should also be thinking about support for the Browns Ferry 95003 (likely the late summer/early fall time frame) and potentially also a Ft. Calhoun 95003 (depending on the final conclusion about the RPS coils finding).

Undine, I assume that you are already talking with Gene Guthrie about the safety culture piece for BF. Please let me/Troy/Jim know how the status of the NEI guidance fits into this picture.

Thanks,
Fred

From: Kennedy, Kriss RIV
Sent: Wednesday, June 08, 2011 10:41 AM
To: Miller, Chris; Roberts, Darrell; Croteau, Rick; Munday, Joel; West, Steven; Reynolds, Steven
Cc: Vegel, Anton; Clark, Jeff; Gaddy, Vincent; Brown, Frederick; Pruett, Troy
Subject: REQUEST FOR ASSISTANCE

Esteemed Colleagues,

Region IV has an emergent need for resources to support inspection activities at Fort Calhoun Station and potential inspection activities at Outside of Scope 100 S

Fort Calhoun

On June 6, Fort Calhoun declared a NUE due to rising river level on the Missouri River. We have established 24 hour site coverage to assess licensee preparations (extensive) for the flooding and monitor the impact of flooding on the plant.

In order to support round the clock site coverage, I am requesting any support you can provide between now and mid-August. Your BCs can contact Jeff Clark directly at 817-860-8147 to discuss specific needs and timeframes.

Outside of Scope

310

Thanks for your consideration of this request.

Kriss

Robles, Jesse

From: King, Mark
Sent: Tuesday, June 14, 2011 2:27 PM
Subject: IOEB Clearinghouse Screening Summary for Tuesday, June 14, 2011

NOTE: THIS SUMMARY IS ~~OFFICIAL USE ONLY~~
*****MAY CONTAIN SENSITIVE/ PROPRIETARY OR NRC INTERNAL USE ONLY INFORMATION*****
DO NOT FORWARD ANY PORTIONS OUTSIDE OF NRC WITHOUT FIRST OBTAINING PERMISSION FROM ORIGINATOR

Issues for Resolution (IFR): None

OpE Forum Postings (COMMS): None

Management Requests: None

Follow-up/Other Tasks: Fifteen (15)

Outside of Scope

OUTSIDE OF SCOPE

B11

Outside of Scope

OUTSIDE OF SCOPE

4) COOPER AND FORT CALHOUN – PROJECTED RISE IN MISSOURI RIVER LEVELS OVER NEXT TWO WEEKS (UPDATE)

*** (6/14/2011) *** The recent breech in a Missouri River levee located at Hamburg, Iowa (see photos) has resulted in a one (1) foot drop in river level at the Cooper Nuclear Station (currently 896' 1"). This will not impact State Route 136 which is an evacuation route for the station. Sections of Interstate I-29 close to Hamburg, Iowa may be closed due to this breech condition. River levels at the Fort Calhoun Station have risen 1 inch since breech (currently at 1005' 7"). (Station remains in a NOUE condition due to flooding). Forward to TRG Lead for Flood Protection/Missiles (Edward Smith) and EP (Eric Schrader); assigned to Russ Haskell.

Outside of Scope

OUTSIDE OF SCOPE

7) LER 2852011003R01 - FORT CALHOUN: INADEQUATE FLOODING PROTECTION DUE TO INEFFECTIVE OVERSIGHT

See LER update. During identification and evaluation of flood barriers in response to the NRC issued white finding (See OpE COMM item, this issue is being reviewed under IFR 2011-01), several unsealed through-wall penetrations were identified on the intake structure to be below the licensing basis flood elevation. During an extreme flooding event, water inflow could have affected the operability of both trains of safety related raw water pumps (ultimate heat sink). This revision adds several other penetrations that were discovered as a result of the review in the intake structure, auxiliary building, and chemistry and radiation protection buildings. EN 46590, EN 46594, EN 46716, EN 46690, EN 46741. Pass to TRG Lead for Flood Protection (Ed Smith), and SW/UHS (Gerard Purciarello). Assigned to Jesse Robles.

Outside of Scope

OUTSIDE OF SCOPE

OUTSIDE OF SCOPE

Outside of Scope

OUTSIDE OF SCOPE

Outside of Scope

5) LER 2852011003R01 - FORT CALHOUN: INADEQUATE FLOODING PROTECTION DUE TO INEFFECTIVE OVERSIGHT

6) LER 2852011502R00 - FORT CALHOUN: INADEQUATELY COMPENSATED UNATTENDED OPENING

Outside of Scope

OUTSIDE OF SCOPE

Outside of Scope

Attendees at Screening Meeting:

Bob Bernardo – by phone
Russ Haskell
Steve Pannier
Adakou Foli
Jesse Robles
Mark King
Ryan Craffey - (NRO)
Mary Wegner- (RES) - by phone

Mark King
Senior Reactor Systems Engineer
NRR/ADRO/DIRS/IOEB
Operating Experience Branch
301-415-1150
Mark.King@nrc.gov

Azua, Ray

From: Clark, Jeff
Sent: Tuesday, June 14, 2011 8:24 AM
To: Kennedy, Kriss; Howell, Linda; Alexander, Ryan; Alferink, Beth; Azua, Ray
Subject: FW: Daily Status at Fort Calhoun

FYI

From: BERCK, ALLEN [mailto:aberck@oppd.com]
Sent: Tuesday, June 14, 2011 7:22 AM
To: 'pott.ema@pottcounty.com'; Bill Pook; Dan; Eric Plautz; Clark, Jeff; Jeff Theulen; Jon Schwarz; Kathy Stodola; Kirkland, John; Larry Oliver; Laurel Ryan; Paul Johnson; Whitney Shipley
Cc: GEBERS, STEVEN W; DEANGELIS, PETER A; HANKINS, RHONDA R; MOELLER, CHRISTOPHER J; RELLER, MARK H; SILKE, DEENA L
Subject: Daily Status at Fort Calhoun

Fort Calhoun Flooding Status

1. Reactor Status: Shutdown
2. Reactor is covered with > 23-ft of cooling water
3. Offsite power and Emergency Diesel Generators are available. Both vital buses are energized at this time.
4. Spent Fuel Pooling cooling is in service and protected.
5. Shutdown cooling is in service and protected
6. Current river level is 1005' 6".
7. Current Blair gauge level is 31.53-ft with the current projection at 31.8-ft at about 19:00 on June 18, 2011.
8. The site has implemented procedures to protect power supplies and vital equipment. Water is onsite, and flood barriers are protecting vital equipment.
9. No release of radioactivity has occurred.
10. Fort Calhoun has declared a Notification of Unusual Even at 08:00 6/6/11.
11. Backup evacuation route onsite is inundated however the primary route onsite is passable and not expected to be affected.
12. Power was removed from siren 257 and 260 in Pottawattamie Co. IA, which is just on the edge of the 10-mile EPZ south east of the plant. Siren 75, 76 in Desoto National Wildlife Refuge have no power. Currently the refuge is closed due to flooding. Siren 142 in Harrison Co. has no power which is north of Loveland IA ~ 9.5 miles from the plant. Siren 1 east of Fort Calhoun on county road 34 between Fort Calhoun and Boyer Chute Recreational Area is without power. This area is closed due to flooding.
13. At this time no known major evacuation routes are affected. **Interstate 29 in both directions: from Exit 55 North 25th Street to Exit 75 (Missouri Valley): I-680** road closed to traffic because of flooding -- follow the detour signs. **Interstate 680 in both directions: from before Exit 1 130th Street to Exit 62: I-29; Old Mormon Bridge Road** --- road closed because of flooding. All in Pottawattamie Co, IA.

Requested Information from states and counties:

1. When offsite evaluation routes are affected please contact emergency planning.
2. When the Blair Water plant is affected please contact emergency planning.

B12

3. Authorized power outages that affect or could affect siren operability, please contact emergency planning.

The river flow rate has been relatively constant at Blair NE, however the river level continues to rise. The Corp of Engineers is releasing at Gavins Point dam at 145,000 cubic feet per second (cfs) and is expected to increase to 150,000 cfs today.

Emergency Planning Contacts at FCS:

Steve Gebers:
Pager: (b)(6) ex 6
Work Phone: 402-533-7308
Cell Phone: (b)(6) ex 6

Allen Berck:
Pager: (b)(6) ex 6
Work Phone: 402-636-2836
Cell phone: (b)(6) ex 6

Allen D. Berck
Supervisor - Emergency Planning
Fort Calhoun Station
Omaha Public Power District
phone: 402-533-6064
pager: (b)(6) ex 6
email: aberck@oppd.com

Robles, Jesse

From: King, Mark
Sent: Wednesday, June 15, 2011 1:59 PM
Subject: IOEB Clearinghouse Screening Summary for Wednesday, June 15, 2011

NOTE: THIS SUMMARY IS ~~OFFICIAL USE ONLY~~
*****MAY CONTAIN SENSITIVE/ PROPRIETARY OR NRC INTERNAL USE ONLY INFORMATION*****
DO NOT FORWARD ANY PORTIONS OUTSIDE OF NRC WITHOUT FIRST OBTAINING PERMISSION FROM ORIGINATOR

Issues for Resolution (IFR): None

OpE Forum Postings (COMMS): None

Management Requests: None

Follow-up/Other Tasks: Eleven (11)

[Note - The information in this part of the Summary is often preliminary in nature and is provided to help IOEB staff communicate and track noteworthy items being followed up by either the Regions or HQ staff.]

Outside of Scope

Outside of scope

4) COOPER AND FORT CALHOUN – PROJECTED RISE IN MISSOURI RIVER LEVELS OVER NEXT TWO WEEKS (UPDATE)

*** (6/15/2011) *** See daily Flooding Report. Forward to update to TRG Lead for Flood Protection/Missiles (Edward Smith) and EP (Eric Schrader); assigned to Russ Haskell.

B13

OUTSIDE OF SCOPE

Outside of Scope

OUTSIDE OF SCOPE

Outside of Scope

OUTSIDE OF SCOPE

Outside of Scope

Attendees at Screening Meeting:

Bob Bernardo
Russ Haskell
Rebecca Sigmon
Adakou Foli
Jesse Robles
Mark King
Ryan Craffey - (NRO)
Mary Wegner- (RES) - by phone

Missouri River Flooding

Potential Impact at NRC Facilities

June 16, 2011

(Updated information is highlighted)

Due to greater than normal snow levels in the upper Missouri River Basin, the associated snowpack runoff and record level rainfall, the Missouri River Mainstem Reservoir System is experiencing flooding challenges. Rainfall in the northern areas of the Basin in the past few weeks has equaled what typically falls during an entire year, and snowpack runoff is expected to be 140% of the normal volume. The U.S. Army Corps of Engineers (USACE) has noted that this spring's flooding will be the most severe the region has seen since the reservoir system was constructed in the 1950's and 1960's. From Gavin's Point Dam near Yankton, South Dakota to Rulo, Nebraska, the Missouri is expected to reach the highest levels seen since 1952. This has prompted USACE to release record volumes of water from each of the six major dams that make up the Missouri River Mainstem Reservoir System. Based on information provided by USACE, five of the six dams are at or near the planned maximum release rate of 150,000 cubic feet per second. These release rates will continue at that level through mid-July, and possibly into August, in order to maintain reservoir storage capacity. The Missouri River levels are projected to crest as noted below and may remain at those levels through mid-July or into August. USACE has noted that flood crest stages on the Missouri River at Blair, Nebraska may exceed levels projected earlier, but currently the predicted crest at Fort Calhoun Station remains the same.

A summary of potential impacts is provided below for NRC facilities located in areas that are or may be impacted by flooding. Region IV is coordinating with Agreement States in the flood impacted areas to verify the status of materials licensees.

Outside of Scope

Outside of Scope

Fort Calhoun Station

Plant Elevation: 1004 feet mean sea level (MSL)

Current river level: 1005 feet 6 inches MSL (~7:00 am, CDT, source is licensee measurement)

Predicted max river level: 1006.4 feet MSL predicted by mid-June (source is USACE)

Potential Impacts on Plant Equipment: (b)(4),(b)(7)(F) Ex4
(b)(4),(b)(7)(F)
(b)(4),(b)(7)(F) The licensee would normally commence plant shutdown when the river level reaches 1004 feet MSL at the Fort Calhoun Station. However, the licensee was nearing the end of a refueling outage when river levels were predicted to reach this level. Currently the plant is shutdown with the core reloaded and flooded up to 23 feet above the vessel flange. The licensee's operational plan is to remain in this configuration until the river crests and then recedes to below 1004 feet MSL with a decreasing trend. The licensee's abnormal operating procedure for acts of nature (AOP-1) has been modified. (b)(4),(b)(7)(F)
Ex4 (b)(4),(b)(7)(F)
(b)(4),(b)(7)(F) The modified AOP-1 now calls for transfer to the Emergency Diesel Generators if loss of offsite power is imminent.

The licensee has entered its flooding procedure and is conducting enhanced monitoring of the river levels. The licensee is leaning forward in completing actions prescribed in its flooding procedure and planned to have actions completed in advance of river levels reaching the trigger

points identified in the flooding procedure. With a few exceptions, actions to protect vital structures to 1007 feet MSL have been completed. The exceptions involve actions that are "on hold" until needed for personnel safety reasons. These actions will be completed when the river level reaches 1006 feet MSL.

Installation of a 2000 foot long Aqua Berm around the perimeter of the power block (with exception of the intake structure) is complete. This temporary water-filled berm is 8 feet tall and 16 feet wide at the base. This berm will provide protection for up to 6 feet of water (equates to 1010 feet MSL). The majority of the switchyard is protected by an earthen berm to a level of approximately 1011 feet MSL. This does not include the 161 KV structures which are currently being protected by sandbag and earthen berms to a level of approximately 1009 feet MSL. The intake structure is currently protected to a level of approximately 1007.5 feet, and with additional actions, can be protected to a level of 1014. The ISFSI is built at a level of 1009 feet, no additional protective measures have been taken at this time.

Additional berms and sandbags have been installed around the Training Center, Administration Building and the South Security Building. These are intended to protect facilities important to site staff, the simulator and communications equipment. The licensee has completed installation of additional Aqua Berms for some of these facilities and is working to complete protective measures for all three buildings. The licensee has installed additional overhead power lines to these facilities as a backup to underground power supplies. The licensee has erected additional protective "walls" around transformers to protect them from water.

Some water intrusion and leakage under the Aqua Berm has been noted in areas where the ground surface is not level and in areas where there are conduits and storm drains. The licensee is managing the leakage using portable dewatering pumps.

All offsite power sources (161 KV and 345 KV) are available and both primary EDGs are operable and available. The licensee is staging two additional fuel oil tanks within the Aqua Berm. These tanks will provide an additional two weeks of fuel (the fuel tanks presently onsite have a two week fuel capacity, resulting in a four week supply of fuel). The licensee is developing plans to replenish fuel oil if there is an anticipated need to run the EDGs greater than a four week period of time. (b)(4),(b)(7)(F)

EX4 (b)(4),(b)(7)(F) The licensee is also evaluating a process for refueling the tanks through the tank vents. The licensee also plans to stage an additional spare generator with an associated fuel tank and step-up transformer within the Aqua Berm.

The licensee is staging additional equipment and supplies within the Aqua Berm including dewatering pumps, sandbagging equipment and supplies, gasoline supplies, food and water. The licensee has procured satellite phones which have been distributed to key staff as backup communication devices.

The licensee has ordered six boats for use onsite, if needed, since parking areas are already under water. Offsite parking arrangements are in place for site staff, and the staff will be shuttled to and from the plant. The licensee is working with the National Guard to arrange for additional backup transportation provisions.

The licensee's procedures and Emergency Plan call for the declaration of a NOUE at 1004 feet MSL. At 0800 CDT on June 6, the licensee declared a NOUE, in advance of the river level reaching 1004 feet MSL. The licensee's Emergency Plan would not call for an Alert declaration until the river level reaches 1009 feet MSL. A response mode decision making conference call was held following the NOUE declaration with Region IV, NRR and NSIR managers present. The agency currently remains in NORMAL mode. This response mode decision will be re-visited if river levels approach 1006 feet MSL or if the licensee's protective actions are challenged or fail and systems are at risk of flooding.

The licensee is presently managing onsite activities through an Incident Command System structure using a model included in the OPPD Pandemic Plan as a template. At the current time, the licensee's Emergency Operations Facility (EOF) is not expected to be challenged by flooding. The Technical Support Center and Operations Support Center are located within the Aqua Berm.

Potential Impact on Evacuation Routes and Sirens: Currently, there are no impacts on major evacuation routes. The licensee has indicated that a small section of Route 75 to the north of the town of Fort Calhoun (the actual river level at which this would occur is being researched at this time) may become impacted by rising water. The residents of Fort Calhoun have evacuation routes to the west and south that are expected to remain available. Evacuation routes for the town of Blair and other communities to the north are expected to remain available to the north and west. Some areas of Interstate 29 and Interstate 680 have been closed with detours established by the state. A portion of this section of highway runs along the southeast border of the emergency planning zone, but the proposed detours would be accessible.

Power was removed from sirens 257 and 260 in Pottawattamie County, Iowa, which is just on the edge of the emergency planning zone to the southeast of the plant. Sirens 75 and 76 in the Desoto National Wildlife Refuge have no power, but the Refuge is currently closed due to flooding. Siren 142 in Harrison County, ~ 9.5 miles from the plant, is also without power. Siren 1, east of Fort Calhoun, is without power but the area is closed due to flooding.

Outside of Scope

NRC Region IV

Region IV staff continues to monitor the flooding conditions along the Missouri River and the potential impacts on Region IV plants and materials licensees located along the river. Region

,IV is monitoring potential impacts on evacuation routes and is coordinating with the power plant licensees, states and FEMA. Region IV has coordinated with the National Weather Service (NWS) and USACE to confirm projected river levels.

Region IV has augmented the resident inspector staff to provide 24 hour coverage at Fort Calhoun Station. Region IV is conducting daily conference calls with Fort Calhoun Station managers to monitor the licensee's preparations and potential impacts on the plant. Region IV has conducted an initial coordination call with FEMA Region VII and plans to establish coordination calls with FEMA Region VII, states and local response organizations next week.

A conference call will be conducted later today with the states, FEMA Region VII, Cooper Nuclear Station, Fort Calhoun Station, the NWS and USACE to review weather and river level predictions. USACE is expected to update the stakeholders on any changes to predicted river crest and results of their validations of river flow, breadth of the river and how these might impact the current river level predictions.

NSIR has coordinated with FEMA Headquarters to ensure that they are aware of the potential impacts from river flooding at Fort Calhoun Station and Cooper Nuclear Station.

Robles, Jesse

From: Haskell, Russell NRR
Sent: Friday, June 17, 2011 2:26 PM
Subject: IOEB Clearinghouse Screening Summary for Friday, June 17, 2011

Follow Up Flag: Follow up
Flag Status: Completed

NOTE: THIS SUMMARY ~~IS OFFICIAL USE ONLY~~
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DO NOT FORWARD ANY PORTIONS OUTSIDE OF NRC WITHOUT FIRST OBTAINING PERMISSION FROM ORIGINATOR

Issues for Resolution (IFR): None

OpE Forum Postings (COMMS): None

Management Requests: None

Follow-up/Other Tasks: Three (3)

[Note - The information in this part of the Summary is often preliminary in nature and is provided to help IOEB staff communicate and track noteworthy items being followed up by either the Regions or HQ staff.]

1) EN 46965 - FORT CALHOUN - ADDITIONAL PENETRATION IDENTIFIED FOR MITIGATION DURING WALKDOWN

(Additional Information) Penetration of concern was due to the (motor-driven) 1A Fire Pump pressure relief discharge line traveling up through Intake structure which houses the Raw Water pumps. Penetration has been sealed. Residents following up. Forward to TRG Leads for Flood Protection/Missiles, SSW/UHX, Fire Protection; assigned to Russ Haskell.

Outside of Scope

OUTSIDE OF SCOPE

615

OUTSIDE OF SCOPE

Outside of Scope

Attendees at Screening Meeting:

Russ Haskell
Dave Garmon
Adakou Foli
John Thompson
Joe Giantelli
Mary Wegner (RES) – phone
Ryan Craffey (NRO)

Azua, Ray

From: Clark, Jeff
Sent: Friday, June 17, 2011 7:51 AM
To: Kennedy, Kriss; Howell, Linda
Cc: Azua, Ray
Subject: FYI: Briefing/Talking Points for FCS
Attachments: Talking Points 6-17-11.doc

Kriss/Linda,

Attached are the updated briefing notes from Sunday, and the talking points I used yesterday for the NSIR brief. The only "iffy" item is the licensee's priorities for today; this comes from our notes from yesterday. We get updated on this about 9:00 am. I will send you another e-mail when we get that info.

Jeff

E16

Briefing Notes from (Sun) 6/12/2011 {updated for 6/17/2011}
(changes noted in RED)

1. River level and forecast for river crest - RCB

2. Plant conditions

(b)(4),(b)(7)(F)

7F

3. Licensee priorities
   1) Monitoring of flood barriers and pumps, 2) complete temp modifications for alternate power to various loads, 3) forensics of the 1B4A bus, followed by RCA and extent of cause 4) exploring alternate sources of water in case Blair city water is lost (installing reverse osmosis water treatment equipment).

4. NRC concerns
   ~~161 kV building leakage, leakage into rooms 10 (Radwaste Monitor Tank Area), 19 (Compressor Area) and 20 (Electrical Penetration Room Basement), leakage past the intake structure roll up door, questions regarding floodgates to switchgear room, mobility around site for emergency response, and continued~~
   Continued operation of 1B4 electrical equipment until cause and extent of condition fully known; operation of barriers and pumping stations against in leakage; industrial and personal safety.

5. Impacts on evacuation routes or ERO activation
   No changes. I-680 between exit 1 in Nebraska to I-29 in Iowa, and I-29 between exits 55 and 71 in Iowa. This impacts the posted evacuation routes. Detour signs are in place.

6. Update on cause of electrical fault on June 7 and repair activities
   Sargent & Lundy came in Friday to begin an investigation. However, the licensee and they determined they could not perform an adequate analysis. The licensee contracted ESI (same company that did FMEA for the RPS M2 contactor). They were onsite Wednesday. They indicated they would likely need to bring in an expert from St. Louis. The licensee still has not determined the cause of the loss of the 1B3A bus. The licensee provided a list of the other Square D breakers that were installed (new) in 2009. Both the 1B4A breaker (faulted/fire) and the 1B3A breaker that had improper operation were among these replacements. The licensee also reported that operators smelled an acrid odor in the West Switchgear Room for the two days prior to the fault/fire.

Other notes: There is a pretty elaborate walkway between the training and admin buildings. They have provided a walkway to the "king tut" barriers so it is dry from the bus drop off to the security building. The understanding with the boats

is that they are for emergency use only. This appears wise as there are quite strong flow currents developing.

Briefing Notes from (Thu) 6/16/2011
(Questions from NSIR, responses noted in RED)

1. What is the design basis elevation for flooding at Ft. Calhoun Station?

   The DB level is 1014 feet MSL. Nuclear safety is maintained below 1014 feet, although certain plant equipment, such as non-safety equipment and offsite power would be lost at lower levels (offsite power likely to be lost at about 1009 feet). Aquadam in protected area is not installed for nuclear safety, but for "economic" reasons (protect licensee property).

2. Has the licensee considered a "what if" scenario?

   Yes. The licensee is considering things they can do beyond design basis. If they can still supply power (i.e. vital busses not lost, or power can be supplied directly to equipment) the extra 1500 kw diesel onsite can provide when EDGs lost. Ultimate defense is supplying water inventory to both the reactor vessel and the SFP. The licensee is currently reviewing alternate paths to gain access to the containment (at 1011 they would begin impacting normal access through the auxiliary building) for this operation. Access to the SFP is not a problem as access points are available at higher levels. Inventory methods would use B.5.b pumps.

3. What happens if river level were near the top of Aquadam, then it was breached or failed?

   As stated in #2, the Aquadam is not installed to ensure nuclear safety. It would make things a lot easier onsite if it remained intact (to 1009 or 1010), but other features, such as the floodgates installed in the intake and auxiliary building doorways, are designed to protect to 1014 feet.

4. If the entire site were flooded, no AC power, how much time would they have to restore before boiling occurred in the reactor cavity and the SFP?

7F (b)(4),(b)(7)(F)

5. How would FCS gain access to the containment and SFP buildings to add water? What pumps and what water sources?

   As discussed in #2, access to the SFP does not appear to be a problem. (b)(4),(b)(7)(7K
   (b)(4),(b)(7)(F)

   (b)(4),(b)(7)(F)

Additional questions were asked regarding security. Mike Hay briefed that a security inspector was onsite last week and reviewed the licensee's problems, challenges, and compensatory measures. He stated we did not have any current concerns.

Scott Morris asked if there were any other problems we had not discussed. I mentioned the difficulty getting around site, the personal safety hazards, and the increased monitoring required. I stated (as you and I discussed) the licensee is continually monitoring these things. They have taken additional steps to have additional people staged, modify entryways, and conduct safety briefings.

Azua, Ray

From: Clark, Jeff
Sent: Saturday, June 18, 2011 7:39 AM
To: Kennedy, Kriss; Howell, Linda
Cc: Azua, Ray
Subject: FW: Daily event status at Fort Calhoun

FYI

-----Original Message-----
From: BERCK, ALLEN [mailto:aberck@oppd.com]
Sent: Saturday, June 18, 2011 7:10 AM
To: Bill Pook; Dan; Eric Plautz; Clark, Jeff; Jeff Theulen; Jon Schwarz; Kirkland, John; Larry Oliver; Laurel Ryan; Paul Johnson; Whitney Shipley; 'Rasmusson, Melanie'; kathy.stodola@iowa.gov; pott.ema@pottcounty.com
Cc: GEBERS, STEVEN W; DEANGELIS, PETER A; HANKINS, RHONDA R; MOELLER, CHRISTOPHER J; RELLER, MARK H; SILKE, DEENA L; BERCK, ALLEN
Subject: Daily event status at Fort Calhoun

Fort Calhoun Flooding Status (changes from yesterday's report are in bold)

1. Reactor Status: Shutdown

2. Reactor is covered with > 23-ft of cooling water

3. Offsite power and Emergency Diesel Generators are available. Both vital buses are energized at this time.

4. Spent Fuel Pooling cooling is in service and protected.

5. Shutdown cooling is in service and protected

6. Current river level is 1005' 8" – a rise of 2" in the last 24 hours.

7. Current Blair gauge level is 31.8 ft. Although no appreciable rise is forecasted (by the NWS/USACE) within the next 5 days, river conditions continue to change and rain is forecasted in the watershed area. Additionally, heavy rain was received in the area over night. The USACE also advised us that we should be prepared for a 3-6 inch rise in river level over the next week. We are continuously monitoring river conditions.

8. The site has implemented procedures to protect power supplies and vital equipment. Water is onsite, and flood barriers are protecting vital equipment.

9. No release of radioactivity has occurred.

10. Fort Calhoun has declared a Notification of Unusual Event at 08:00 6/6/11.

11. Backup evacuation route onsite is inundated however the primary route onsite is passable and not expected to be affected.

17

12. Power was removed from siren 257 and 260 in Pottawattamie Co. IA, which is just on the edge of the 10-mile EPZ south east of the plant. Siren 75, 76 in Desoto National Wildlife Refuge have no power. Currently the refuge is closed due to flooding. Siren 142 in Harrison Co. has no power which is north of Loveland IA ~ 9.5 miles from the plant. Siren 1 east of Fort Calhoun on county road 34 between Fort Calhoun and Boyer Chute Recreational Area is without power. This area is closed due to flooding.

13. At this time no known major evacuation routes are affected without contingency actions planned. Interstate 29 in both directions: from Exit 55 North 25th Street to Exit 75 (Missouri Valley): I-680 road closed to traffic because of flooding -- follow the detour signs for the evacuation route to Bellevue. Interstate 680 in both directions: from before Exit 1 130th Street to Exit 62: I-29; Old Mormon Bridge Road --- road closed because of flooding. All in Pottawattamie Co, IA.

14. On 6/14, Washington County issued evacuation to approximately 75 residents northeast of Blair east of county road 33 to the Burt County line.

Requested Information from states and counties:

1. When offsite evaluation routes are affected please contact emergency planning.

2. When the Blair Water plant is affected please contact emergency planning.

3. Authorized power outages that affect or could affect siren operability, please contact emergency planning.

The river flow rate and level have been relatively constant at Blair NE. The Corp of Engineers is releasing Gavin's Point dam at 150,000 cubic feet per second (cfs).

Emergency Planning Contacts at FCS:

Steve Gebers:
Pager: (b)(6) ex 6
Work Phone: 402-533-7308
Cell Phone: (b)(6) ex 6

Allen Berck:
Pager: (b)(6) ex 6
Work Phone: 402-636-2836
Cell phone: (b)(6) ex 6

Allen D. Berck
Supervisor - Emergency Planning
Fort Calhoun Station
Omaha Public Power District
phone: 402-533-6064
pager: (b)(6) ex 6
email: aberck@oppd.com

Robles, Jesse

From: King, Mark
Sent: Tuesday, June 21, 2011 2:25 PM
Subject: IOEB Clearinghouse Screening Summary for Tuesday, June 21, 2011

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Issues for Resolution (IFR): None

OpE Forum Postings (COMMS): None

Management Requests: None

Follow-up/Other Tasks: Thirteen (13)

[Note - The information in this part of the Summary is often preliminary in nature and is provided to help IOEB staff communicate and track noteworthy items being followed up by either the Regions or HQ staff.]

Outside of Scope

OUTSIDE OF SCOPE

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Outside of Scope

OUTSIDE OF SCOPE

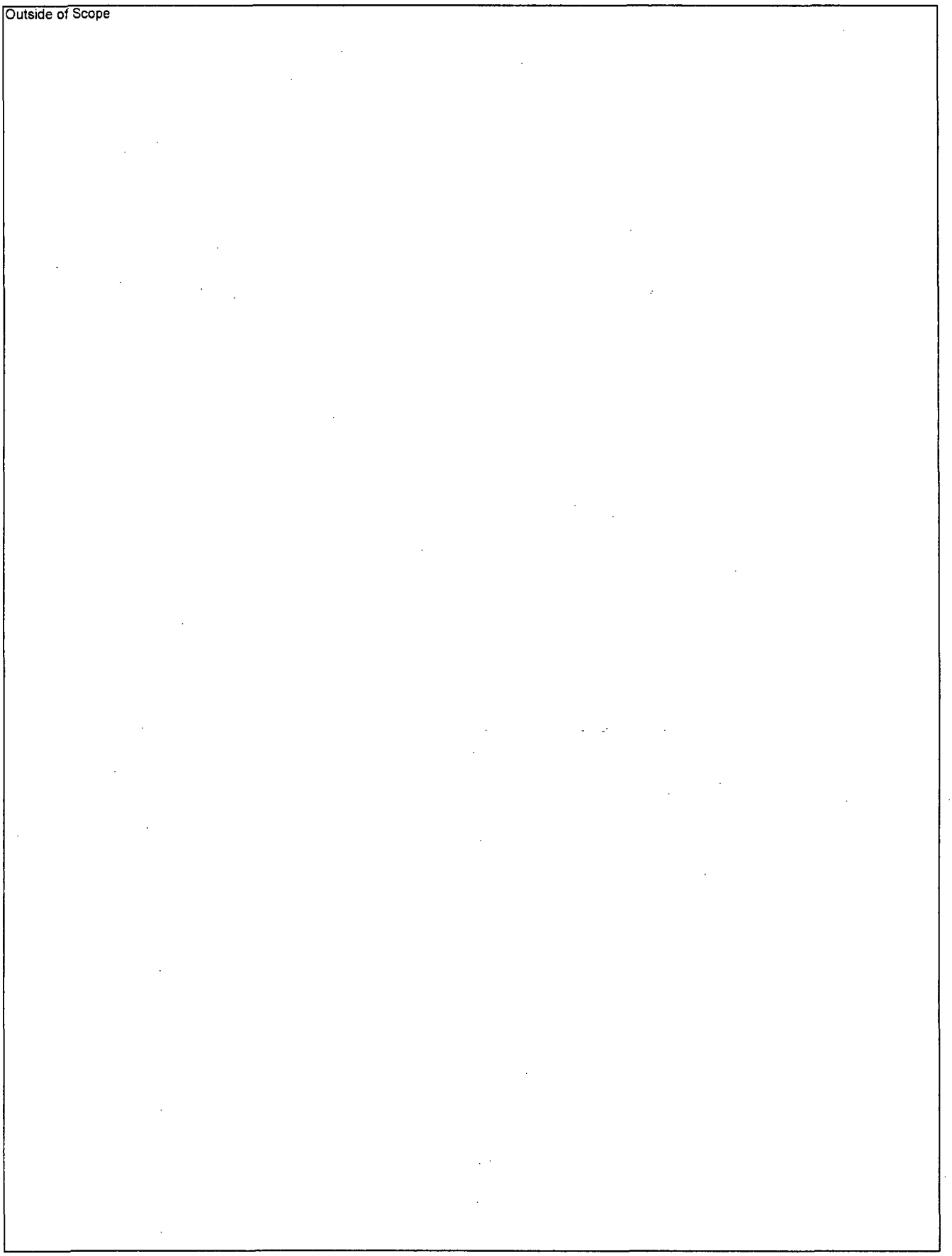
3) PNO-IV-11-003A - FORT CALHOUN - PNO-IV-11-003A - (UPDATE) FORT CALHOUN STATION DECLARATION OF A NOTIFICATION OF UNUSUAL EVENT DUE TO HIGH RIVER LEVEL

See PNO text: Forward to TRG Leads for Flood Protection/Missiles (Edward Smith), EP (Eric Schrader); assigned to Russ Haskell.

Outside of Scope

OUTSIDE OF SCOPE

OUTSIDE OF SCOPE



OUTSIDE OF SCOPE

Outside of Scope

OUTSIDE OF SCOPE

Outside of Scope

Attendees at Screening Meeting:

Russ Haskell
Bob Bernardo
Adakou Foli
Mark King
Mary Wegner (RES) – by phone
Al Issa - (NRO)

Azua, Ray

From: Clark, Jeff
Sent: Tuesday, June 21, 2011 8:59 AM
To: Kennedy, Kriss; Howell, Linda
Cc: Azua, Ray; Alexander, Ryan; Alferink, Beth; Kirkland, John
Subject: FYI: Daily Update - FCS Flooding <6/21>

Kriss/Linda,

Current river level is 1006 feet 1 inch. The area had severe thunderstorms last night, and was in a tornado watch. No appreciable damage to the site. Big Bend Reservoir received over 5 inches of rain last night.

Licensee continues to monitor flooding and in leakage. They are bringing in several experts for the switchyard berm and the PA Aquadam, regarding undercutting and sand boils.

The licensee received 15 new pumps (various sizes) for pumping stations. They are doing some thinking ahead and staging pumps at higher elevations in the event of Aquadam failure.

John and I had a meeting with Tim Nellenbach (Plant Mgr) and Susan Baughn (Licensing Mgr) yesterday afternoon regarding communications. This was at their request. They felt the observations and discussions we were having with FCS staff (such as incident commander, pumping crews, and operators) was not filtering up to them. Tim indicated there were examples (e.g. the boat accidents and tornado missiles) where he was finding out about our issues some time after the fact. I believe this is indicative of their interior communications. John and I plan to meet briefly with them each weekday afternoon to go over the items we have raised to their staff.

Ex 7E

(b)(4),(b)(7)(F)

71

Licensee priorities: maintain flooding protection by pumping and walkdowns; get experts in for erosion and sand boil reviews; extend elevated walkways; pour additional aqua-blocks in switchyard to reduce in leakag

Jeff

B19

Robles, Jesse

From: King, Mark
Sent: Wednesday, June 22, 2011 2:10 PM
Subject: IOEB Clearinghouse Screening Summary for Wednesday, June 22, 2011

NOTE: THIS SUMMARY IS ~~OFFICIAL USE ONLY~~
*****MAY CONTAIN SENSITIVE/ PROPRIETARY OR NRC INTERNAL USE ONLY INFORMATION*****
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Issues for Resolution (IFR): None

OpE Forum Postings (COMMS): None

Management Requests: None

Follow-up/Other Tasks: Seven (7)

[Note - The information in this part of the Summary is often preliminary in nature and is provided to help IOEB staff communicate and track noteworthy items being followed up by either the Regions or HQ staff.]

Outside of Scope

Outside of Scope

3) FORT CALHOUN – PROJECTED RISE IN MISSOURI RIVER LEVELS OVER NEXT TWO WEEKS (UPDATE)

6/22/2011 The river level at Fort Calhoun Station is currently 1006 ft 5 inches (6/22); FCS remains in a NOUE due to flooding. The Army Corps of Engineers has communicated its intent to increase the release rate of the upstream Gavin's Point dam to 160k cubic-feet/sec (currently 150K cfs). This move is due to recent rain

820

activity in the Northern Missouri River basin. Increases are expected to be in place by Thursday (6/23). Increases in release rates typically influence site river levels within 2 days. FCS river levels are anticipated to rise over the next several days due to these events. Forward update to TRG Leads for Flood Protection/Missiles (Edward Smith), EP (Eric Schrader); assigned to Russ Haskell.

Outside of Scope

OUTSIDE OF SCOPE

OUTSIDE OF SCOPE

Outside of Scope

Attendees at Screening Meeting:

Russ Haskell
Bob Bernardo
Adakou Foli
Mark King
Jesse Robles
Mary Wegner (RES) – by phone
Al Issa - (NRO)

Robles, Jesse

From: Haskell, Russell
Sent: Monday, June 27, 2011 3:26 PM
Subject: IOEB Clearinghouse Screening Summary for Monday, June 27, 2011

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Issues for Resolution (IFR): None

OpE Forum Postings (COMMS): None

Management Requests: None

Follow-up/Other Tasks: Twelve (12)

[Note - The information in this part of the Summary is often preliminary in nature and is provided to help IOEB staff communicate and track noteworthy items being followed up by either the Regions or HQ staff.]

Outside of Scope

OUTSIDE OF SCOPE

B21

Outside of Scope

12) PNO-IV-11-003B (UPDATE) - FORT CALHOUN - Fort Calhoun Station Declaration of a Notification of Unusual Event Due to High River Level

See PNO text (ML111770003). Forward update to TRG Leads for Flood Protection/Missiles (Edward Smith), EP (Eric Schrader); assigned to Russ Haskell.

New Reactors Items: None

Research (RES) Items: None

OUTSIDE OF SCOPE

Outside of Scope

Attendees at Screening Meeting:

Russ Haskell
Dave Garmon
Adakou Foli
John Thompson
Joe Giantelli
Mary Wegner (RES) – phone
Ryan Craffey (NRO)

Robles, Jesse

From: Haskell, Russell
Sent: Tuesday, June 28, 2011 3:12 PM
To: Smith, Edward; Schrader, Eric
Subject: IOEB Clearinghouse Screening Summary for Tuesday, June 28, 2011

NOTE: THIS SUMMARY IS OFFICIAL USE ONLY
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Issues for Resolution (IFR): None

OpE Forum Postings (COMMS): None

Management Requests: None

Follow-up/Other Tasks: Two (2)

[Note - The information in this part of the Summary is often preliminary in nature and is provided to help IOEB staff communicate and track noteworthy items being followed up by either the Regions or HQ staff.]

1) PNO-IV-11-003C - FORT CALHOUN - PNO-IV-11-003C (UPDATE) - FORT CALHOUN STATION DECLARATION OF A NOTIFICATION OF UNUSUAL EVENT DUE TO HIGH RIVER LEVEL

See PNO text: (ML111780547). Forward update PNO to TRG Leads for Flood Protection (Edward Smith), EP (Eric Schrader); assigned to Russ Haskell.

Outside of Scope

OUTSIDE OF SCOPE

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OUTSIDE OF SCOPE

Outside of Scope

Attendees at Screening Meeting:

Russ Haskell
Joe Giantelli
Dave Garmon (phone)
Jesse Robles
Mary Wegner (RES) (phone)
Ryan Craffey (NRO)
John Thompson

Missouri River Flooding

Potential Impact at NRC Facilities

June 28, 2011

(Updated information is highlighted. Older information that has not changed has been removed and can be reviewed in prior reports.)

Due to greater than normal snow levels in the upper Missouri River Basin, the associated snowpack runoff and record level rainfall, the Missouri River Mainstem Reservoir System is experiencing flooding challenges. The U.S. Army Corps of Engineers (USACE) has noted that this spring's flooding will be the most severe the region has seen since the reservoir system was constructed in the 1950's and 1960's. From Gavins Point Dam near Yankton, South Dakota to Rulo, Nebraska, the Missouri is expected to reach the highest levels seen since 1952. This has prompted USACE to release record volumes of water from each of the six major dams that make up the Missouri River Mainstem Reservoir System. The release rates from these dams have remained steady over the past few days at the current maximum predicted levels with some minor adjustments to balance the system. USACE has reported that these release rates are expected to continue until August and that no additional releases are planned at this time. Region IV will continue to work with USACE to assure that any updates to the USACE predictions are incorporated in this report

In Nebraska, some decrease in water levels occurred from Brownsville to Kansas City along the Missouri River due to breeches in levees and outflow into flood plains.

A slight chance of thunderstorms is predicted for Nebraska.

A summary of potential impacts is provided below for NRC facilities located in areas that are or may be impacted by flooding. Region IV is coordinating with Agreement States in the flood impacted areas to verify the status of materials licensees.

Outside of Scope

Outside of Scope

Outside of Scope

Fort Calhoun Station

Plant Elevation: 1004 feet mean sea level (MSL)

Design Basis for Flooding: 1014 feet MSL

Current river level: 1006 feet 5 inches MSL (~7:00 am, CDT, source is licensee measurement)

Predicted max river level: 1006 - 1008 feet MSL (source is USACE)

Current Plant Conditions: The plant is shutdown with the reactor cavity flooded such that more than 23 feet of water is covering the fuel. Both shutdown cooling and spent fuel pool cooling are in service. The vital buses are being supplied by the 345 kV power source; the 161 kV power source and both diesel generators are available. Only one 480 volt bus remains de-energized (1B4A, the faulted bus).

Fort Calhoun Station declared a Notice of Unusual Event (NOUE) on June 6 in advance of river level reaching 1004 feet MSL. The site remains in a NOUE.

Potential Impacts on Plant Equipment: The licensee is implementing its flooding procedure and is conducting enhanced monitoring of the river levels. Procedure actions to protect vital structures have been completed for river levels in excess of what is currently observed at the site.

On June 26, 2011, at approximately 1:25 a.m. CDT, the 2000 foot long Aquadam that had been providing supplemental protection to structures and equipment within the power block failed as a result of site activities. As a result, floodwaters have reached an elevation of 1006 feet 4 inches MSL around the auxiliary and containment buildings. Those buildings are protected by design to a floodwater elevation of 1014 feet MSL. The licensee is currently focusing on controlling floodwaters to protect vital equipment and systems by placing additional sandbags and barriers where needed and pumping water to protect structures and systems where needed.

The Aquadam vendor was onsite on June 26 to perform physical inspections of the deflated Aquadam. The initial assessment and vendor recommendation is that a new Aquadam be installed. A team consisting of site personnel and vendor representatives is developing a plan for replacement of the Aquadam. A new unit has been ordered and is expected to arrive onsite on July 5. The licensee currently estimates that the new unit will be installed on or about July 8.

The majority of the switchyard is protected by an earthen berm to a level of approximately 1009-1010 feet MSL. Some equipment associated with the 161 kV offsite power is being protected by sandbags and earthen berms to a level of approximately 1009 feet MSL.

The ISFSI is built at a level of 1009 feet,MSL, no additional protective measures have been taken at this time.

Aquadams have been installed around the Training Center, Administration Building and the South Security Building. These are intended to protect facilities where site staff are working, the simulator and communications equipment. The licensee has installed additional overhead power lines to these facilities as a backup to underground power supplies.

Existing diesel fuel tanks have been topped and two additional fuel oil tanks are staged within the Aqua Berm. With the addition of these tanks, the licensee estimates there is sufficient fuel onsite to run the EDGs for approximately 17 days. The licensee is developing plans to replenish fuel oil if there is an anticipated need to run the EDGs for a greater period of time. An additional spare generator with an associated fuel tank and step-up transformer has been staged within the Aqua Berm.

The licensee has procured satellite phones which have been distributed to key staff as backup communication devices.

In accordance with the licensee's Emergency Plan, an Alert would be declared if the river level reaches 1009 feet MSL. At the current time, the licensee's Emergency Operations Facility (EOF) is not expected to be challenged by flooding. The Technical Support Center and Operations Support Center are located within the Aqua Berm.

Outside of Scope

NRC Region IV

Following the failure of the Aquadam, a response mode decision call was conducted early on June 26 with Region IV, NRR and NSIR. A decision was made to enter Monitoring Mode with Region IV in the lead. Region IV has activated its Incident Response Center and a response team is currently monitoring licensee activities with the onsite team of inspectors and through routine briefings with licensee managers.

Region IV staff continues to monitor the flooding conditions along the Missouri River and the potential impacts on Region IV plants and materials licensees located along the river. Region IV is monitoring potential impacts on evacuation routes and is coordinating with the power plant licensees, states and FEMA. Region IV has coordinated with the National Weather Service (NWS) and USACE to confirm projected river levels.

Region IV will continue to provide 24 hour coverage with resident inspectors and supplemental inspection staff at Fort Calhoun Station.

Region IV has conducted coordination calls with FEMA Region VII and the states and local response organizations. Collectively, the stakeholders have established "triggers" which would prompt scheduling future conference calls. A call was conducted with the external stakeholders this morning. Region IV participated in a daily conference call sponsored by USACE and provided an update on the status of Cooper Nuclear Station and Fort Calhoun Station.

Missouri River Flooding

Potential Impact at NRC Facilities

June 30, 2011

(Updated information is highlighted. Older information that has not changed has been removed and can be reviewed in prior reports.)

Due to greater than normal snow levels in the upper Missouri River Basin, the associated snowpack runoff and record level rainfall, the Missouri River Mainstem Reservoir System is experiencing flooding challenges. The U.S. Army Corps of Engineers (USACE) has noted that this spring's flooding will be the most severe the region has seen since the reservoir system was constructed in the 1950's and 1960's. From Gavins Point Dam near Yankton, South Dakota to Rulo, Nebraska, the Missouri is expected to reach the highest levels seen since 1952. This has prompted USACE to release record volumes of water from each of the six major dams that make up the Missouri River Mainstem Reservoir System. The release rates from these dams have remained steady over the past few days at the current maximum predicted levels with some minor adjustments to balance the system. The release rate at Gavins Point dam remains at 160,000 cubic feet per second. USACE has reported that these release rates are expected to continue until August and that no additional increase in release rates are planned at this time. Region IV will continue to work with USACE to assure that any updates to the USACE predictions are incorporated in this report

The next substantial precipitation in the Missouri River Basin is forecast for July 1, 2011.

A summary of potential impacts is provided below for NRC facilities located in areas that are or may be impacted by flooding. Region IV is coordinating with Agreement States in the flood impacted areas to verify the status of materials licensees.

Outside of Scope

Outside of Scope

Fort Calhoun Station

Plant Elevation: 1004 feet mean sea level (MSL)

Design Basis for Flooding: 1014 feet MSL

Current river level: 1006 feet 6 inches MSL (~7:00 am, CDT, source is licensee measurement)

Predicted max river level: 1006 - 1008 feet MSL (source is USACE)

Current Plant Conditions: The plant is shutdown with the reactor cavity flooded such that more than 23 feet of water is covering the fuel. Both shutdown cooling and spent fuel pool cooling are in service. The vital buses are being supplied by the 345 kV power source; the 161 kV power source and both diesel generators are available. Only one 480 volt bus remains de-energized (1B4A, the faulted bus).

Fort Calhoun Station declared a Notice of Unusual Event (NOUE) on June 6 in advance of river level reaching 1004 feet MSL. The site remains in a NOUE.

Potential Impacts on Plant Equipment: The licensee is implementing its flooding procedure and is conducting enhanced monitoring of the river levels. Procedure actions to protect vital structures have been completed for river levels in excess of what is currently observed at the site.

On June 26, 2011, at approximately 1:25 a.m. CDT, the 2000 foot long Aquadam that had been providing supplemental protection to structures and equipment within the power block failed as a result of site activities. As a result, floodwaters have reached an elevation of 1006 feet 4 inches MSL around the auxiliary and containment buildings. Those buildings are protected by design to a floodwater elevation of 1014 feet MSL. The licensee is currently focusing on controlling floodwaters to protect vital equipment and systems by placing additional sandbags and barriers where needed and pumping water to protect structures and systems where needed.

The Aquadam vendor was onsite on June 26 to perform physical inspections of the deflated Aquadam. The initial assessment and vendor recommendation is that a new Aquadam be installed. A team consisting of site personnel and vendor representatives is developing a plan for replacement of the Aquadam. A new unit has been ordered and is expected to arrive onsite on July 5. Installation of the new unit will begin next week .

The majority of the switchyard is protected by an earthen berm to a level of approximately 1009-1010 feet MSL. Some equipment associated with the 161 kV offsite power is being protected by sandbags and earthen berms to a level of approximately 1009 feet MSL. The concrete barrier erected around the main transformers has been enhanced to protect the transformers to a level of 1010 feet MSL.

The ISFSI is built at a level of 1009 feet,MSL, no additional protective measures have been taken at this time.

The failure of the Aquadam resulted in loss of the condenser for the air cooling system serving the switchgear room. The licensee has installed temporary air cooling units and is working to add additional units to assure adequate cooling for electrical supplies to reactor cooling systems.

Aquadams have been installed around the Training Center, Administration Building and the South Security Building. These are intended to protect facilities where site staff are working, the simulator and communications equipment. The licensee has installed additional overhead power lines to these facilities as a backup to underground power supplies.

Existing diesel fuel tanks have been topped and two additional fuel oil tanks are staged within the Aqua Berm. With the addition of these tanks, the licensee estimates there is sufficient fuel onsite to run the EDGs for approximately 17 days. The licensee continues to sample fuel and monitor for water content because both existing fuel tanks are underground and extensions have been added to filling connectors to keep them above water. The licensee is developing plans to replenish fuel oil if there is an anticipated need to run the EDGs for a greater period of time. An additional spare generator with an associated fuel tank and step-up transformer has been staged within the Aqua Berm.

In accordance with the licensee's Emergency Plan, an Alert would be declared if the river level reaches 1009 feet MSL. At the current time, the licensee's Emergency Operations Facility (EOF) is not expected to be challenged by flooding. The Technical Support Center and Operations Support Center are located within the Aqua Berm.

Outside of Scope

NRC Region IV

Following the failure of the Aquadam, on June 26,a decision was made to enter the Monitoring Mode of the agency Incident Response Plan with Region IV in the lead. At 10:50 (CDT) on June 30, 2011, the NRC returned to Normal Mode and deactivated the Region IV Incident Response Center. The decision was based on an NRC assessment that plant conditions are stable, the impacts on the plant from the collapse of the Aquadam are understood and are being addressed, and that the required flood protection measures continue to be effective in protecting plant structures, systems and components. Region IV continues to monitor the

licensee's response and the plant with additional inspectors at the site who are providing round-the-clock coverage.

Region IV staff continues to monitor the flooding conditions along the Missouri River and the potential impacts on Region IV plants and materials licensees located along the river. Region IV is monitoring potential impacts on evacuation routes and is coordinating with the power plant licensees, states and FEMA. Region IV has coordinated with the National Weather Service (NWS) and is participating daily in USACE conference briefings to confirm projected river levels.

Region IV has conducted coordination calls with FEMA Region VII and the states and local response organizations. Collectively, the stakeholders have established "triggers" which would prompt scheduling future conference calls

Robles, Jesse

From: Giantelli, Joseph NRR
Sent: Friday, July 01, 2011 2:42 PM
Subject: IOEB Clearinghouse Screening Summary for Friday, July 01, 2011

NOTE: THIS SUMMARY IS ~~OFFICIAL USE ONLY~~
*****MAY CONTAIN SENSITIVE/ PROPRIETARY OR NRC INTERNAL USE ONLY INFORMATION*****
DO NOT FORWARD ANY PORTIONS OUTSIDE OF NRC WITHOUT FIRST OBTAINING PERMISSION FROM ORIGINATOR

Issues for Resolution (IFR): None

OpE Forum Postings (COMMS): None

Management Requests: None

Follow-up/Other Tasks: Five (5)

[Note - The information in this part of the Summary is often preliminary in nature and is provided to help IOEB staff communicate and track noteworthy items being followed up by either the Regions or HQ staff.]

Outside of Scope

OUTSIDE OF SCOPE

3) PNO-IV-11-003D - FORT CALHOUN - PNO-IV-11-003D (UPDATE) - FORT CALHOUN STATION DECLARATION OF A NOTIFICATION OF UNUSUAL EVENT DUE TO HIGH RIVER LEVEL
See PNO text: PNO-IV-11-003D (ML111810950) Forward to TRG Leads for Flood Protection (Edward Smith); EP (Eric Schrader), assigned to Russ Haskell.

Outside of Scope

OUTSIDE OF SCOPE

925

OUTSIDE OF SCOPE

Outside of Scope

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

July 1, 2011

ML111822555

Need to check for availability

MEMORANDUM TO: Elmo E. Collins
Regional Administrator

THRU: Anton Vegel, Director /RA/
Division of Reactor Safety

FROM: David P. Loveless /RA/
Senior Reactor Analyst

SUBJECT: PROPOSED ADEQUATE PROTECTION BACKFIT EXCEPTION

(b)(4),(b)(5),(b)(7)(F)

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B 76

2.7.4.5

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PROPOSED ADEQUATE PROTECTION BACKFIT EXCEPTION AT FORT CALHOUN

Regulatory Authority

10 CFR 50.109, "Backfitting," describes the methods available to the Commission to require that licensees modify or add structures, components, or design of a facility. Section (a)(4)(ii) states that a backfit analysis is not required where the staff finds and declares with an appropriately documented evaluation, that regulatory action is necessary to ensure that the facility provides adequate protection to the health and safety of the public.

Management Directive 8.4, "Management of Facility-Specific Backfitting and Information Collection, states that the Regional Administrator has the authority to develop, update and maintain the backfit procedures and administrative controls for nuclear power plants.

PG 0901.6, "Facility-Specific Backfit and Information Collection Procedure," states that NRC staff positions may be identified as potential backfits by the staff. When the staff invokes a backfit exception, the RA must provide a documented evaluation that includes a statement of the objectives, reasons for the modification, and the basis for the backfit exception.

Additionally, 10 CFR 50.54(f) permits the Commission to request a licensee submit under oath or affirmation, to enable the Commission to determine whether or not the license should be modified, suspended, or revoked. If this information is not sought to verify licensee compliance with the current licensing basis for that facility, the NRC must prepare the reason for each information request.

(b)(4),(b)(5),(b)(7)(F)

(b)(4),(b)(5),(b)(7)(F)

(b)(4),(b)(5),(b)(7)(F)

(b)(4),(b)(5),(b)(7)(F)

(b)(4),(b)(5),(b)(7)(F)

(b)(4),(b)(5),(b)(7)(F)

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(b)(4),(b)(5),(b)(7)(F)

~~OFFICIAL USE ONLY - SECURITY-RELATED INFORMATION~~

(b)(4),(b)(5),(b)(7)(F)

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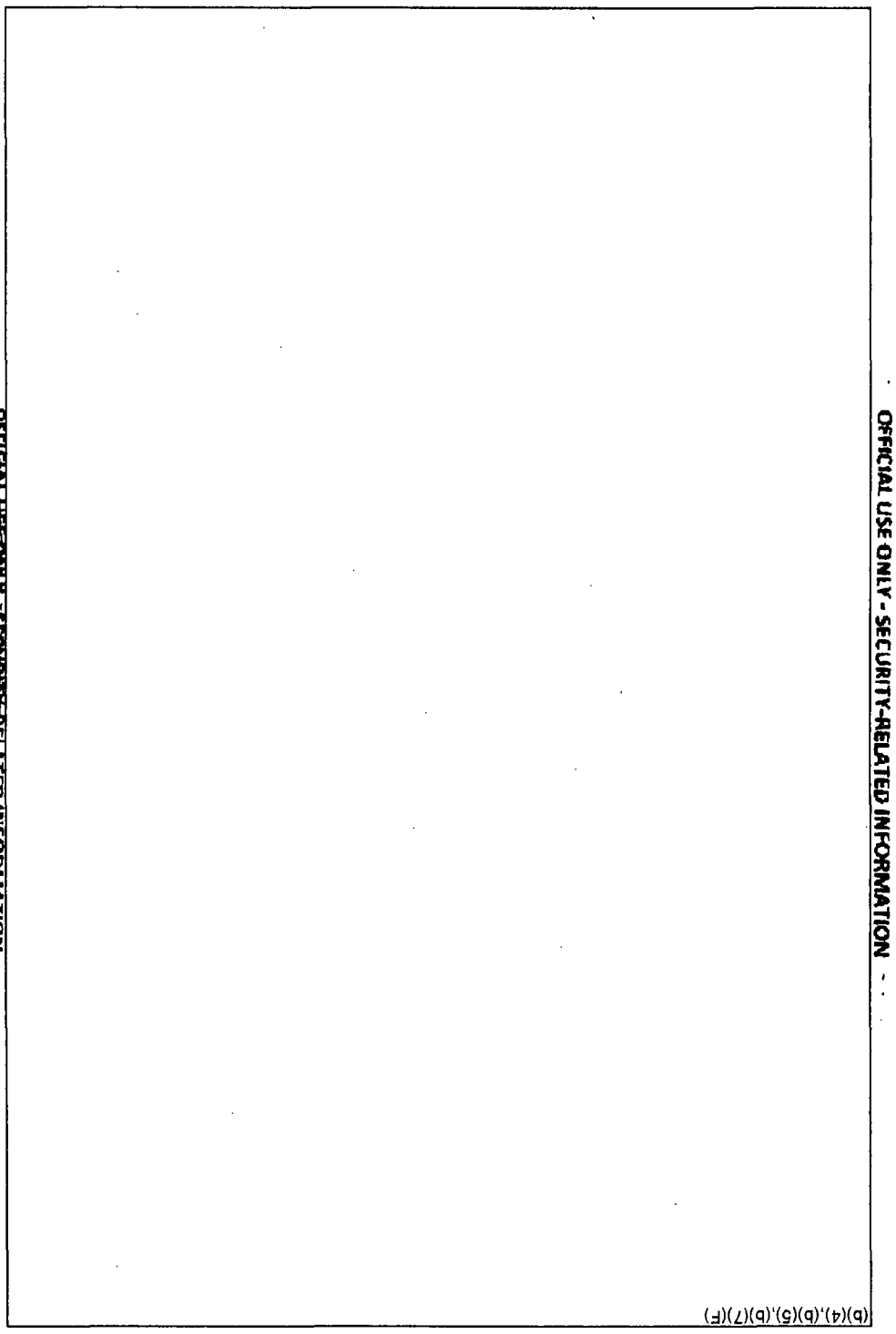

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(b)(4),(b)(5),(b)(7)(F)

OFFICIAL USE ONLY – SECURITY-RELATED INFORMATION

1

Enclosure 5

OFFICIAL USE ONLY – SECURITY-RELATED INFORMATION

Robles, Jesse

From: Bernardo, Robert
Sent: Wednesday, July 27, 2011 2:25 PM
Subject: IOEB Clearinghouse Screening Summary for Wednesday, July 27, 2011

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Issues for Resolution (IFR): None

OpE Forum Postings (COMMS): None

Management Requests: None

Follow-up/Other Tasks: Seven (7)

[Note - The information in this part of the Summary is often preliminary in nature and is provided to help IOEB staff communicate and track noteworthy items being followed up by either the Regions or HQ staff.]

Outside of Scope

OUTSIDE OF SCOPE

3) PNO-IV-11-003E - (UPDATE) FORT CALHOUN STATION DECLARATION OF A NOTIFICATION OF UNUSUAL EVENT DUE TO HIGH RIVER LEVEL

See PNO Text. Based on an assessment that conditions in and around the facility have remained stable, the NRC has made the decision to suspend the augmented 24 hour a-day coverage at the plant beginning on July 30, 2011. The resident inspectors will continue to provide 7 day coverage onsite. Forward to TRG Leads for Flood Protection (Ed Smith) and EP (Eric Schrader). Assigned to Rebecca Sigmon.

B77

OUTSIDE OF SCOPE

Outside of Scope

OUTSIDE OF SCOPE

Outside of Scope

Attendees at Screening Meeting:

Bob Bernardo
Rebecca Sigmon
Steve Pannier
John Thompson
Ryan Craffey (NRO)
Chris Lamb (NSIR)
Mary Wegner (RES) - by phone

Robles, Jesse

From: King, Mark
Sent: Tuesday, August 23, 2011 2:01 PM
Subject: IOEB Clearinghouse Screening Summary for Tuesday, August 23, 2011

NOTE: THIS SUMMARY IS OFFICIAL USE ONLY
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Issues for Resolution (IFR): None

OpE Forum Postings (COMMS): None

Management Requests: None

Follow-up/Other Tasks: Three (3)

[Note - The information in this part of the Summary is often preliminary in nature and is provided to help IOEB staff communicate and track noteworthy items being followed up by either the Regions or HQ staff.]

Outside of Scope

Outside of Scope

2) EN 46893 - FORT CALHOUN - POTENTIAL FLOODING PATH DISCOVERED (RETRACTED)

See EN text: (8/22/2011; 1142 EDT) Following additional review of the reported condition, it has been determined that the Raw Water pumps are adequately protected during flooding conditions and that the open penetrations would not impact the ability of the Raw Water pumps to perform their design accident mitigation functions. The licensee notified the NRC Resident Inspector. Notified R4DO (Haire). Forward retraction to TRG Leads for Flood Protection/Missiles (Edward Smith), SSW/UHS (Gerard Purciarello); assigned to Russ Haskell.

Outside of Scope

Outside of Scope

OUTSIDE OF SCOPE

Outside of Scope

1) EN 46893 - FORT CALHOUN - POTENTIAL FLOODING PATH DISCOVERED (RETRACTED)

Outside of Scope

Attendees at Screening Meeting:

Bob Bernardo
Jesse Robles
Mark King
Russ Haskell
Ryan Craffey (NRO)
Mary Wegner (RES) – by phone

Robles, Jesse

From: King, Mark
Sent: Tuesday, August 30, 2011 3:16 PM
Subject: IOEB Clearinghouse Screening Summary for Tuesday, August 30, 2011

NOTE: THIS SUMMARY IS ~~OFFICIAL USE ONLY~~
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Issues for Resolution (IFR): None

OpE Forum Postings (COMMS): None - *[Note: NRO COMM assignments are provided in the link listed in the New Reactor Items section]*

Management Requests: None

Follow-up/Other Tasks: Four (4)

[Note - The information in this part of the Summary is often preliminary in nature and is provided to help IOEB staff communicate and track noteworthy items being followed up by either the Regions or HQ staff.]

1) EN 46929 - FORT CALHOUN - UNUSUAL EVENT DECLARED DUE TO RIVER LEVEL (NOUE TERMINATED)

See EN Text. Send to TRG Leads for EP (Eric Schrader) and Missiles/Flood Protection (Ed Smith). Assigned to Russ Haskell.

Outside of Scope

OUTSIDE OF SCOPE

B 29

OUTSIDE OF SCOPE

Outside of Scope

2) EN 46929 - FORT CALHOUN - UNUSUAL EVENT DECLARED DUE TO RIVER LEVEL (NOUE TERMINATED)

3) EN 47202 - FORT CALHOUN - TECHNICAL SUPPORT CENTER UNAVAILABLE FOR EMERGENCY RESPONSE (COMPENSATORY ACTIONS IN PLACE)

Outside of Scope

Attendees at Screening Meeting:

Mark King
Bob Bernardo
Russ Haskell
Steve Pannier
Larry Criscione (RES)
Ryan Craffey (NRO)
Al Issa (NRO)
Doug Copeland (NRO)
Bob Beall (NRO)

OUTSIDE OF SCOPE

Jay Patel (NRO)
Dave Harmon (R-II/DCI/CIB3) – by phone
Jonathan Kent (R-II/DCP/CPB4) – by phone
Denise Edwards (R-II/DCP/CPB1) – by phone
Chelsea Smith-Standberry (R-II/DCI/CIB1) – by phone

Robles, Jesse

From: King, Mark
Sent: Wednesday, August 31, 2011 2:01 PM
Subject: IOEB Clearinghouse Screening Summary for Wednesday, August 31, 2011

NOTE: THIS SUMMARY IS ~~OFFICIAL USE ONLY~~
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Issues for Resolution (IFR): None

OpE Forum Postings (COMMS): None

Management Requests: None

Follow-up/Other Tasks: Seven (7)

[Note - The information in this part of the Summary is often preliminary in nature and is provided to help IOEB staff communicate and track noteworthy items being followed up by either the Regions or HQ staff.]

Outside of Scope

OUTSIDE OF SCOPE

4) PNO-IV-11-003F- FORT CALHOUN - PNO-IV-11-003F - DECLARATION OF A NOTIFICATION OF UNUSUAL EVENT - (UPDATE)

See PNO text: Forward to TRG Leads for Flood Protection (Ed Smith) and EP (Eric Schrader). Assigned to Russ Haskell.

1330

OUTSIDE OF SCOPE

Outside of Scope

OUTSIDE OF SCOPE

Outside of Scope

Attendees at Screening Meeting:

Mark King
Bob Bernardo
Russ Haskell
Steve Pannier
Larry Criscione (RES) – by phone
Ryan Craffey (NRO)

Albert, Michelle

From: Mizuno, Geary OGC
Sent: Monday, September 26, 2011 4:37 PM
To: Albert, Michelle; Benowitz, Howard
Subject: RE: LOVELESS Dam Backfit.docx

(b)(5)

Geary

From: Albert, Michelle OGC
Sent: Monday, September 26, 2011 2:49 PM
To: Mizuno, Geary; Benowitz, Howard
Subject: FW: LOVELESS Dam Backfit.docx

FYI – This is the technical document that prompted the creation of the backfit panel regarding Fort Calhoun.

From: Blount, Tom R6/NIV
Sent: Monday, September 26, 2011 2:45 PM
To: Albert, Michelle
Cc: Loveless, David
Subject: FW: LOVELESS Dam Backfit.docx

Michelle – As requested....

Tom B.
(b)(6)

From: Mehrhoff, Vivian R6/N-IV
Sent: Monday, September 26, 2011 1:42 PM
To: Blount, Tom
Subject: LOVELESS Dam Backfit.docx

Albert, Michelle

From: Mizuno, Geary OGC
Sent: Monday, September 26, 2011 4:37 PM
To: Albert, Michelle; Benowitz, Howard
Subject: RE: LOVELESS Dam Backfit.docx

(b)(5)

Geary

From: Albert, Michelle OGC
Sent: Monday, September 26, 2011 2:49 PM
To: Mizuno, Geary; Benowitz, Howard
Subject: FW: LOVELESS Dam Backfit.docx

FYI – This is the technical document that prompted the creation of the backfit panel regarding Fort Calhoun.

From: Blount, Tom R6NTX
Sent: Monday, September 26, 2011 2:45 PM
To: Albert, Michelle
Cc: Loveless, David
Subject: FW: LOVELESS Dam Backfit.docx

Michelle – As requested....

Tom B.
817-860-8146

From: Mehrhoff, Vivian R6NTX
Sent: Monday, September 26, 2011 1:42 PM
To: Blount, Tom
Subject: LOVELESS Dam Backfit.docx

831

Albert, Michelle

OOS

Outside of Scope

outs of scop

****** ATTORNEY-CLIENT/ATTORNEY WORK-PRODUCT DOCUMENT — NOT FOR PUBLIC DISCLOSURE ******

RGN-IV

From: Harrison, Deborah
Sent: Friday, September 23, 2011 6:25 PM
To: Jones, Bradley
Subject: Dam Backfit Panel Charter Letter for Your Concurrence

This is an updated letter for you to concur on for Mr. Tom Blount and he asked that you provide your concurrence by next Wednesday, September 28, 2011. Thank you.

232

(2)

Albert, Michelle

From: Blount, Tom RGN-IV
Sent: Monday, September 26, 2011 2:45 PM
To: Albert, Michelle
Cc: Loveless, David
Subject: FW: LOVELESS Dam Backfit.docx
Attachments: LOVELESS Dam Backfit.docx

Michelle – As requested....

Tom B.
(b)(6)
EX 6

From: Mehrhoff, Vivian RGN-IV
Sent: Monday, September 26, 2011 1:42 PM
To: Blount, Tom
Subject: LOVELESS Dam Backfit.docx

B-33

Albert, Michelle

From: Blount, Tom R6MTV
Sent: Tuesday, September 27, 2011 4:30 PM
To: Albert, Michelle
Cc: Jones, Bradley; Biggins, James; Mizuno, Geary; Williamson, Edward; Spencer, Mary
Subject: RE: RIV Ft. Calhoun Backfit Panel Charter – OGC/RMR Comments

Thanks Michelle – We will incorporate your comments, and coordinate with Ed's Division as you recommended. Thanks for the quick turnaround.

Tom

(b)(5)

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From: Harrison, Deborah R6MTV
Sent: Friday, September 23, 2011 6:25 PM
To: Jones, Bradley
Subject: Dam Backfit Panel Charter Letter for Your Concurrence

This is an updated letter for you to concur on for Mr. Tom Blount and he asked that you provide your concurrence by next Wednesday, September 28, 2011. Thank you.

B34

Biggins, James

From: Blount, Tom
Sent: Wednesday, September 28, 2011 9:10 AM
To: Williamson, Edward
Cc: Jones, Bradley; Biggins, James; Mizuno, Geary; Spencer, Mary; Albert, Michelle
Subject: RE: RIV Ft. Calhoun Backfit Panel Charter – OGC/RMR Comments

Thanks Ed....

(b)(5)

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(b)(5)

(b)(5)

*** ATTORNEY-CLIENT PRIVILEGED INFORMATION, ATTORNEY WORK PRODUCT, AND/OR PREDECISIONAL INFORMATION – DO NOT DISCLOSE WITHOUT COMMISSION APPROVAL ***

RGN IV

From: Harrison, Deborah
Sent: Friday, September 23, 2011 6:25 PM
To: Jones, Bradley
Subject: Dam Backfit Panel Charter Letter for Your Concurrence

This is an updated letter for you to concur on for Mr. Tom Blount and he asked that you provide your concurrence by next Wednesday, September 28, 2011. Thank you.

Jones, Bradley

From: Markley, Michael NRR
Sent: Thursday, September 29, 2011 12:16 PM
To: Jones, Bradley
Cc: Lyon, Fred; Hall, Randy; Mizuno, Geary; Harrison, Donnie; Murphy, Martin; Khanna, Meena; Blount, Tom; Wilkins, Lynnea
Subject: RE: Ft. Calhoun

Bradley,

Thank you. These insights will be very helpful as this issue/review progresses.

Mike

OGC

From: Jones, Bradley
Sent: Thursday, September 29, 2011 11:56 AM
To: Markley, Michael
Cc: Lyon, Fred; Hall, Randy; Mizuno, Geary; Harrison, Donnie; Murphy, Martin; Khanna, Meena; Blount, Tom
Subject: Ft. Calhoun

outside of scope

Outside of Scope

From: Markley, Michael NRR
Sent: Thursday, September 29, 2011 11:02 AM
To: Wilkins, Lynnea
Cc: Lyon, Fred; Hall, Randy; Mizuno, Geary; Harrison, Donnie; Murphy, Martin; Khanna, Meena; Blount, Tom
Subject: FW: Ft Calhoun Upstream Dam failure Backfit Panel

Lynnea,

RIV is considering an adequate protection backfit for Fort Calhoun. Please see the attached.

Please consult Geary Mizuno who is the OGC legal expert and Fred Lyon and Randy Hall who are the DORL subject matter experts. The cognizant technical division for this is EMCB. Please handle expeditiously. Below is the applicable guidance.

MD 8.4: http://www.internal.nrc.gov/ADM/DAS/cag/Management_Directives/md8.4.pdf

The NRR Office Instruction is LIC-202, http://nrr10.nrc.gov/nrr-office/webapps/OI/docs/ML092010045.pdf

DORL Handbook Links: http://nrr10.nrc.gov/nrr-office/DORLHandbook/Backfits.html

Mike

Bradley W. Jones

B.3.6

Jones, Bradley

From: Mizuno, Geary OGC
Sent: Thursday, September 29, 2011 11:48 AM
To: Albert, Michelle
Cc: Jones, Bradley
Subject: FW: Ft Calhoun Upstream Dam failure Backfit Panel
Attachments: FW: LOVELESS Dam Backfit.docx; Emailing: Dam Backfit Panel Charter.docx

outside of scope

Outside of Scope

From: Markley, Michael NRR
Sent: Thursday, September 29, 2011 11:02 AM
To: Wilkins, Lynnea
Cc: Lyon, Fred; Hall, Randy; Mizuno, Geary; Harrison, Donnie; Murphy, Martin; Khanna, Meena; Blount, Tom
Subject: FW: Ft Calhoun Upstream Dam failure Backfit Panel

Lynnea,

RIV is considering an adequate protection backfit for Fort Calhoun. Please see the attached.

Please consult Geary Mizuno who is the OGC legal expert and Fred Lyon and Randy Hall who are the DORL subject matter experts. The cognizant technical division for this is EMCB. Please handle expeditiously. Below is the applicable guidance.

MD 8.4: http://www.internal.nrc.gov/ADM/DAS/cag/Management_Directives/md8.4.pdf

The NRR Office Instruction is LIC-202, http://nrr10.nrc.gov/nrr-office/webapps/OI/docs/ML092010045.pdf

DORL Handbook Links: http://nrr10.nrc.gov/nrr-office/DORLHandbook/Backfits.html

Mike

From: Blount, Tom R4N-IV
Sent: Thursday, September 29, 2011 9:27 AM
To: Markley, Michael; Murphy, Martin
Cc: Howe, Allen; Lund, Louise; Hiland, Patrick; Loveless, David; Vegel, Anton
Subject: Ft Calhoun Upstream Dam failure Backfit Panel

Mike / Marty– we are putting together a "Backfit Panel" to consider a proposed "Adequate Protection Backfit Exception" analysis done by one of our SRA's, Dave Loveless. We are seeking a NRR panel member. I seem to recall some discussion that Meena Khanna was on the Oconee panel (?). In any case we are seeking an NRR representative for the panel. I have included information I have at this time; hopefully this will assist in your decision making. Included is the Charter, which I am seeking your concurrence on, assuming the inclusion of your named representative.
Any questions, please call me....Thanks in advance for your support....

Tom Blount
Dep. DRS R-IV
(b)(6)

Ex 6

37

Smith, Chris

From: Kirkland, John
Sent: Wednesday, October 12, 2011 11:04 AM
To: Clark, Jeff
Cc: Wingebach, Jacob; Smith, Chris; Willoughby, Leonard; Farnholtz, Thomas
Subject: Manhole

Outside of Scope

John Kirkland
Senior Resident Inspector, Fort Calhoun Station
9610 Power Lane
Blair, NE 68008
402-426-9612
402-426-9613 (fax)

B-38

Hair, Christopher

From: Haire, Mark
Sent: Wednesday, October 12, 2011 5:33 PM
To: Wilkins, Lynnea; Mensah, Tanya; Smith, Edward; Li, Yong; Uribe, Juan; Holian, Brian; Rosenberg, Stacey; Goel, Vijay; DLRCalendar Resource; Hoang, Dan; Hair, Christopher; Wilson, George; Markley, Michael; Murphy, Martin
Subject: SECURITY RELATED INFORMATION ATTACHED: RE: Continuation: Internal PRB Meeting: G20110492/G20110506 - Fort Calhoun/Cooper Petitions Re: Flooding (ME6622 & ME6681)

SECURITY RELATED INFORMATION ATTACHED

Thanks.

On our last call I mentioned that RIV had been looking internally at the flooding danger at FCS with regard to upstream dam failures. Attached is the Memo to the RIV RA from one of our SRA's regarding an analysis of flooding risk associated with FCS dam failure (the memo is in ADAMS, and is Security-Related Info).

FCS Proposed
Adequate Protecti...

SECURITY RELATED INFORMATION ATTACHED

MARK S. HAIRE
CHIEF, OPERATIONS BRANCH RIV
817-860-8159 OFFICE
(b)(6) *CELL*

From: Wilkins, Lynnea
Sent: Wednesday, October 12, 2011 12:55 PM
To: Mensah, Tanya; Smith, Edward; Li, Yong; Uribe, Juan; Haire, Mark; Holian, Brian; Rosenberg, Stacey; Goel, Vijay; DLRCalendar Resource; Hoang, Dan; Hair, Christopher; Wilson, George; Markley, Michael; Murphy, Martin
Subject: RE: Continuation: Internal PRB Meeting: G20110492/G20110506 - Fort Calhoun/Cooper Petitions Re: Flooding (ME6622 & ME6681)

All,

Please see the attached for tomorrow's meeting. I've update the Internal PRB notes based on our last meeting. I've also attached a "thumbnail" of Mr. Saporito's concerns as expressed in the teleconference (ML11256A036).

Thanks
Lynnea

<< File: Cooper Internal PRB Notes - G20110506.doc >> << File: Fort Calhoun Internal PRB Notes - G20110492 .doc >> << File: Saporito Concerns From Transcript- August 29.docx >>

-----Original Appointment-
From: Mensah, Tanya
Sent: Friday, September 23, 2011 4:22 PM

339

To: Mensah, Tanya; Wilkins, Lynnea; Smith, Edward; Li, Yong; Uribe, Juan; Haire, Mark; Holian, Brian; Rosenberg, Stacey; Goel, Vijay; DLRCalendar Resource; Hoang, Dan; Hair, Christopher; Wilson, George; Markley, Michael; Murphy, Martin
Subject: Continuation: Internal PRB Meeting: G20110492/G20110506 - Fort Calhoun/Cooper Petitions Re: Flooding (ME6622 & ME6681)
When: Thursday, October 13, 2011 2:45 PM-3:30 PM (GMT-05:00) Eastern Time (US & Canada).
Where: HQ-OWFN-11B02-12p

When: Thursday, October 13, 2011 2:45 PM-3:30 PM (GMT-05:00) Eastern Time (US & Canada).
Where: HQ-OWFN-11B02-12p

Note: The GMT offset above does not reflect daylight saving time adjustments.

~~*~*~*~*~*~*~*~*~*

Purpose: The PRB will continue its internal discussion to make the initial recommendation to accept/reject the petition for review. Due to the schedules of the various PRB members and advisors (i.e, training, travel, AL), the earliest time to permit PRB participation from is 10/13/11.

Handouts: Will be provided by Lynnea via separate email.

Dial-In: Will Be Provided

Tanya Mensah, 2.206 Coordinator
301-415-3610

Robles, Jesse

From: Robles, Jesse
Sent: Friday, October 21, 2011 2:07 PM
Subject: IOEB Clearinghouse Screening Summary for Friday, October 21, 2011

NOTE: THIS SUMMARY IS OFFICIAL USE ONLY
*****MAY CONTAIN SENSITIVE/ PROPRIETARY OR NRC INTERNAL USE ONLY INFORMATION*****
DO NOT FORWARD ANY PORTIONS OUTSIDE OF NRC WITHOUT FIRST OBTAINING PERMISSION FROM ORIGINATOR

Issues for Resolution (IFR): None

OpE Forum Postings (COMMS): One (1)

Outside of Scope

OUTSIDE OF SCOPE

B40

3) EN 47359 - FORT CALHOUN - FLOOD BARRIER PENETRATIONS NOT WATER TIGHT

See EN Text. Pass to TRG Lead for AFW (Stanley Gardocki) and Electrical Power (Roy Mathew). Assigned to Jesse Robles.

Outside of Scope

OUTSIDE OF SCOPE

NOTE: ~~THIS SUMMARY IS OFFICIAL USE ONLY~~
~~***MAY CONTAIN SENSITIVE/ PROPRIETARY OR NRC INTERNAL USE ONLY INFORMATION***~~
~~DO NOT FORWARD ANY PORTIONS OUTSIDE OF NRC WITHOUT FIRST OBTAINING PERMISSION FROM ORIGINATOR~~

Attendees at Screening Meeting:

Jesse Robles
Eric Thomas
Rebecca Sigmon
Bob Bernardo (by phone)
Jay Patel (NRO – by phone)
Mary Wegner (RES – by phone)

Smith, Chris

From: Kirkland, John
Sent: Friday, October 21, 2011 10:26 AM
To: Clark, Jeff
Cc: Smith, Chris; Azua, Ray
Subject: Flood Penetrations

Conduits in the affected pull boxes are supposed to have a water proof sealant in them. It was described to me as a "liquid asphalt that hardens." They are injected into the conduit from ports on the conduit, located a few inches from the end of the conduit. Then the end of the conduit is sealed with a more "beeswax" type material, that hardens and keeps the asphalt type material inside of the conduit.

When they inspected them before, they saw the beeswax and assumed that the entire penetration was installed correctly. (b)(5)

(b)(5)

John Kirkland
Senior Resident Inspector, Fort Calhoun Station
9610 Power Lane
Blair, NE 68008
402-426-9612
402-426-9613 (fax)

R41

(12)

Albert, Michelle

From: Albert, Michelle OGC
Sent: Friday, October 28, 2011 11:23 AM
To: Williamson, Edward; Spencer, Mary
Cc: Jones, Bradley; Biggins, James
Subject: FW: FCS Backfit Panel
Attachments: PG0901-6 Facility-Specific Backfit.doc } check w/ R6N-IV

Release

FYI

From: Albert, Michelle OGC
Sent: Friday, October 28, 2011 10:56 AM
To: Jones, Bradley; Biggins, James; Mizuno, Geary; Benowitz, Howard
Subject: FW: FCS Backfit Panel

FYI

From: Blount, Tom R6N-IV
Sent: Friday, October 21, 2011 1:19 PM
To: Kellar, Ray; Farnholtz, Thomas; Clark, Jeff; Albert, Michelle; Wilson, George
Cc: Fuller, Karla; Mehrhoff, Vivian; Loveless, David
Subject: FCS Backfit Panel

Release

Hello everyone – I wanted to provide an update on our efforts to put together the "Backfit Panel" for the Ft Calhoun Upstream Dam Failure Issue. You may be aware Elmo Collins (R-IV RA) authorized the Panel Charter this past week (10/19). During his review, Elmo took a more "global" perspective of other activities associated with the "Flooding" issues that the agency is currently engaged in, and had questions regarding impact/influence of other agency activities. With the ongoing efforts regarding the Fukushima Near-Term task force and the soon to be issued Generic Issue, GI-204 for Flooding, taking action that has the potential for unintended consequences affecting a larger agency effort would not be appropriate. After some dialogue with various folks, including Ben Beasley (RES), Dave Skeen (NRR) and George Wilson (NRR), I'm convinced we can proceed, while ensuring communications/coordination with the other programs, and I advised Elmo of the same, which supported his decision to go forward with the panel.

At this juncture I think we need an initial meeting, with the primary purpose of aligning on what our outcome will need to be, and defining a path to get there. With that in mind I will try to find a time that supports everyone's calendar. (**ACTION**: Vivian, please arrange conference call with phone # and passcode).

The ADAMS accession # for the Charter and the Dave L. analysis is:

ML11293A198 – *Charter*
ML111822555 – Analysis } ex 5

The link to Management Directive 8.4 "Management of Facility-specific Backfitting and Information Collection" is http://www.internal.nrc.gov/ADM/DAS/cag/Management_Directives/md8.4.pdf

I have also attached the Regional Policy Guide for Facility – Specific backfits to this e-mail for your awareness.

Thank you for your willingness to support this panel. I look forward to our productive efforts as we move this to completion.

B42

Tom Blount
Dep. DRS R-IV
(b)(6)

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

October 31, 2008

PG 0901.6 - FACILITY-SPECIFIC BACKFIT AND INFORMATION COLLECTION PROCEDURE

EFFECTIVE: Immediately
SUPERSEDES PG 0901.5

CONTACT: Regional Counsel
DISTRIBUTION: Standard

APPROVAL: /RA/
Elmo Collins, Regional Administrator

REVISION: THIS PG HAS BEEN REVISED TO REQUIRE INTERIM TRAINING UNTIL PERMANENT FORMAL TRAINING IS DEVELOPED AND TO CHANGE THE REGIONAL BACKFIT PROGRAM ASSESSMENTS FROM ANNUALLY TO TRIENNIALLY. ALSO, THE REVISION CONTAINS MINOR EDITORIAL CHANGES AND REVISIONS ARE IN BOLD.

A. Purpose/Discussion

This policy guide provides guidance for implementing NRC's backfit and information collection regulations, and M.D. 8.4, **Management of Facility-specific Backfitting and Information Collection,** relating to power reactors and certain materials facilities. Neither generic backfitting, nor test, research, nor training reactors are covered by this policy guide. M.D. 8.4 is the principal reference for this Regional Office Policy Guide (ROPG).

Enclosures:
1. Backfit Examples
2. Backfit Review Panel
3. RIV Backfit Status Log

cc/w Enclosures:
RIV Coordinator, OEDO (MS:16E15)
C. Carpenter, OE

SUNSI Review Completed: __KDF__ ADAMS: ☐ Yes X No Initials: __KDF__
☐ Publicly Available ☐ Non-Publicly Available ☐ Sensitive ☐ Non-Sensitive
NAME: R: \ROPG\PG 0901.6 Facility-Specific Backfit and Information Collection Procedure.doc

KDFuller	WBJones	ATHowell	DDChamberlain	RJCaniano
/RA/	/RA/	/RA/	/RA/	/RA/
10/27/08	10/27/08	10/28/08	10/28/08	10/29/08
CACasto	EECollins			
/RA/	/RA/			
10/30/08	10/31/08			

OFFICIAL RECORD COPY T=Telephone E=E-mail F=Fax

Backfitting is the process by which NRC decides whether to impose new or revised regulatory requirements or staff positions on NRC-licensed nuclear power reactors or certain materials facilities.

Backfitting for nuclear power reactors is defined in 10 C.F.R. 50.109 as the modification of or addition to systems, structures, components, or design of a facility; or the design approval or manufacturing license for a facility; or the procedures or organization required to design, construct, or operate a facility. Any of the aforementioned may result from a new or amended provision in the Commission rules or the imposition of a regulatory staff position interpreting the Commission rules that is either new or different from a previously applicable staff position. The backfitting definitions in 10 C.F.R. Parts 70, 72, and 76 are slightly different.

NRC staff positions may be identified as potential backfits either by the staff or a stakeholder (e.g., a licensee). In the case of a licensee claimed backfit, the licensee must submit the backfit claim in writing to the Regional Administrator (RA) for disposition.

Generally, there are three types of backfits. They are (1) compliance, (2) adequate protection[1] (including defining and redefining the level of adequate protection), and (3) a cost-justified substantial increase in safety. See M.D. 8.4, Figure 1. Enclosure 1 provides examples of backfit situations. The first two types of backfits (i.e., a backfit to bring a facility into compliance with the license, rules, Commission orders, or written commitments by the licensee, or one imposed to ensure that the facility provides adequate protection of public health and safety or common defense and security) are termed as exceptions, and do not require findings of substantial safety improvements. Economic costs may not be considered in defining or refining what is an adequate level of protection or in ensuring that an adequate level of protection is achieved or maintained or requiring compliance with regulations that ensure adequate protection. Neither of these two types of backfits requires a backfit analysis. The third, cost justified backfit, does require a backfit analysis.

B. Action

1. The Backfit Process

When the staff invokes a backfit exception, the RA must provide a documented evaluation that includes a statement of the objectives, reasons for the modification, and the basis for the backfit exception. The documented evaluation should be issued with the backfit except when an immediately effective agency action is necessary because the safety or security implications are urgent, and full documentation cannot be completed. In those cases, the documentation may follow the backfit imposition. For more guidance on preparing the documented evaluation, see M.D. Handbook 8.4, Part II, pps. 9-13.

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[1] This refers to adequate protection of public health and safety or common defense and security.

For backfits other than the compliance or adequate protection varieties (i.e., a cost-justified substantial increase in safety), the staff must perform a backfit analysis[2] and may be required to prepare a regulatory analysis[3] to show that certain improvements in safety or security are justified on the basis of the associated costs. Often only one analysis is performed to meet both the backfit and regulatory analysis requirements. For more guidance on backfit and regulatory analyses, see Handbook 8.4, Part II, pps. 15-17 and Exhibit 2, Guidance for Performing a Combined Backfit and Regulatory Analysis.

The RA shall review and approve any documented evaluations, backfit analyses, and/or regulatory analyses developed as a part of the backfit process. Additionally, the RA will determine if a staff position is a backfit (whether staff or licensee identified), whether the proposed backfit should be imposed on the licensee, and any appeals to the region of backfit decisions. In order to make these determinations, the RA may elect to use a panel as described in Enclosure 2. The RA will consult and coordinate with the applicable program offices (NRR, NMSS, or NSIR [for all security-related backfits]), OGC, and OE, as appropriate, in making these determinations. After the RA has approved the supporting regulatory analysis, and/or backfit analysis, and after this documentation has been forwarded for information to the EDO, the cognizant Division Director will issue the backfit determination along with the supporting evaluation or analyses to the licensee. The licensee may choose to implement or appeal any backfit.

Implementation is normally accomplished on a schedule negotiated between the licensee and the NRC. The staff should consult OE and OGC for establishing the schedule.

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[2]The backfit rules require a demonstration that "there is a substantial increase in the overall protection of the public health and safety or the common defense and security to be derived from the backfit and that the direct and indirect costs of implementation for that facility are justified in view of this increased protection." See 10 C.F.R. 50.109(a)(3) and Handbook 8.4, Part II, p. 14.

[3]Generally, a regulatory analysis helps to ensure that NRC decisions are based on adequate information concerning the need for and consequences of proposed actions; appropriate alternative approaches are identified and analyzed; and no clearly preferable alternative is available to the proposed action.

2. Backfit Appeal Process

There are two types of backfit appeal processes:

a. Appeal to the Region to modify or withdraw a proposed backfit for which a regulatory analysis has been prepared and transmitted to the licensee; or

b. Appeal to the Region to reverse a denial of a prior licensee claim that a staff position, not identified by the NRC as a backfit, is one, or that a backfit which staff believes falls within one of the exceptions from the requirement for a regulatory analysis, does not.

For all appeals, licensees should address the appeal to the RA with a copy to the EDO. (A copy of all security related appeals will be provided to the Director of NSIR and will be coordinated with NSIR as appropriate.) The RA will report to the EDO within 90 days after receipt of the appeal, the plan for resolving the issue. The licensee should also be promptly and periodically informed in writing regarding the status of the issue. The RA will decide the appeal and inform the licensee in writing with a copy to the EDO. If dissatisfied with the RA's decision, the licensee may appeal to the EDO, unless resolution is achieved at a lower management level. If after losing an appeal, the licensee does not agree to implement the backfit, it may be imposed by order. See Handbook 8.4, Part II, pp. 23-24.

In the first type of appeal, the staff should reconsider the supporting regulatory analysis, and other information that is relevant and material to the proposed backfit. In the second type of appeal, the appeal should take into account the staff's evaluation, the licensee's response, and other information that is relevant and material. Backfit claims and resultant staff determinations that are re-evaluated in response to an appeal, and that are again determined by the NRC not to be backfits, or are exempt from the requirement for a regulatory analysis, are not to be treated further in the context of this procedure.

3. Record Keeping and Reporting

The Regional Counsel (RC) will administratively manage each proposed facility-specific backfit by maintaining records related to it, including requests, positions, statements, panel minutes, and summary reports. The RC will provide these records to the RA's secretary for inclusion in ADAMS with recommendations coordinated with the staff concerning whether the documents should be placed in

the public or non-public section. [4] Additionally, the RC will keep a RIV backfit status log for tracking purposes. [5] Enclosure 3 is a copy of the log.

4. Training

The Office of Human Resources is developing backfit training modules and refresher courses for the staff, some of which may be available online. The Division Directors will ensure that regional inspection staff and any other personnel who may be involved in backfit issues take the initial or refresher backfit training annually **once it is developed. In the interim, all technical staff will be required to perform a read and sign of this policy guide annually that will be tracked as a Regional Administrator action item.**

5. Information Collection (See Handbook 8.4. Part III, pps. 26-28.)

The RA will authorize requests for information from power reactor licensees in accordance with 10 CFR 50.54(f) (and from certain material licensees under 70.22(d), 72.62(d), and 76.70(e)). Requests under 10 C.F.R. 50.54(f) must be justified by a supporting analysis which finds that the burden to be imposed is justified in view of the potential safety significance of the issue to be addressed in the requested information. The division requesting the information (e.g., DRS, DRP, or DNMS) will prepare the supporting analysis for the RA's review. Refer to Handbook 8.4, Part III, pps. 26-28, for guidance on preparing the supporting analysis and exceptions to providing a supporting analysis.

6. Audits

DRS will conduct an assessment **triennially** of the implementation of the regional backfit program **in the same year as the update to this policy guide**.

7. References:

- See pps. 12-13 of M.D. 8.4.

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[4] Classified and safeguards information should not be placed in ADAMS, and proprietary and sensitive information should be excluded from the public domain in ADAMS.

[5] The time needed to complete an initial backfit issue or backfit appeal may vary depending on the complexity of the backfit claim. As a guideline, however, the following time line is suggested:

- Inform EDO and licensee of an initial backfit determination within 90 calendar days after receipt of the claim and resolve the issue within 180 calendar days after receipt of the claim.
- Keep the licensee informed of the backfit or backfit appeal status no less than quarterly.
- Inform the EDO of the plan for resolving an appeal by the 80th calendar day after receiving the appeal, and resolve the backfit appeal within 180 calendar days.

- LIC-202, Procedures for Managing Plant-Specific Backfits and 50.54(f) Information Requests
- NMSS Policy and Procedure Letter (P&P) 1-84, May 2004

BACKFIT EXAMPLES

1. The Region considered whether the NRC staff imposition of a 10 C.F.R. 50.73 reportability requirement of a licensee-identified Technical Specification 6.12 violation on the Wolf Creek plant was a backfit. The issue involved the reporting of high radiation area control violations by use of the licensee event report requirements of 10 C.F.R. 50.73. A regional panel determined that it was a plant-specific (Wolf-Creek) backfit. It was a **compliance backfit**, since it would have been a backfit to bring Wolf Creek into compliance with 10 C.F.R. 50.73, an NRC regulation. The matter was also referred to NRR and it determined that future violations of T.S. 6.12 shall be reported in accordance with 10 C.F.R. 50.73.

2. NRC issued a 10 C.F.R. 50.59 violation to TXU Electric (Comanche Peak) June 11, 1997, associated with NRC Inspection Report 50-445;446/97-12, for failure to perform written safety evaluations to provide the basis for concluding that four changes to drawings contained in the safety analysis report did not involve unreviewed safety questions. The licensee requested the NRC to perform a backfit analysis to evaluate the apparent change in staff position from that given in NRC Inspection Report 50-445;446/93-32 dated October 13, 1993 to that expressed in NRC Inspection Report 50-445;446/97-12. The 1993 report stated in reference to an issue unrelated to the subject four changes:

   This temporary modification should have been identified as a "trivial" type change. That is, a change having "no potential safety impact (e.g., affecting safe shutdown or the safety of operations)."

   In each of the four examples of the violation, the licensee invoked Category 7 "trivial" change (minor changes which had no potential safety impact) from its procedure, "10 CFR 50.59 Review Guide," Revision 4, to disposition the associated design change notices as not requiring safety evaluations. In the 1993 inspection report, the inspectors provided statements that appeared to accept the licensee's guidance on this issue. The staff found during the backfit analysis that because the statements in the 1993 inspection report were misleading, the reversal of the previous position, which accepted the licensee's interpretation of "trivial" changes, constituted a change in the staff's position and a **compliance backfit**, because the change was necessary to assure compliance with the requirements of 10 C.F.R. 50.59.

3. A Notice of Enforcement Discretion (NOED) was issued to the Oconee Nuclear Station on September 8, 2000. The licensee requested the NOED as a result of its inability to comply with Technical Specification (TS) 3.8.1, Surveillance Requirement (SR) 3.8.1.9.a which provides for annual verification of voltage and frequency response of the Keowee Hydro Units (KHUs). Specifically, the licensee could not meet upper voltage and frequency limits that had been incorporated into the TS by the staff when Oconee TSs

were converted to Improved Technical Specifications (ITSs). In the background section of the NOED, the staff discussed the September 4, 1998, approved amendment (Nos. 232, 232 and 231) for Oconee Units 1, 2 and 3. Under this amendment, the relevant portion of the SR (then referenced as SR 3.7.1.11) was that the annual test verifies each KHU can attain rated speed and voltage within 23 seconds of an emergency start signal. ***No limits existed on speed or voltage.*** During the conversion of the Oconee TSs to ITSs (December 16, 1998), ***limits were incorporated on the upper and lower frequency and voltage***, and the present SR 3.8.1.9.a limits (which the licensee could not meet) were adopted. An NRC staff member claimed that the inclusion of limits on the upper and lower frequency and voltage in the TS was a backfit. The region determined that it was a backfit, because the staff **modified** the licensee's surveillance procedure by incorporating new limits where **none** had previously existed. It appears to have been a **compliance backfit,** because the modification was made for consistency with the ITS Writer's Guide and ITS convention program. (This backfit issue later became moot due to the submission of a request for an amendment.)

4. **[NOTE: Although not a facility-specific backfit, the following is an example of an adequate protection backfit.]**

The NRC addressed the issues of reactor pressure vessel (RPV) head penetration leakage and the potential for degradation of the low-alloy steel head by boric acid corrosion through a 2003 order and a 2004 revised order. The orders required PWR licensees to determine the degradation susceptibility category of their reactor and to implement specific inspections of the RPV head and associated penetration nozzles. The staff believed that the orders were not appropriate regulatory tools for long-term regulation in this area. Therefore, it pursued rulemaking activities to incorporate the inspection requirements of the orders into 10 C.F.R. 50.55a. Although a strict codification of the requirements in the orders would not be a backfit, because the staff expected that the requirements may be modified as a result of the rulemaking, it treated the rulemaking as a backfit necessary for **adequate protection of public health and safety.**

PG 0901.6

BACKFIT REVIEW PANEL

A. Purpose:

To define a review panel to consider potential items relative to the backfit rules.

B. Discussion:

ROPG 0901.**6**, "FACILITY-SPECIFIC BACKFIT AND INFORMATION COLLECTION PROCEDURE," defines the procedures to be followed for consideration and processing of NRC-imposed changes having a potential for falling under the provisions of M.D. 8.4, MANAGEMENT OF FACILITY-SPECIFIC BACKFITTING AND INFORMATION COLLECTION. The decision to prepare a Regulatory Analysis is assigned by this ROPG to the appropriate Division Director.

As an aid to the Division Directors, and to assure consistent application of the backfit rule within the region, a panel is hereby commissioned to consider potential backfit items and to recommend the need for a Regulatory Analysis if judged necessary to comply with the above requirements.

The panel will be composed of the following or their designated alternate:

Division Director (of the relevant division appropriate to the issue, e.g., DRP, DRS, or DNMS): Panel Chairman
Enforcement Officer
Branch Chief, DNMS (Primary Materials Contact)
Branch Chief, DRP (Primary Reactor Contact)
Branch Chief, DRS (Primary Reactor Contact)

C. Action:

1. The above panel will meet when convened by the Chairman.

2. Items to be considered by the panel will be identified by the Chairman/Division Director assigned to the panel.

3. Copies of applicable documentation will be distributed by the Chairman to each panel member in advance of a meeting to consider potential backfit items.

4. Minutes of each panel meeting will be kept by the Chairman to reflect the items considered and the panel recommendations.

D. Backfit Appeal Panel Composition

The backfit appeal panel will function similarly to the initial backfit panel. The backfit appeal panel should consist of the Regional Counsel as Chairman and the two technical Division Directors who did not participate in the initial panel (i.e., DNMS, DRP, or DRS) as members for independence purposes. Also, one member of the appeal panel should

be a technical expert from an organization outside of the region (e.g., NRR, NMSS, RES, EDO, OGC, NSIR, etc.). The appeal panel chairman will provide minutes and decision documents from the appeal panel to the RA's secretary for inclusion in ADAMS and include the decision in the regional backfit status table.

PG 0901.6

ENCLOSURE 3, ML032940098 (redacted) and ML 032940104 (redacted)

RIV BACKFIT STATUS			
DATE	LICENSEE	ISSUE	STATUS
4/99	River Bend Station (RBS)	Change to the calculated loss-of-coolant accident offsite doses at RBS	CLOSED
3/99	Arkansas Nuclear One (ANO)	Appendix R Compliance Issue	(b)(5)
10/97	Comanche Peak (CP)	Failure to perform safety evaluation for configuration changes in FSAR	CLOSED-3/27/00
7/92	Arkansas Nuclear One (ANO)	Security Issue in re X-ray devices	CLOSED - unnecessary backfit
12/90	Wolf Creek (WC)	Part 50.73 reportability issue in re Sec. 6 of Tech Specs	CLOSED
5/89	Wolf Creek (WC)	Emergency action levels employed at WC	CLOSED - no backfit
5/89	Wolf Creek (WC)	Security Compensation measures beyond what was required imposed by NRC	CLOSED - no backfit
4/88	ARKANSAS Nuclear One (ANO)	Safeguards related matter at ANO	CLOSED - no backfit
3/88	Wolf Creek (WC)	Safeguards related matter at WC	CLOSED - no backfit

ENCLOSURE 3, ML032940098 (redacted) and ML 032940104 (redacted)

RIV BACKFIT STATUS			
DATE	LICENSEE	ISSUE	STATUS
1/87	Wolf Creek (WC)	Change in interpretation of 73.71	CLOSED - no backfit
7/86	Fort Calhoun Station (FCS)	Safeguards related issue at FCS	CLOSED - no backfit
5/13/98	South Texas Project	10 C.F.R. 50.59-Unreviewed safety question w/o NRC review & approval	CLOSED-8/4/00 (Due to new rule & minor significance, backfit consideration canceled)
2/7/01	Callaway-AMEREN/UE	SDP-ALARA-Occupational Radiation Safety	CLOSED-no backfit 5/4/01
9/28/01	ANO	Manual actions & 10 C.F.R. Part 50, App. R, III.G.2	CLOSED-no backfit 4/15/02

Boyer, Rachel

From: Collins, Elmo
Sent: Tuesday, November 01, 2011 11:10 AM
To: Borchardt, Bill
Cc: Virgilio - Disabled 5-4-2012 per 574504, Martin; Leeds, Eric
Subject: FW: FYI - Fort Calhoun Station update

Bill

Here is the e-mail sent to Commission TAs to update on status of Ft Calhoun

Elmo

From: Castleman, Patrick
Sent: Tuesday, November 01, 2011 10:58 AM
To: Franke, Mark; Hipschman, Thomas; Marshall, Michael; Gilles, Nanette; Orders, William; Franovich, Mike
Cc: Collins, Elmo; Bowman, Gregory; Brock, Kathryn
Subject: RE: FYI - Fort Calhoun Station update

Thanks, Mark.

From: Franke, Mark
Sent: Tuesday, November 01, 2011 10:57 AM
To: Hipschman, Thomas; Marshall, Michael; Castleman, Patrick; Gilles, Nanette; Orders, William; Franovich, Mike
Cc: Collins, Elmo; Bowman, Gregory; Brock, Kathryn
Subject: FYI - Fort Calhoun Station update

Good Morning -

The following is as update on Fort Calhoun Station, which has been shutdown since April for a refueling outage. The outage was extended due to flooding along the Missouri River. Fort Calhoun Station is currently in Column 4 of the Reactor Oversight Program response matrix.

- On September 2, 2011, Region IV issued a Confirmatory Action Letter (CAL) to Fort Calhoun regarding post-flooding recovery actions needed prior to restart, including tests and inspections.
- Fort Calhoun is beginning a review and assessment in preparation for NRC supplemental inspections (IP 95003) associated with their Column 4 status.
- Region IV is implementing Manual Chapter (MC) 0351 to address Performance Indicator and Baseline Inspection program impacts due to the plant's extended shutdown period.
- Based on several additional performance issues identified during recent NRC inspections, Region IV is working with NRR to consider MC 0350.
- Region IV formed a back-fit panel to consider what actions are appropriate to address an Army Corps of Engineers report regarding the impact of dam failures on the Missouri River system.

Please give me a call if you have any questions.

Thanks,

243

Mark

301-415-1622

(b)(6) (blackberry) ex 6

Boyer, Rachel

From:	Wiggins, Jim
Sent:	Monday, December 05, 2011 3:49 PM
To:	Borchardt, Bill
Cc:	Virgilio - Disabled 5-4-2012 per 574504, Martin
Subject:	ACTION: NEED TO SPEAK TO YOU THIS WEEK ABOUT FT. CALHOUN

Want to discuss the fact that RIV and NRR are recommending entry into the 0350 process for Ft Calhoun. By tomorrow, I'll have a brief write-up on the rationale. For now, suffice it to say that I'm unaware we've seen a set of performance results like we're seeing at Ft Calhoun since the start of the ROP. Ft. Calhoun is firmly in Column 4 with potentially 3 Degraded Cornerstones (IE, MS and Security (b)(5) RIV staff indicates that it's not clear that the licensee has its arms around the problems and what will be needed to address them. Going to 0350 will be a way to make the licensee face the issues....though likely it would result in the restart date for the facility being later than what the licensee is telling itself (March) and more like what the Region thinks is realistic (June).

I tend to agree with the Region and NRR.

More to come.

Don't know if you or Marty have had any discussions on this with the Chairman or the Commissioners.

Uribe, Juan

From: Wang, Weijun
Sent: Thursday, December 15, 2011 1:42 PM
To: Xi, Zuhan; Candelario, Luissette; Uribe, Juan
Subject: FW: Fort Calhoun Flooding

This is one of the earliest e-mail communication regarding the Fort Calhoun site flooding.

Weijun

From: Wang, Weijun
Sent: Tuesday, September 06, 2011 12:37 PM
To: Williams, Megan; Wilson, George
Cc: Manoly, Kamal; Cook, Christopher
Subject: RE: Fort Calhoun Flooding

Megan:

I am not sure whether we have regulatory authority to ask the licensee to monitor cracks – Kamal may know more.

Regarding the soil types and properties, you may want to get the soil profile and soil properties to see if there are clayey soil and cemented sandy soil because the clayey soil may cause additional long term settlement if it became saturated from unsaturated state for a while, and the cemented sandy soil may greatly reduce its strength when becomes saturated (non-cemented sand does not have this issue, saturation only reduce the effective stress and it should be considered during design).

By the way, usually cracking is an indication of differential settlement. If the cracks continue increasing, then local foundation failure is possible.

Please let me know if you have any questions. Thanks.

Weijun

From: Williams, Megan
Sent: Tuesday, September 06, 2011 11:53 AM
To: Wang, Weijun; Wilson, George
Cc: Manoly, Kamal; Cook, Christopher
Subject: RE: Fort Calhoun Flooding

Thank you, Weijun. This is most helpful.

We are seeing many cracks in concrete walls in the turbine building (below grade), which have been leaking water since the flood started. I am trying to find out the Structures Monitoring Program owner, to see if they had a baseline inspection documentation (they should have completed for license renewal ~2004) indicating what cracks were evident before the flood, and their size, etc.

(b)(5)

R/,

Megan

From: Wang, Weijun NRO
Sent: Tuesday, September 06, 2011 9:56 AM
To: Williams, Megan; Wilson, George
Cc: Manoly, Kamal; Cook, Christopher
Subject: RE: Fort Calhoun Flooding

Megan:

Without knowing much details, I'd like to suggest the follows:

1. Get documents to see how the hydraulic loading was considered during the original structure and foundation design. If the actual flood level is higher than the original design, then the additional lateral pressure and uplift force may cause some damage to the foundation walls and foundation floor concrete slabs, and also may have negative impact on the stability of foundation soils.

2. Regardless the flood levels considered in the original design, you may still need to inspect the structure and foundation to see if there is any damages caused by flooding, such as cracks and settlement. The GPR is a good method to detect voids and the licensee should also perform additional NDT testing to inspect the integrity of the foundation walls and floor concrete slabs or mats, should cracks be discovered.

3. Pay attention to settlements, both in vertical and horizontal directions. Flood normally will reduce the strength of foundation soil, especially if the water did not dissipate for a longer period of time. For certain type of soils and drainage conditions, as well as the actual foundation condition after the flood, the additional settlement caused by flood may continue for certain period of time, and therefore the settlement monitoring should be kept for a longer time until no detectible settlement increase is observed.

The above just for your reference. Please let me know if you have questions.

Thanks.

Weijun
(301)415-1175

From: Williams, Megan
Sent: Tuesday, September 06, 2011 9:44 AM Please
To: Wilson, George
Cc: Manoly, Kamal; Wang, Weijun; Cook, Christopher
Subject: RE: Fort Calhoun Flooding

Good morning,

I am at Fort Calhoun this week, and trying to get some details from the contractors on their approach to evaluating subgrade conditions at the site, now that most of the water has receded.

In reviewing the USAR, certain structures had hydraulic loading designs based on different flood levels (Class I versus Class II, and several references to 2.7.1.2 for design peak flood elevation, which itself references

multiple different flood elevations within its paragraphs). Is it possible to get documentation that we have regarding this hydraulic loading design?

I am trying to get information on the GPR they are using to look for voids. Are there any other specific questions or things you all can think of that I should look at while on site?

Thank you,

Megan Williams
RIV

From: Wilson, George
Sent: Tuesday, August 23, 2011 5:53 AM
To: Williams, Megan
Cc: Manoly, Kamal; Wang, Weijun; Cook, Christopher
Subject: RE: Fort Calhoun Flooding

Megan use Kamal Manoly as your reference person he will get assistance from Weijun Wang in NRO

From: Williams, Megan
Sent: Friday, August 19, 2011 12:28 PM
To: Wilson, George
Subject: Fort Calhoun Flooding

Hey, Mr. Wilson,

I left you a voicemail, and understand you are out of the office until next week, but I thought I would also send you an email, since I will be out of the office next week on inspection.

We are beginning to engage in reviewing the licensee's efforts for restart at the plant after extensive flooding this spring/summer. You probably know a large portion of the plant is still under water, but they have engaged a consultant to start assessing geotechnical conditions around the site. I am looking for resources that can help us know what to look for in these assessments – do we have any history of plants in the agency recovering from this sort of water conditions? Do you know of any references that would tell us what kinds of tests of studies should be completed to assess the condition of the soils, etc.?

I appreciate any guidance you have in this area.

r/,

Megan Williams

Uribe, Juan

From: Wang, Weijun
Sent: Thursday, December 15, 2011 1:44 PM
To: Xl, Zuhan; Candelario, Luissette; Uribe, Juan
Subject: FW: Fort Calhoun Flooding
Attachments: Picture 001.jpg; Picture 002.jpg; Picture 003.jpg; Picture 004.jpg; Picture 005.jpg; Picture 006.jpg; Picture 007.jpg; FCS settled column.jpg

FYI.

Weijun

From: Williams, Megan
Sent: Wednesday, September 07, 2011 4:48 PM
To: Wang, Weijun; Wilson, George
Cc: Manoly, Kamal; Cook, Christopher
Subject: RE: Fort Calhoun Flooding

Good afternoon. I wanted to let you know about developments today.

We met with HDR (geotechnical investigation sub to the licensee) to discuss their approach, tasks to date, etc. They are in the process of getting us a good amount of requested information, such as original design documents, etc. They have yet to characterize the current condition of the soil; (b)(5) (b)(5)

As they remove mud/silt from the site with bobcats, an exterior walkway slab showed settlement in one corner, and also a large void where the concrete completely gave way. (see attached). There is also a column that has settled, and it is taking the adjacent masonry walls with it (stepped cracking) – you may have seen this photo before.

Again, I will pass along information as I receive it, but if you think of anything I should be asking for or looking at, I appreciate any guidance you can provide.

R/,

megan

From: Williams, Megan
Sent: Tuesday, September 06, 2011 10:53 AM
To: Wang, Weijun; Wilson, George
Cc: Manoly, Kamal; Cook, Christopher
Subject: RE: Fort Calhoun Flooding

Thank you, Weijun. This is most helpful.

We are seeing many cracks in concrete walls in the turbine building (below grade), which have been leaking water since the flood started. I am trying to find out the Structures Monitoring Program owner, to see if they had a baseline inspection documentation (they should have completed for license renewal ~2004) indicating what cracks were evident before the flood, and their size, etc.

B46

(b)(5)

R/,

Megan

From: Wang, Weijun
Sent: Tuesday, September 06, 2011 9:56 AM
To: Williams, Megan; Wilson, George
Cc: Manoly, Kamal; Cook, Christopher
Subject: RE: Fort Calhoun Flooding

NRO

Megan:

Without knowing much details, I'd like to suggest the follows:

1. Get documents to see how the hydraulic loading was considered during the original structure and foundation design. If the actual flood level is higher than the original design, then the additional lateral pressure and uplift force may cause some damage to the foundation walls and foundation floor concrete slabs, and also may have negative impact on the stability of foundation soils.

2. Regardless the flood levels considered in the original design, you may still need to inspect the structure and foundation to see if there is any damages caused by flooding, such as cracks and settlement. The GPR is a good method to detect voids and the licensee should also perform additional NDT testing to inspect the integrity of the foundation walls and floor concrete slabs or mats, should cracks be discovered.

3. Pay attention to settlements, both in vertical and horizontal directions. Flood normally will reduce the strength of foundation soil, especially if the water did not dissipate for a longer period of time. For certain type of soils and drainage conditions, as well as the actual foundation condition after the flood, the additional settlement caused by flood may continue for certain period of time, and therefore the settlement monitoring should be kept for a longer time until no detectible settlement increase is observed.

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Thanks.

Weijun
(301)415-1175

From: Williams, Megan
Sent: Tuesday, September 06, 2011 9:44 AM
To: Wilson, George
Cc: Manoly, Kamal; Wang, Weijun; Cook, Christopher
Subject: RE: Fort Calhoun Flooding

Release (duplicate email)

Good morning,

I am at Fort Calhoun this week, and trying to get some details from the contractors on their approach to evaluating subgrade conditions at the site, now that most of the water has receded.

In reviewing the USAR, certain structures had hydraulic loading designs based on different flood levels (Class I versus Class II, and several references to 2.7.1.2 for design peak flood elevation, which itself references multiple different flood elevations within its paragraphs). Is it possible to get documentation that we have regarding this hydraulic loading design?

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Megan Williams
RIV

From: Wilson, George
Sent: Tuesday, August 23, 2011 5:53 AM
To: Williams, Megan
Cc: Manoly, Kamal; Wang, Weijun; Cook, Christopher
Subject: RE: Fort Calhoun Flooding

Megan use Kamal Manoly as your reference person he will get assistance from Weijun Wang in NRO

From: Williams, Megan
Sent: Friday, August 19, 2011 12:28 PM
To: Wilson, George
Subject: Fort Calhoun Flooding

(Mail duplicate email)

Hey, Mr. Wilson,

I left you a voicemail, and understand you are out of the office until next week, but I thought I would also send you an email, since I will be out of the office next week on inspection.

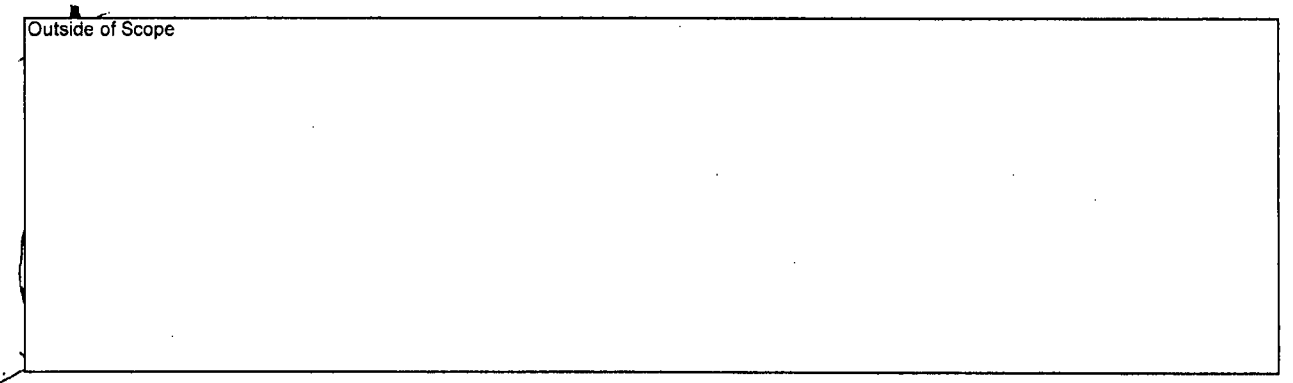
We are beginning to engage in reviewing the licensee's efforts for restart at the plant after extensive flooding this spring/summer. You probably know a large portion of the plant is still under water, but they have engaged a consultant to start assessing geotechnical conditions around the site. I am looking for resources that can help us know what to look for in these assessments – do we have any history of plants in the agency recovering from this sort of water conditions? Do you know of any references that would tell us what kinds of tests of studies should be completed to assess the condition of the soils, etc.?

I appreciate any guidance you have in this area.

r/,

Megan Williams

1/5/12 Brief to Sr. Mngmnt on FCS Geotechnical work

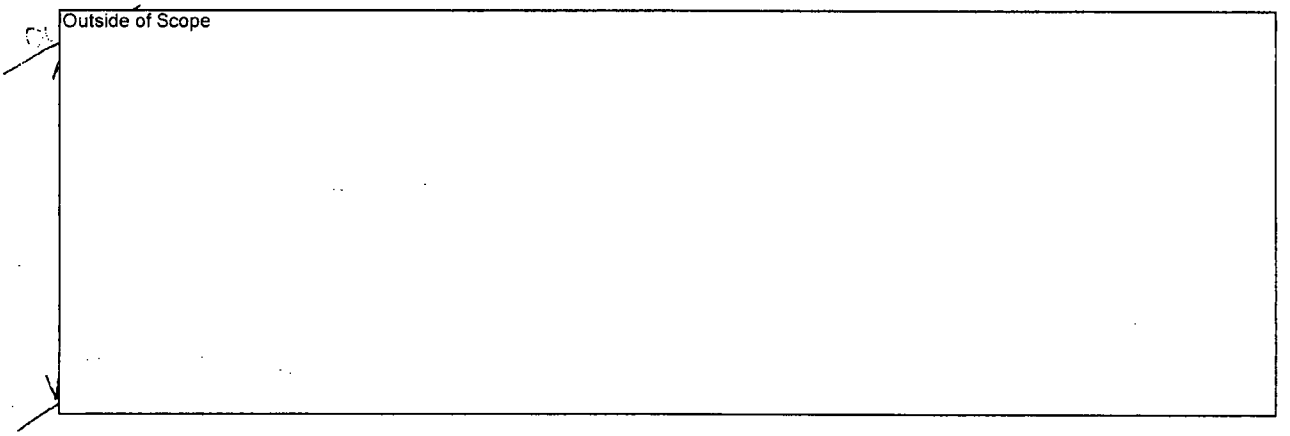


Cite 3 failures on site:

1. Increased groundwater flow into turbine sump pump
2. Pavement failure and sinkhole development in utility corridor between service building and intake structure
3. Column settlement in maintenance shop

Turbine Building Sump pump:

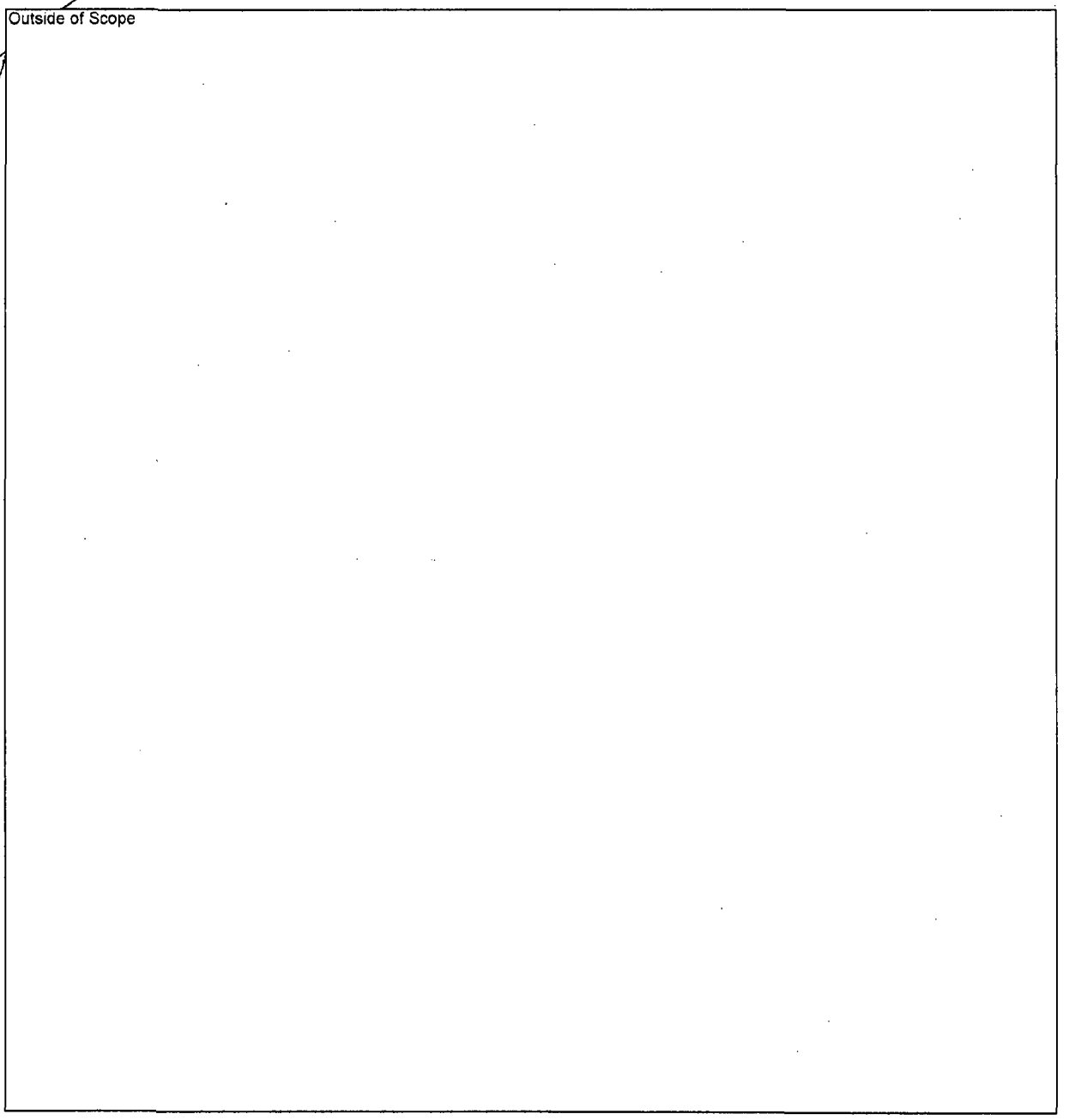
Subsurface piping of soil material due to the sump operation and seepage/flow into the drainage system pipe is occurring; voids are significant and interconnected. Voids, soft zones, and associated groundwater and piping flow paths will continue to enlarge and extend out from the system unless the flow of water is stopped. The most significant and closely connected voids are on the west wall, adjacent to the auxillary building. Eleven of the voids occur at or below the bottom elevation of the pile caps.

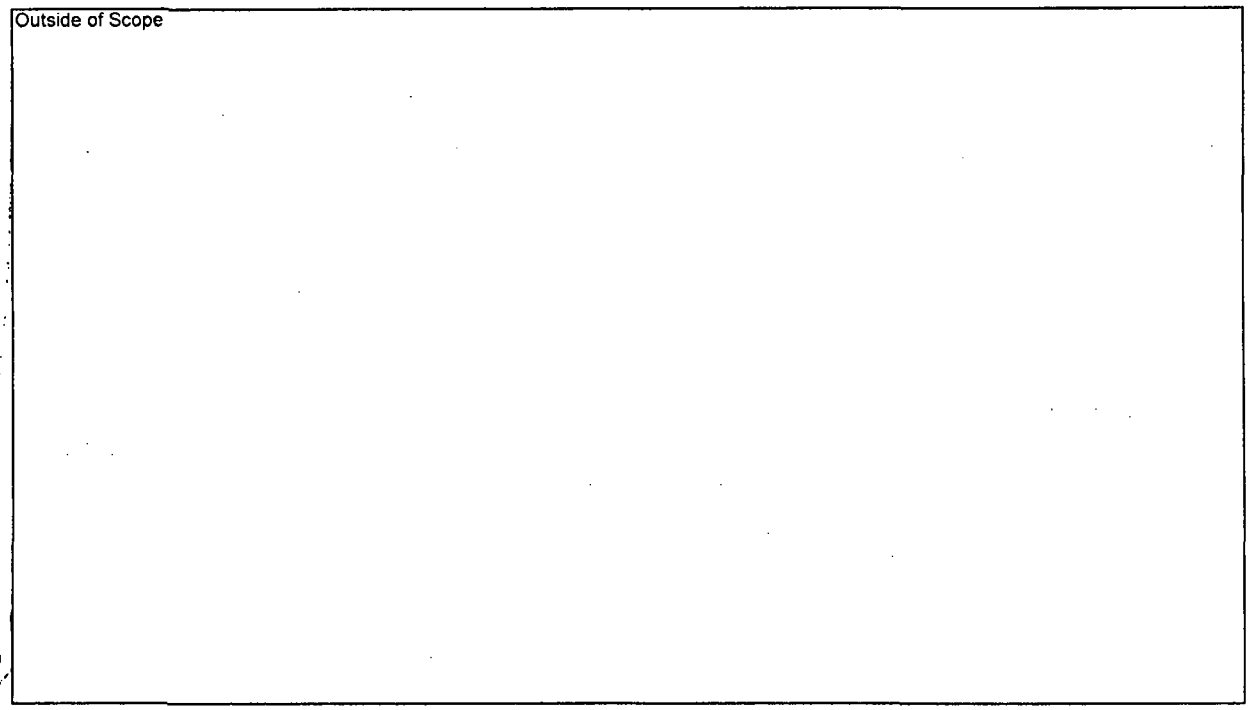


Additionally, two other CPFMs, 3a (Undermining and settlement of shallow foundation/slab/surfaces (due to pumping) and undermined buried utilities (due to pumping), both from subsurface erosion/piping, associated with this KDI have the potential to keep affecting structures other than the Turbine Bldg: TSC, FP, Raw Water line, BBREs, Maint shop, U/G cable system, Waste disposal piping, Blair Water system, demin water, TB S. SY, FOT&P, PA drives, San Sewer, and Condensate Storage Tank buried utilities.

- The fact that the initial condition (broken pipes) has been occurring for many years, makes the hypothesis that the voids could extend beyond the turbine bldg more plausible.

  Recommendations: block the drainage system pipes; then 1) abandon the system and replace w/ above-slab system or trench cut for new system; or 2) replace existing system. Either will need to address the voids created. HDR is currently researching and interviewing expert grouting companies for possible solutions.




Outside of Scope

Mizuno, Geary

From: Mizuno, Geary OGC
Sent: Thursday, January 19, 2012 9:01 AM
To: Spencer, Mary
Cc: Williamson, Edward; Biggins, James; Jones, Bradley
Subject: FW: Ft Calhoun Status... and my suggestions for covering the on-going issues there

Ex. 5 Deliberative process

Mary:

(b)(5)

Geary

From: King, Mark NRR
Sent: Wednesday, January 18, 2012 11:32 AM
To: Tomon, John
Cc: Cartwright, William; Chernoff, Harold
Subject: Ft Calhoun Status... and my suggestions for covering the on-going issues there

John,

(b)(5)

B 49

(b)(5)

(b)(5)

FYI, for your consideration.
Mark

Mark King
Senior Reactor Systems Engineer
NRR/ADRO/DIRS/IOEB
Operating Experience Branch
301-415-1150
Mark.King@nrc.gov

NRC – One Mission – One Team

OGC

From: Mizuno, Geary
Sent: Monday, January 30, 2012 9:53 AM
To: Spencer, Mary
Cc: Biggins, James
Subject: FW: OGC ticket No. 2012-0215 logged in for review-Commission Paper — FW: AO Report for OGC Second Review and NLO

Mary:

(b)(5)

Geary

OGC

From: Martin, Circe **On Behalf Of** RidsOgcMailCenter Resource
Sent: Friday, January 27, 2012 4:08 PM
To: Rothschild, Trip; Jones, Bradley; Mayberry, Theresa; Lora, Kimberly; Mizuno, Geary
Subject: OGC ticket No. 2012-0215 logged in for review-Commission Paper — FW: AO Report for OGC Second Review and NLO

RCS

From: Pope, Tia
Sent: Friday, January 27, 2012 3:43 PM
To: RidsOgcMailCenter Resource
Cc: Mizuno, Geary; Bush-Goddard, Stephanie
Subject: AO Report for OGC Second Review and NLO

Mizuno, Geary

From: Mizuno, Geary OGC
Sent: Thursday, February 02, 2012 11:05 AM
To: Chidakel, Susan
Cc: Biggins, James; Jones, Bradley
Subject: RE: OGC ticket No. 2012-0215 logged in for review-Commission Paper — FW: AO Report for OGC Second Review and NLO

(b)(5)

Ex 5 Deliberative process

From: Chidakel, Susan OGC
Sent: Thursday, February 02, 2012 10:56 AM
To: Mizuno, Geary
Cc: Biggins, James
Subject: RE: OGC ticket No. 2012-0215 logged in for review-Commission Paper --- FW: AO Report for OGC Second Review and NLO

(b)(5)

Ex 5 Deliberative process

From: Tomon, John RES
Sent: Wednesday, February 01, 2012 4:58 PM
To: Chidakel, Susan
Cc: Bush-Goddard, Stephanie; Lewis, Doris; Biggins, James; Mizuno, Geary
Subject: RE: OGC ticket No. 2012-0215 logged in for review-Commission Paper --- FW: AO Report for OGC Second Review and NLO

Susan

(b)(5)

Ex 5 Deliberative process

Thanks so much!

V/r

John J. Tomon, CHP
Health Physicist
RES/DSA/HEB
(301) 251-7904 (Office)
(b)(6) (cell)
CSB-3C23 Mail Stop CSB- C3A07M

From: Chidakel, Susan OGC
Sent: Wednesday, February 01, 2012 8:12 AM
To: Tomon, John
Cc: Bush-Goddard, Stephanie; Lewis, Doris
Subject: RE: OGC ticket No. 2012-0215 logged in for review-Commission Paper --- FW: AO Report for OGC Second Review and NLO

B51

(b)(5)

From: Tomon, John RES
Sent: Wednesday, February 01, 2012 7:57 AM
To: Chidakel, Susan
Cc: Bush-Goddard, Stephanie; Lewis, Doris
Subject: RE: OGC ticket No. 2012-0215 logged in for review-Commission Paper — FW: AO Report for OGC Second Review and NLO

Susan

(b)(5)

Thanks so much!

V/r

John J. Tomon, CHP
Health Physicist
RES/DSA/HEB
(301) 251-7904 (Office)
(b)(6) (cell)
CSB-3C23 Mail Stop CSB- C3A07M

From: Chidakel, Susan OGC
Sent: Wednesday, February 01, 2012 7:47 AM
To: Tomon, John
Cc: Mizuno, Geary
Subject: RE: OGC ticket No. 2012-0215 logged in for review-Commission Paper --- FW: AO Report for OGC Second Review and NLO

(b)(5)

From: Tomon, John RES
Sent: Tuesday, January 31, 2012 4:59 PM
To: Mizuno, Geary; Pope, Tia
Cc: Spencer, Mary; Chidakel, Susan; Biggins, James; Bush-Goddard, Stephanie; Lewis, Doris
Subject: RE: OGC ticket No. 2012-0215 logged in for review-Commission Paper --- FW: AO Report for OGC Second Review and NLO

Geary

Good afternoon! I incorporated the changes that Mary Spencer and you provided into the document in ADAMS. I have been in training this week and I am checking and answering my e-mails either before or after the training is finished for the day. I have received e-mails from Susan regarding some of the medical issues in the draft report and I tried to carbon copy you on my responses to her. I will continue to converse with regarding her concerns with the medical issues and hope to have her concerns adequately addressed as soon as possible.

Thanks and have a great day!

V/r

John J. Tomon, CHP
Health Physicist
RES/DSA/HEB
(301) 251-7904 (Office)
(b)(6) (cell)
CSB-3C23 Mail Stop CSB- C3A07M

From: Mizuno, Geary OGC
Sent: Tuesday, January 31, 2012 10:20 AM
To: Tomon, John; Pope, Tia
Cc: Spencer, Mary; Chidakel, Susan; Biggins, James
Subject: FW: OGC ticket No. 2012-0215 logged in for review-Commission Paper — FW: AO Report for OGC Second Review and NLO

John:

(b)(5)

Geary

From: Spencer, Mary OGC
Sent: Monday, January 30, 2012 3:35 PM
To: Mizuno, Geary
Subject: RE: OGC ticket No. 2012-0215 logged in for review-Commission Paper — FW: AO Report for OGC Second Review and NLO

Geary,

(b)(5) Outside of Scope

Outside of Scope

Mary

~~Official Use Only~~ Attorney-Client Privilege/Attorney Work Product

Robles, Jesse

From: King, Mark
Sent: Monday, February 13, 2012 3:02 PM
Subject: IOEB Clearinghouse Screening Summary for Monday, February 13, 2012

NOTE: THIS SUMMARY IS ~~OFFICIAL USE ONLY~~
*****MAY CONTAIN SENSITIVE/ PROPRIETARY OR NRC INTERNAL USE ONLY INFORMATION*****
DO NOT FORWARD ANY PORTIONS OUTSIDE OF NRC WITHOUT FIRST OBTAINING PERMISSION FROM ORIGINATOR

Follow-up/Other Tasks: Twelve (12)

[Note - The information in this part of the Summary is often preliminary in nature and is provided to help IOEB staff communicate and track noteworthy items being followed up by either the Regions or HQ staff.]

Outside of Scope

OUTSIDE OF SCOPE

2) EN 47658 - FORT CALHOUN - UNANALYZED CONDITION - GUIDANCE NOT ADEQUATE TO MITIGATE A DESIGN BASIS FLOOD

During review of the flood protection procedures, inspectors identified deficiencies in the guidance to mitigate a design basis flood event where river level would reach 1014 feet mean sea level. Pass to TRG Lead for Flooding/Missiles (Ed Smith). Assigned to Jesse Robles.

Outside of Scope

OUTSIDE OF SCOPE

B53

OUTSIDE OF SCOPE

Outside of Scope

OUTSIDE OF SCOPE

Outside of Scope

2) EN 47658 - FORT CALHOUN - UNANALYZED CONDITION - GUIDANCE NOT ADEQUATE TO MITIGATE A DESIGN BASIS FLOOD

Outside of Scope

OUTSIDE OF SCOPE

Attendees at Screening Meeting:

Jesse Robles – by phone
Bob Bernardo- by phone
Mark King
Doug Bollock, NRO
Mary Wegner, RES – by phone

Robles, Jesse

From: King, Mark
Sent: Thursday, February 16, 2012 2:37 PM
Subject: IOEB Clearinghouse Screening Summary for Thursday, February 16, 2012

NOTE: THIS SUMMARY IS ~~OFFICIAL USE ONLY~~
MAY CONTAIN SENSITIVE/ PROPRIETARY OR NRC INTERNAL USE ONLY INFORMATION
DO NOT FORWARD ANY PORTIONS OUTSIDE OF NRC WITHOUT FIRST OBTAINING PERMISSION FROM ORIGINATOR

Outside of Scope

OUTSIDE OF SCOPE

Outside of Scope

OUTSIDE OF SCOPE

6) LER 2852011003R02 **- FORT CALHOUN: INADEQUATE FLOODING PROTECTION DUE TO INEFFECTIVE OVERSIGHT.**

See LER update. Pass to TRG Lead for Flood Protection (Ed Smith), and SW/UHS (Gerard Purciarello). Assigned to Jesse Robles.

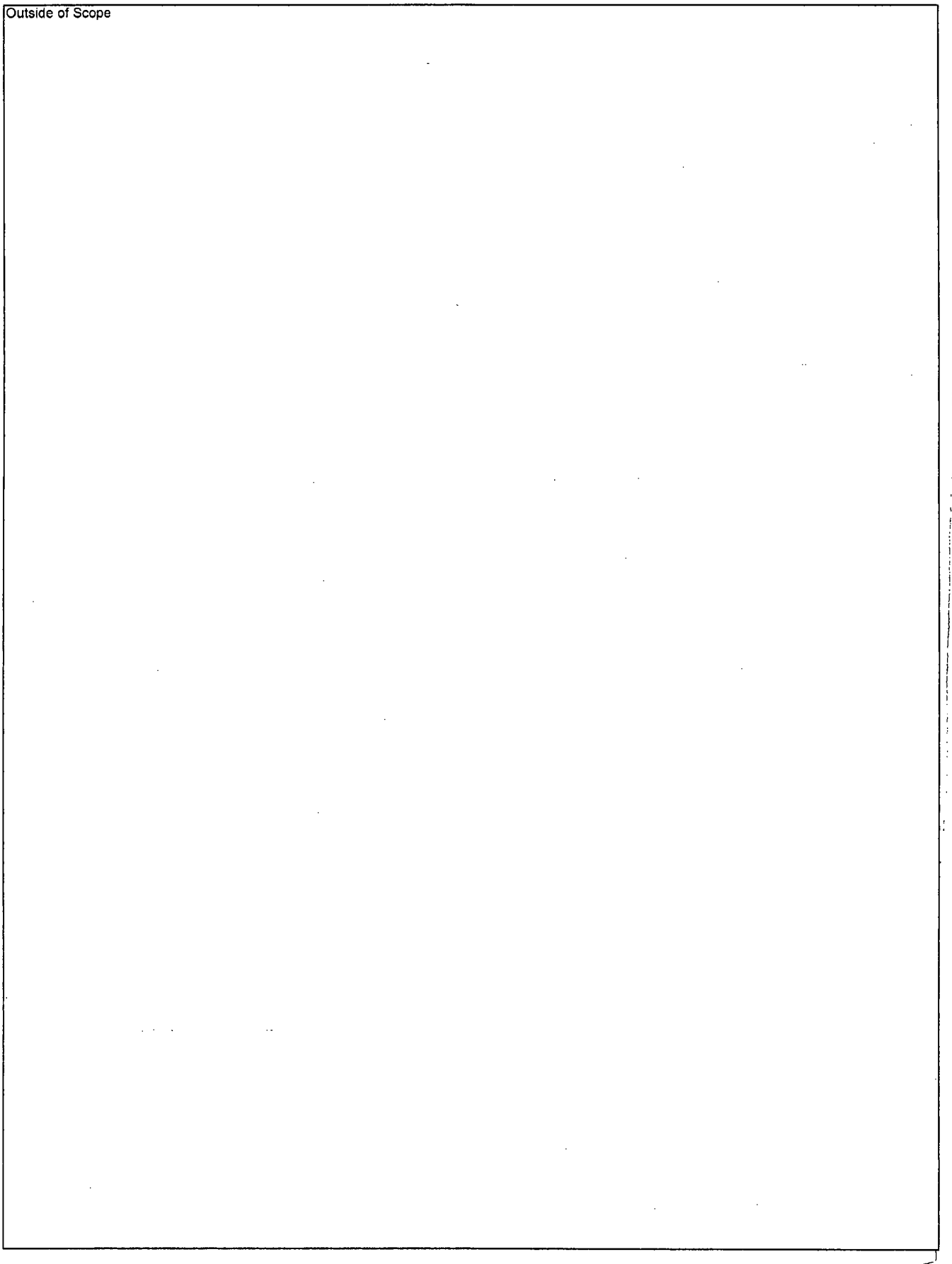
7) LER 2852011003R03 **- FORT CALHOUN: INADEQUATE FLOODING PROTECTION DUE TO INEFFECTIVE OVERSIGHT.**

See LER update. Pass to TRG Lead for Flood Protection (Ed Smith), and SW/UHS (Gerard Purciarello). Assigned to Jesse Robles.

Outside of Scope

OUTSIDE OF SCOPE

OUTSIDE OF SCOPE



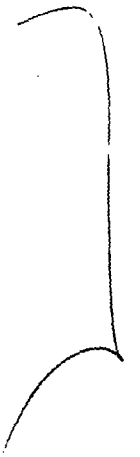
OUTSIDE OF SCOPE

Outside of Scope

Attendees at Screening Meeting:

Jesse Robles
Bob Bernardo

Dave Garmon
Mark King
Doug Bollock, NRO
Mehdi Reisifard, RES– by phone



Re-Marked
~~All Ex 5 Predecisional~~

Ft Calhoun oversight – ~~Sensitive Pre-Decisional~~ **February 14, 2012**

Recap history

- 2010 - 'yellow' finding for inadequate strategies and procedures to protect the site up to 1014' (licensing basis)
- 2010 – 'white' finding for inadequate control of SGI
- April 2011 - FCS shuts down for refueling outage
- June 2011 - ACE projects water levels at FCS up to 1007' (3 ft above site grade level)
- June 2011 – NOUE with water approaching 1004'
- June 2011 – Alert for fire in safety-related switchgear room
- July 2011 – water reaches about 1006' 11"
- July 2011 – public meeting on restart plan commitments
- August 2011 - NRC finalized a 'white' finding for inadequate actions to evaluate and fix a RPS coil – it was ultimately found failed in unsafe condition.
- August 2011 – **CAL issued containing restart commitments (flood related)**
- September 2011 – FCS oversight move to **Column IV** (a repetitive degraded cornerstone) – facility considered safe to operate - licensee plans to complete their preparations for 95003 inspection after startup
- September 2011 – water <1004'
- September 2011

(b)(5)

Ex. 5 deliberative predecisional - different from final Agency Decision

- December 2011 – **MC 0350 oversight applied. MC 0350 aimed to handle situations where multiple/significant examples of frontline equipment degradation and/or a significant operational event have substantially reduced safety margins or have the potential to indicate a substantial reduction in safety margins.**

Analysis:

The August 2011 CAL addressed actions to inspect, test, and resolve system, structure or component issues resulting from the site grade level being underwater for 60+ days.

Column IV of action matrix addresses site-wide performance issues, but the facility is considered safe to operate. The site's original strategy to do their 95003 preps after startup was viable, but in essence meant that their site-wide assessment of identifying and addressing the causes of the site-wide performance issue was not going to happen until after startup.

In MC 0350, this strategy is no longer viable.

MC 0350 aimed to handle situations where multiple/significant examples of frontline equipment degradation and/or a significant operational event have substantially reduced safety margins or have the potential to indicate a substantial reduction in safety margins. Both exist at Ft. Calhoun.

Also, MC 0350 gives the flexibility to formulate inspection/assessment mechanisms for long periods of shutdown where performance indicators are not valid and the baseline inspection program cannot be completed.

The licensee has two significant cause evaluations underway: 1) Corrective Action Program 'broke' and 2) Lack of Organizational Effectiveness (need to confirm the problem statements).

#1 and #2 combined with multiple/significant examples of frontline safety equipment degradation dictate the need to 3) determine, **before plant restart,** the causes (called key attributes in IP 95003), extent of causes, and extent of the degradation of structures, systems, and components; and, how the issues have or will be addressed.

NRC will use the results of #3 are needed to inform the restart checklist. Ultimately we plan to revise the CAL that is in place to include items from restart check list.

NRC is interacting with site leadership to understand how actions will accomplish #3.

(b)(5)

Ex. 5 deliberative

Consider the oversight/governance employed to ensure Board is meaningfully apprised of relevant site performance issues.

Ft Calhoun Oversight ~~– Sensitive Pre-Decisional~~ **February 14, 2012**

Key Points for OPPD Board of Directors

Good morning. My name is Bill Borchardt. I am the Executive Director for Operations for the Nuclear Regulatory Commission.

With me is Elmo Collins, whom some of you have met, the Regional Administrator for NRC Region IV.

Thank you for taking the time to talk to us about NRC's assessment of the safety performance of Ft. Calhoun Station.

The purpose of our requesting this meeting is to ensure, by communicating at all levels of the OPPD organization that the issues are understood and the commitment and resources to resolve the issues are being applied.

Most recently on December, 13, 2011, we communicated to you that we had placed Ft. Calhoun Station into a special category of NRC's inspection and assessment processes, described in our Inspection Manual Chapter 0350, and one that is designed to provide for increased verification of safety for situations where a nuclear power plant is shutdown for an extended period of time for performance issues stemming from a significant operational event.

Specifically, Ft. Calhoun Station was shutdown in April 2011 for a refueling outage. The station remained shut down when high levels of Missouri River water covered the site grade level for an extended period of time, and remains shutdown today.

On June 7, a fire had occurred in safety-related electrical switchgear that impacted both trains of safety-related equipments. Subsequently, Ft. Calhoun Station review and NRC inspection determined that cause for the fire traced its roots back to a design modification that had been performed about two years ago. This modification introduced an unreliable configuration and the potential for high electrical resistance connections on 12 safety-related breakers. Preliminary evaluations show that this configuration combined with poor maintenance practices caused the failure and that this event and configuration were risk significant.

To put this special category of NRC oversight into perspective, NRC has not needed to use it for almost a decade.

Accordingly, we are meeting with you to ensure that you have full recognition of the issues that need to be resolved, their significance, and that you understand the substantial level of support and commitment that will be needed from the Board of Directors to resolve these problems.

Ft. Calhoun Station performance has reached the point that a thorough, comprehensive review of site equipment performance and organizational effectiveness must be completed before plant restart is warranted.

The most relevant items for safety from this review will need to be resolved prior to plant restart. These items will be included in a modified NRC Confirmatory Action Letter and form what we call the "restart" checklist. NRC will inspect these items before plant restart.

The results of the equipment and organizational reviews will also inform your long-term, integrated performance improvement plan/business plan.

Where is Ft. Calhoun today? This comprehensive review has not been done and an integrated plan is currently being developed, putting us at the very front end of developing the restart checklist.

Accordingly, NRC will continue to meet with station managers to understand the scope of the integrated plans and the results of the review when completed and incorporate the appropriate items into the "restart" checklist.

The NRC emphasizes that:

- These problems did not emerge quickly and will not be quickly resolved. A significant amount of work has yet to be completed to determine the extent of problems, and extent of causes of problems. As a result, there is a high amount of uncertainty surrounding the level of effort/resources that will be needed to accomplish the needed actions.
- The site is still in discovery. Expect more performance insights and more items needing corrective action to be identified.
- It is imperative that site reviews and actions be thorough, probing, and challenging. The preliminary results from the flooding inspection indicate that site preparation and actions fell short in that it took NRC inspection to uncover a potential unanalyzed condition illustrating that the site still needs to consider the full range equipment and actions to protect the facility to its licensing basis 1014 feet.
- Your ultimate goal needs to be to establish a long term, sustainable high level of safety performance at Ft. Calhoun Station.

We welcome your comments and we will elaborate on any of our comments as needed.

~~Sensitive Internal Information – OUO Only~~

Narrative – Commission Meeting Ft. Calhoun Station – February 22, 2012

Thank you Bill. Mr. Chairman, NRC Commissioners, good morning.

Slide 4

This morning I plan to briefly recap the sequence of events and regulatory actions with respect to Ft. Calhoun Station that have preceded this meeting and summarize Ft. Calhoun Station's safety performance.

Slide 5 – there were several important actions preceding the CAL that are important

In 2010, NRC finalized a finding of "yellow" significance for an inadequate strategy for protecting the facility to the licensing basis of 1014 feet.

In 2011 the licensee was doing the review and corrective action necessary for NRC to conduct the 95002 inspection. Twice the inspection was scheduled, and twice the licensee reported that their self-assessments showed that they were not yet ready. Finally the 95002 inspection was scheduled for June 2012.

In May 2012 however, the licensee and the NRC learned that release rates from the upstream dams in the Missouri River system were going to reach unprecedented levels, raising the water at Ft. Calhoun Station.

On June 6, the licensee declared an Unusual Event as waters reached the grade level of 1004 feet. Note that on June 7, the licensee declared an alert for a fire in safety-related 480 volt switchgear. Later that day the licensee secured from the alert.

In advance of the rising waters, the licensee took substantial actions to protect the facility, including a number of actions that had been formulated in response to the "yellow" flood protection finding

Region IV also responded, providing 24/7 onsite coverage, with inspector assistance from the other three regions during the emergency response period.

With the station and NRC in emergency response, and with Missouri River levels rising to above site grade, NRC deferred the 95002 inspection. By this time, the site had already entered into the 5th calendar quarter with a degraded cornerstone.

The Missouri River reached a peak level of 1006' 11" in July 2012.

In late July and August, the licensee formulated a plan to recover the site from the high water levels. This plan was submitted to NRC and key items from this plan were formalized as commitments in a confirmatory action letter in August 2012.

During the same period of time, NRC finalized another white finding associated with the reactor protection system. Combined with the previous "yellow" finding, in September 2012 the NRC assessed Ft. Calhoun Station's safety performance as needing the highest level of oversight called for by the reactor oversight process, Column IV. Accordingly, Region IV added a branch to the Division of Reactor Projects to provide specific oversight for Ft. Calhoun Station.

Once the Missouri River receded and the licensee exited emergency response modes, NRC initiated an onsite review of the June 7 fire. NRC found performance deficiencies during this inspection, and while NRC's inspection report is in final draft and the final significance has yet to be determined, NRC has concluded that this fire was a significant operational event.

Beginning in October, with the facility shutdown for over 6 months, NRC's normal PIs losing their efficacy and an inability to meaningfully complete the baseline inspection program, NRC evaluated Ft. Calhoun station performance, and existing guidance to determine the appropriate level of NRC inspection and engagement. Already in Column IV, Manual Chapters 0350 and 0351 were considered.

In December 2012, Region IV determined, in consultation with the Director of the Office of Nuclear Reactor Regulation and the Executive Director for Operations, that Manual Chapter 0350 entry criteria were met and that this level of regulatory oversight and engagement was appropriate to provide added verification of safety of the facility prior to plant restart. This NRC decision was communicated in a December 13, 2012 letter to the licensee.

(b)(5)

Ex5 Deliberative Final Agency Action Pending

Murphy, Martin

From: Murphy, Martin
Sent: Friday, March 09, 2012 2:52 PM
To: Uribe, Juan
Subject: RE: Emailing: Fort Calhoun Station Timeline of Events.docx

This is great.

I have to read the GL and response before I would want to talk

-----Original Message-----
From: Uribe, Juan
Sent: Friday, March 09, 2012 2:44 PM
To: Murphy, Martin
Subject: RE: Emailing: Fort Calhoun Station Timeline of Events.docx

As stated in the USAR, the 1009.3' msl (not 1009.5'msl) is the probable maximum flood (pmf) resulting from the runoff from a maximum probable rain storm over the area below Gavins Point dam, which is the first dam upstream of FCS. Failure of Fort Randall dam (2nd upstream) OR Oahe dam (4th upstream) has been analyzed by USACE and determined to be 1014' msl. Keep in mind FCS does not consider credible the failure of either dam.

The 2003' msl data did not include dam failures. The licensee was using the 1000yr flood to correlate with probable maximum flood, which is 1009.3 in the original design basis and determined the elevation to be the aforementioned 1010.5' msl.

Consequently, they updated their external flood analysis in 2005 to reflect these analyses but to my knowledge, did nothing else. This is based on the premise that there is no actual requirement for them to update their FSAR on 3rd party info. The region, in terms of regulatory space, could not pursue a violation down this road and therefore ended up citing the failure of adequate procedures since 1967. It could be argued that if the licensee found this study as part on a license renewal effort, it was information sought on their behalf and therefore could fall under 50.71(e). But the Region analyzed this and determined it wasn't the way to go.

Hope this helps, keep in mind we can also talk to George Gerond today and he has the best insights into this issue.

-----Original Message-----
From: Murphy, Martin
Sent: Friday, March 09, 2012 2:22 PM
To: Uribe, Juan
Subject: RE: Emailing: Fort Calhoun Station Timeline of Events.docx

What is the FEMA information?

The last section states that there is a TS level of 1009.5. The design basis is 1014. Is this correct? The 2003 data was at 1010.5 - this exceeds the TS limit. What did they do?

-----Original Message-----
From: Uribe, Juan
Sent: Friday, March 09, 2012 1:42 PM
To: Murphy, Martin
Subject: FW: Emailing: Fort Calhoun Station Timeline of Events.docx

B56

w/ comments from RIV inspector

-----Original Message-----
From: George, Gerond
Sent: Friday, March 09, 2012 1:38 PM
To: Uribe, Juan
Subject: Emailing: Fort Calhoun Station Timeline of Events.docx

With changes

Gerond A. George
NRC Region IV
817.200.1562
(b)(6) Cell
gerond.george@nrc.gov

Fort Calhoun Station Timeline of Events

1967

- As part of licensing, FCS gets estimate of 1009'msl design basis flood level from USACE
- It is determined that a dam failure is an incredible event.
- However, DB flood concurrent with dam failure is required by NRC
- This is the 1014' msl DB flood level specified in USAR.
- This is the level that the procedures in place at FCS fail to adequately protect.
- This is the basis for the yellow finding and violation in 2010.

1993

- NRC issues GL 88-20. Specifically, supplement 4 asks licensees to look for external events and verify the inherent risk of these events to the site. It requests a systematic individual plant examination for severe accidents initiated by external events (IPEEE).
- FCS obtains info from USACE as part of IPEEE to answer GL. ~~Documented in CR 2002-1296~~
- USACE levels provided include dam failure and are stated to be 1029' msl.
- FCS determines that, as stated in USAR, dam failure in NOT credible scenario and therefore DB flood levels remain at 1014' msl.
- IPEEE ~~talks about the~~uses 1993 flood data provided by USACE to determine event frequencies and risk
- ~~FCS submits USAR change in January 2008.~~

2002-2003

- As part of LR efforts, FCS evaluates the FEMA information and 1993 USACEanalysis performed in 1993 to verify adequacy.
- A need to evaluate this information in entered into the CA program. ~~Documented~~Condition Report ~~in~~ CR 2002-1296 documents discrepancies between the USAR flood levels, the FEMA, and USACE information.
- Licensee determined that design basis remained unchanged from this evaluation
- Licensee identifies more recent information from USACE and documents it in separate Condition Report~~CR~~ 2003-2664
- ~~A need to evaluate this information in entered into the CA program~~FCS submits USAR change in January 2008.
-

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2004

- Latest info is titled 2004 study "Upper Mississippi River System Flow Frequency Study"
- As action from CR 2003-2664, FCS PRA group evaluated the new information and completed new external flood analysis in August 2005.
- New flood elevations were 3' higher for each flooding frequency.

- When 2003 data was extrapolated to 1000 year flood frequency, it was found to be 1010.5' msl. This was higher than original probable maximum flood and TS value of 1009.5' msl. ~~Site is protected to 1014' msl.~~
- ~~Therefore, the site is still protected.~~ Result of the 2005 evaluation results in an action to change the IPEEE and probalistic risk assessment. No action was developed to evaluate the design basis.
- Licensee did NOT develop corrective action plan to evaluate potential change to DB and operating procedures.
- 2005 external flood analysis was NOT mentioned in USAR change done in January 2008.

Robles, Jesse

From: King, Mark
Sent: Monday, April 30, 2012 2:41 PM
Subject: IOEB Clearinghouse Screening Summary for Monday, April 30, 2012

NOTE: THIS SUMMARY IS ~~OFFICIAL USE ONLY~~
MAY CONTAIN SENSITIVE/ PROPRIETARY OR NRC INTERNAL USE ONLY INFORMATION
DO NOT FORWARD ANY PORTIONS OUTSIDE OF NRC WITHOUT FIRST OBTAINING PERMISSION FROM ORIGINATOR

Follow-up/Other Tasks: Eighteen (18)

[Note - The information in this part of the Summary is often preliminary in nature and is provided to help IOEB staff communicate and track noteworthy items being followed up by either the Regions or HQ staff.]

Outside of Scope

OUTSIDE OF SCOPE

6) LER 2852012001R00 **- FORT CALHOUN: INADEQUATE FLOODING PROTECTION PROCEDURE.**

See LER text. This issue was screened in as IFR 2011-01 earlier. Pass to TRG Lead for Flood Protection (Ed Smith) and SW/UHS (Gerard Purciarello). Assigned to Jesse Robles.

Outside of Scope

OUTSIDE OF SCOPE

B57

OUTSIDE OF SCOPE

Outside of Scope

OUTSIDE OF SCOPE

Outside of Scope

Attendees at Screening Meeting:

Mark King –by phone
Jesse Robles–by phone
Bob Bernardo–by phone
Eric Thomas- by phone
Russ Haskell
John Thompson
Mehdi Reisi-Fard (RES)- by phone
Doug Bollock (NRO) –by phone

Biggins, James

From: Mizuno, Geary
Sent: Thursday, May 10, 2012 2:20 PM
To: Matharu, Gurcharan
Cc: Scott, Catherine; Safford, Carrie; Benowitz, Howard; Biggins, James; Jones, Bradley
Subject: RE: Fort Calhoun

(b)(5)

Geary

From: Matharu, Gurcharan
Sent: Thursday, May 10, 2012 7:21 AM
To: Mizuno, Geary
Subject: RE: Fort Calhoun

OK thanks,
It seems that the licensee gave us 'inadequate information when the application to change the wording as per STS was submitted.

Singh

From: Mizuno, Geary
Sent: Wednesday, May 09, 2012 5:33 PM
To: Matharu, Gurcharan
Subject: RE: Fort Calhoun

(b)(5)

From: Matharu, Gurcharan
Sent: Wednesday, May 09, 2012 5:18 PM
To: Mizuno, Geary
Subject: Fort Calhoun

Geary,
Fort Calhoun is currently shutdown and have been liberally removing BOTH their EDGs out of service as they claim that the TS allows operation of RHR with offsite power alone when the RCS is below 300F.
The attached SE made subtle changes in their TS that allows them to operate in this manner.
What would it take for us to retract this change?

Singh

NRR Nuclear Reactor Regulation
@OperatingExperienceCommunity
Continual Learning Through Knowledge Sharing

Information Security Reminder

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Page: 1

Jesse Robles *(2/6/2012 9:26:56 am)*

Revised on 4/19/2012 11:05:39 am

FORT CALHOUN - NOUE DECLARED DUE TO HIGH RIVER LEVELS AND ALERT DECLARED DUE TO FIRE IN SWITCHGEAR ROOM ISSUES - SITE PLACED UNDER IMC 0350 OVERSIGHT

Summary

On June 6, 2011, while shutdown for a refueling outage, elevated river levels prompted Fort Calhoun to declare a Notification of Unusual Event (NOUE). On June 7 while still in the NOUE, an Alert was declared due to evidence of a possible fire in a switchgear room. Due to the previous significant performance issues in addition to these events, Fort Calhoun Station was placed under IMC 0350 - "Oversight of Reactor Facilities in a Shutdown Condition Due to Significant Performance and/or Operational Concerns." The switchgear room fire issue was subsequently determined to be a finding of high safety significance (a RED finding).

Event Description

See Public Webpage on Special NRC Oversight at Fort Calhoun Station and FCS Oversight SharePoint Website.

Outside of Scope

Fort Calhoun Station (FCS) had entered a scheduled refueling outage on April 9, 2011. When indications of imminent flooding were received, the site entered Abnormal Operating Procedure 1 (AOP-1), Acts of Nature, on May 22, 2011 and commenced preparation for the rising river level. The site began sandbagging procedures and installation of flood gates to protect the site up to 1007 feet river level. Site staff staged materials to support flood protection up to 1014 feet, and installed an AquaDam/aqua-berm (design is similar to a large inner tube filled with water, see AquaDam website) to protect the entire protected area (with exception of the intake structure) up to 1012 feet of river level. A NOUE was declared on June 6, 2011 due to the river level expected to exceed the 1004 feet NOUE threshold (see EN 46929, and PNO-IV-11-003).

Exemption 2

B59

Fort Calhoun Arial Picture of Flooding

The NRC Operating Experience Branch gave a presentation at an international conference regarding the Fort Calhoun flooding event response which includes more photographs of the site and includes lessons learned and other insights. See slides.

Fire Event

On June 7, 2011, while the plant was in Mode 5 and the site was in a NOUE due to the high river level, fire alarms were received in the control room and the Halon system discharged for the Bus 1B4A switchgear room. A safety related 480 volt AC load center supply breaker had failed. The fire brigade responded to the alarm and found the room filled with smoke, but no active fire. During the event, both trains of class 1E Direct Current (DC) grounded due to extensive damage inside cubicle 1B4A, which resulted in numerous control room alarms that are fed from the DC circuits. At 0930 CDT electrical buses were de-energized to aid in mitigating damage. This resulted in both trains of spent fuel pool cooling to be de-energized. At 0940 CDT the site declared an Alert due to a fire affecting the operability of plant safety systems required to establish of maintain safe shutdown (see EN 46932 and PNO-IV-11-004). During the event, the local fire department responded to the site. At 1147 CDT, power was restored to one train of spent fuel pool cooling. The spent fuel pool temperature rose approximately 3 degrees Fahrenheit while cooling was out of service. Shutdown cooling was not affected and remained in service during the event. The site exited the Alert at 1313 CDT after confirming that the fire was extinguished and the area was ventilated to restore access. At 1056 EDT, the NRC entered the Monitoring Mode as a result of the event, and exited at 1439 EDT after SFP cooling was restored (see PNO-IV-11-004A). An MD 8.3 evaluation was performed for this event, and a Special Inspection Team was dispatched to the site.

UPDATE: On April 10, 2012 press release IV-12-012 was issued: NRC ISSUES FORT CALHOUN STATION INSPECTION FINDING OF HIGH SAFETY SIGNIFICANCE [Red Finding]. See Enforcement Action notification (EA 12-023).

Failure of the Aqua Berm

Outside of Scope

Outside of Scope

Cause of the Breaker Failure

The original 1B4A supply breaker (model General Electric (GE) AK-50) had been replaced with a Square D breaker in 2009 due to aging issues and a lack of available spare parts (a total of twelve breakers were replaced at that time). These were not a direct replacement for the GE breaker; therefore a cradle assembly was used to match up the Square D equipment with the GE switchgear. The cradle consists of finger clusters that engage the bus bars at the back of the GE switchgear, and had stabs on the circuit breaker side of the cradle to accept the breaker finger clusters. The circuit breaker cradle fingers were longer than the original AK-50 breakers, and they engaged the bus bar in a contact area of hardened grease and copper oxide build-up. This caused a high resistance connection at the stab to finger interface. The high resistance connection overheated the finger cluster resulting in bus grounding and phase-to-phase shorting.

Other contributing causes to failure of the breaker included:

- An acrid odor that existed for three days preceding the bus fire was not adequately communicated to engineering, maintenance, or management.
- FCS engineering had limited knowledge of GE AKD-5 switchgear resulting in overreliance on vendor knowledge and skill.
- An FCS modification procedure lacks requirements to identify and compare critical design characteristics of equipment being modified. Additionally, this procedure has weak requirements for the use of operating experience criteria.
- Maintenance procedures that govern 480 V bus cleaning are inadequate. Also, access to the bus side of the GE AKD-5 switchgear is difficult limiting the selection of inspection/testing methods.
- As-left resistance readings from the line to load side of the switchgear following circuit breaker replacement were not confirmed.

See LER 2852011008R01 for more information on the failure of supply breaker 1B4A.

Previous Performance Issues and Transition into IMC 0350

Fort Calhoun Station's has had several performance issues in recent years that have resulted in increased NRC oversight. These issues are described below.

- On October 6, 2010, the NRC issued a Yellow Finding (substantial safety significance) to Fort Calhoun Station due to inadequate flood protection strategies. This finding is the subject of OpE Issue for Resolution (IFR) 2011-001 and associated OpE COMM.
- On July 18, 2011, The NRC issued a White Finding (low to moderate safety significance) to Fort Calhoun for the failure to preclude shading coils from repetitively becoming loose material in the M2 reactor trip contactor. The loose parts in the trip contactor can become an obstruction and cause the failure of the contactor. This issue was included in the OpE COMM Contribution of Corrective Action Program Deficiencies to Greater-than-Green Inspection Findings and IFR 2011- 010 due to the repetitive nature of the condition.
- Fort Calhoun Station transitioned to Column IV of the Reactor Oversight Process (ROP) Action Matrix in September 2011 due to the Mitigating Systems cornerstone being degraded for more than four consecutive quarters (due to the Yellow Finding), with an additional input to the action matrix (due to the White Finding). See the Mid-Cycle Performance Review.

Restart of the facility has been delayed by performance concerns involving electrical fire and inadequate train separation, in addition to flood recovery. Following the plant shutdown, additional performance issues were identified that required additional NRC oversight, including:

- Incomplete high energy line break and environmental qualification analyses.
- The breaker failure and fire described above.
- Inadequate communications with state and local officials following the declaration of an ALERT following the fire event.

The NRC issued Confirmatory Action Letter (CAL) 4-11-003 (ML112490164) on September 2, 2011 to confirm the actions FCS planned to take in its submitted Post-Flooding Recovery Action Plan (ML112430102).

Due to these past performance issues in addition to the flood and fire events, Fort Calhoun was placed in IMC 0350, "Oversight of Reactor Facilities in a Shutdown Condition Due to Significant Performance and/or Operational Concerns" (see Notification of Change to Regulatory Oversight of Fort Calhoun Station (ML113470721) and Fort Calhoun IMC 0350 Charter (ML120120661)).

Operating Experience

Flooding Issues
IN 87-49 - Deficiencies in Outside Containment Flooding Protection
IN 94-27 - Facility Operating Concerns Resulting from Local Area Flooding
Inspection Procedure 71111.06 - Flood Protection Measures

Breaker Issues
Outside of Scope

Outside of Scope

For questions or concerns related to this OpE COMM, contact Jesse Robles (jesse.robles@nrc.gov), 301-415-2940.

Outside of Scope

Page: 1

Boyer, Rachel

From: Collins, Elmo
Sent: Tuesday, November 01, 2011 8:59 AM
To: Borchardt, Bill
Cc: (b)(5)
Subject: Ft Calhoun

Bill

(b)(5)

Ex 5
Predecisional

1:60

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Page: 1

Jesse Robles *(2/6/2012 9:26:56 am)*

Revised on 4/19/2012 11:05:39 am

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B.2
6

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Outside of Scope

Outside of Scope

For questions or concerns related to this OpE COMM, contact Jesse Robles (jesse.robles@nrc.gov), 301-415-2940.

Outside of Scope

Page: 1

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Page: **1**

Jay Patel *(5/2/2011 12:29:43 pm)*

Revised on 4/19/2012 1:23:41 pm

INADEQUATE DESIGN CHANGE IMPLEMENTATION INVOLVING ABANDONED IN PLACE EQUIPMENT

Summary:

This COMM intends to raise awareness of underlying issues associated with two recent events caused by inadequate design change implementation involving abandoned in place equipment. The two events highlight the importance of properly performing and implementing design change packages associated with abandoned in place systems, structures, and components (SSCs).

Discussion:

Outside of Scope

OUTSIDE OF SCOPE

The second event, reported by the Fort Calhoun Station on February 27, 2011, identified unsealed through wall penetrations in the intake structure that were below the licensing basis flood elevation. These penetrations had been installed during the original installation of the plant security system and were abandoned when the security system was replaced in 1985. The penetrations for the new security system were sealed, however, the

old penetrations were abandoned in place and never sealed, thus making the intake structure vulnerable to water inflow during an extreme flooding event. The unsealed penetrations could have jeopardized the ability of the raw water pumps (located in the intake structure) to perform their design basis function during an accident. A configuration change was later developed and permanent seals were installed in the subject conduit penetrations.

The cause of the event pertinent to this COMM was an inadequate design change process that did not require abandoned in place penetrations below the flood line to be sealed thus invalidating design assumptions and placing the plant in an unanalyzed condition.

Construction Experience Insights:

The following valuable insights can help avoid latent problems during the design and construction of nuclear facilities similar to the ones caused by these two events:

1. Engineering changes made to one system should not adversely affect other safety systems or invalidate design assumptions. Refer to IP 35007, Section A3.04.01, Item D for guidance.

2. The applicant/licensee work control process and inspection program should verify that the as-built configuration in the field is consistent with design requirements. Refer to Criterion V and X of 10 CFR 50, Appendix B. In addition, IP 65001.A, Section 02.01 and IP 37051, Section 02.01 provide specific related guidance for the construction of 10 CFR Part 52 plants and 10 CFR Part 50 plants respectively.

Existing Reactors Insights:

To avoid latent problems associated with inadequate design changes or abandoned in place equipment reviews for existing facilities, various Reactor Oversight Process (ROP) inspection procedures such as: IP 71111.18 "Plant Modifications," IP 71111.21 "Component Design Bases Inspection," or IP 71152 "Problem Identification and Resolution" are in place to provide the necessary guidance. Inspectors should be aware of the type of issues described in this COMM and look to identify them during their plant walkdowns and follow-up as necessary during their normal inspection reviews.

Selected Related Information:

Outside of Scope

Outside of Scope

*****Update 10/21/11*****

8) FORT CALHOUN - FLOOD BARRIER PENETRATIONS NOT WATER TIGHT (EN 47359). During follow-up inspections of flood barrier penetrations, it was determined some of the water tight conduit fittings were not filled with the material required to make them water tight.

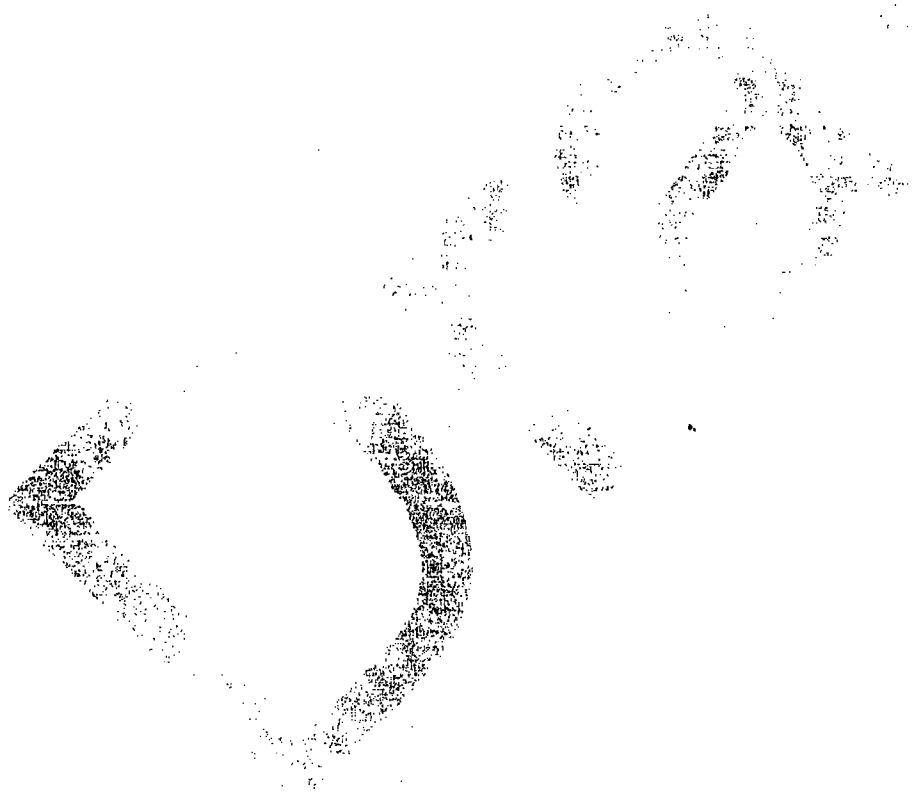
*****Update 11/08/11*****

Outside of Scope

Page: 1

SECTION 2.0

SITE HISTORY, DESCRIPTION, AND BASELINE CONDITION



2.0 SITE HISTORY, DESCRIPTION, AND BASELINE CONDITION

2.1 Geologic Setting

The surficial geology of the FCS site consists primarily of Missouri River alluvium deposited during the Holocene Epoch after Late Pleistocene, Wisconsin glaciation (Miller, 1964). Because it is thought that the Missouri River did not occupy its current position during the Wisconsin glaciation (Miller, 1964), a sequence of erosion of the Missouri River channel and deposition of the present Holocene alluvium is the sequence that has developed the current site stratigraphy. Post Wisconsin glacial event (Late Pleistocene) to Holocene alluvium overlies the Winterset Member of the Dennis Formation Limestone of the Pennsylvanian Kansas City Group at the site. Glacial and alluvial deposits of Quaternary Age (less than 1.6 million years) are less than 100 ft thick at the site but vary from 300 to less than 100 ft thick within a 5-mile radius of the site (Burchette, et al., 1975). Limestone of the Kansas City Group is described as dark gray to light gray, very thinly bedded to massive, argillaceous, fossiliferous, and containing some pyrite crystals and mica (Burchette, et al., 1975). Bedrock is not exposed at the site. A more specific description of soil and bedrock conditions at the site is presented in Section 2.4, Geotechnical Baseline Condition.

Regional geologic structure includes a gentle dip of bedrock bedding to the west (McBee, 2003). Faults within a 100-mile radius of the site are limited to basement structures such as the Nemaha Fault Zone, do not offset Pennsylvanian strata, and are not recognized as active (McBee, 2003).

2.1.1 Historical Seismicity

HDR conducted an inventory of recorded historical seismic events that occurred at a magnitude of 2.0 or greater within 100 miles of FCS. The location of each event, its magnitude, and its distance from the site are shown in Table 2-1. The investigation of the historical seismicity was conducted using the Advanced National Seismic System (ANSS) at http://www.ncedc.org/anss/catalog-search.html. The ANSS is a worldwide earthquake catalog created by merging the master earthquake catalogs of the contributing ANSS member network and can be queried by geographic location.

Table 2-1 – Historical Seismicity Within 100 Miles of Fort Calhoun Station

Year	Latitude (decimal degrees)	Longitude (decimal degrees)	Magnitude	Distance from Site (kilometers)
1877	41.00	-97.00	5.0	99
1902	42.00	-97.60	4.5	140
1935	40.3	-96.20	4.7	136
1981	41.520	-97.630	2.7	132
1995	40.51	-94.95	3.1	145
1997	41.79	-97.18	3.4	100
2004	40.63	-95.55	3.5	106
2009	40.41	-95.86	3.6	124
2010	41.35	-97.01	3.3	83

Source: U.S. Geological Survey (USGS). October 26, 2009. "2008 National Seismic Hazard Maps - Fault Parameters." Earthquake Hazards Program. Retrieved September 20, 2011. http://geohazards.usgs.gov/cfusion/hazfaults_search/hf_search_main.cfm.

2.1.2 Regional Seismicity and Faulting

FCS is located within the Central and Eastern United States (CEUS) as delineated by the U.S. Geological Survey (USGS) (Crone and Wheeler, 2000). The CEUS experiences minimal seismic activity with the exception of specific zones such as the New Madrid Seismic Zone and Mears Fault Zone not located in proximity to FCS (Petersen et al., 2008). In conjunction with many local and state agencies, USGS maintains a database of Quaternary faults for the U.S. (USGS, October 26, 2009). These include known faults that are estimated to have undergone movement in the past 1.6 million years (within the Quaternary Period), or since late Cenozoic Age for Class B faults. Active faults generally include Holocene Age faults that have undergone movement in the past 15,000 years. For this study, the database was searched for all fault classifications (A, B, C, and D). The USGS fault classifications are as follows:

- Class A – Geologic evidence demonstrates the existence of a Quaternary fault (within the past 1.6 million years) of tectonic origin.
- Class B – Geologic evidence demonstrates the existence of Quaternary deformation, but either 1) the fault might not extend deeply enough to be a potential source of significant earthquakes, or 2) the currently available geologic evidence is too strong to confidently assign the feature to Class C but not strong enough to assign it to Class A.
- Class C – Geologic evidence is insufficient to demonstrate 1) the existence of tectonic faulting, or 2) Quaternary slip or deformation associated with the feature.
- Class D – Geologic evidence demonstrates that the feature is not a tectonic fault or feature; this category includes features such as joints, landslides, erosional or fluvial scarps, or other landforms resembling fault scarps but of demonstrable non-tectonic origin.

No Class A or B fault exists within a 400-mile radius of FCS. The closest Class A or B fault is the Cheraw fault, which is 450 miles to the southwest in southeastern Colorado. The closest fault system is the Ord escarpment, located approximately 150 miles west of FCS. This fault system is a Class C feature (it is not associated with tectonic processes) and was determined by Machette et al. (1998) as not exhibiting Quaternary movement. The USGS database contains no Class D faults within a 400-mile radius of FCS.

2.1.3 Seismic Hazard

Assessment of seismic hazard is based on the earthquake characteristics and the causative fault associated with the earthquake. These characteristics include magnitude of maximum earthquake, distance from the site to the causative fault, fault length, and activity of the fault. The effects of site soil conditions and the mechanism of faulting are accounted for in the attenuation relationships.

The probabilistic strong ground-motion values were developed from USGS gridded databases, developed by Frankel, et al. (1996 and 2002), and with most recently developed Next Generation Attenuation (NGA) relationships by Petersen, et al. (2008). These values were queried from USGS-maintained databases located at http://gldims.cr.usgs.gov/website/nshmp2008/viewer.htm and https://geohazards.usgs.gov/deaggint/2008/. The results of this analysis are presented in Attachment 1, Deaggregation Plots. Attachment 1 illustrates the regional probabilistic strong ground motion for the 10 percent probability of exceedance in 50 years, 2 percent probability of exceedance in 50 years, 2 percent probability of exceedance in 100 years, and 2 percent probability of exceedance in 200 years. Estimated peak ground acceleration (PGA) is summarized in Table 2-2.

Table 2-2 – Peak Ground Acceleration as Percentage for Various Return Periods		
Earthquake Return Period (years)	**Approximate Probability of Exceedance in 50 years (%)**	**Peak Ground Acceleration[A]**
500	10	0.0142 g
2500	2	0.0431 g
5000	1	0.0669 g
10,000	0.5	0.1020 g
[A] - Peak ground acceleration is measured by the acceleration due to gravity (g).		
Source: USGS. July 21, 2011. "2008 Interactive Deaggregations (Beta)." *Geologic Hazards Science Center*. Retrieved September 20, 2011. https://geohazards.usgs.gov/deaggint/2008/.		

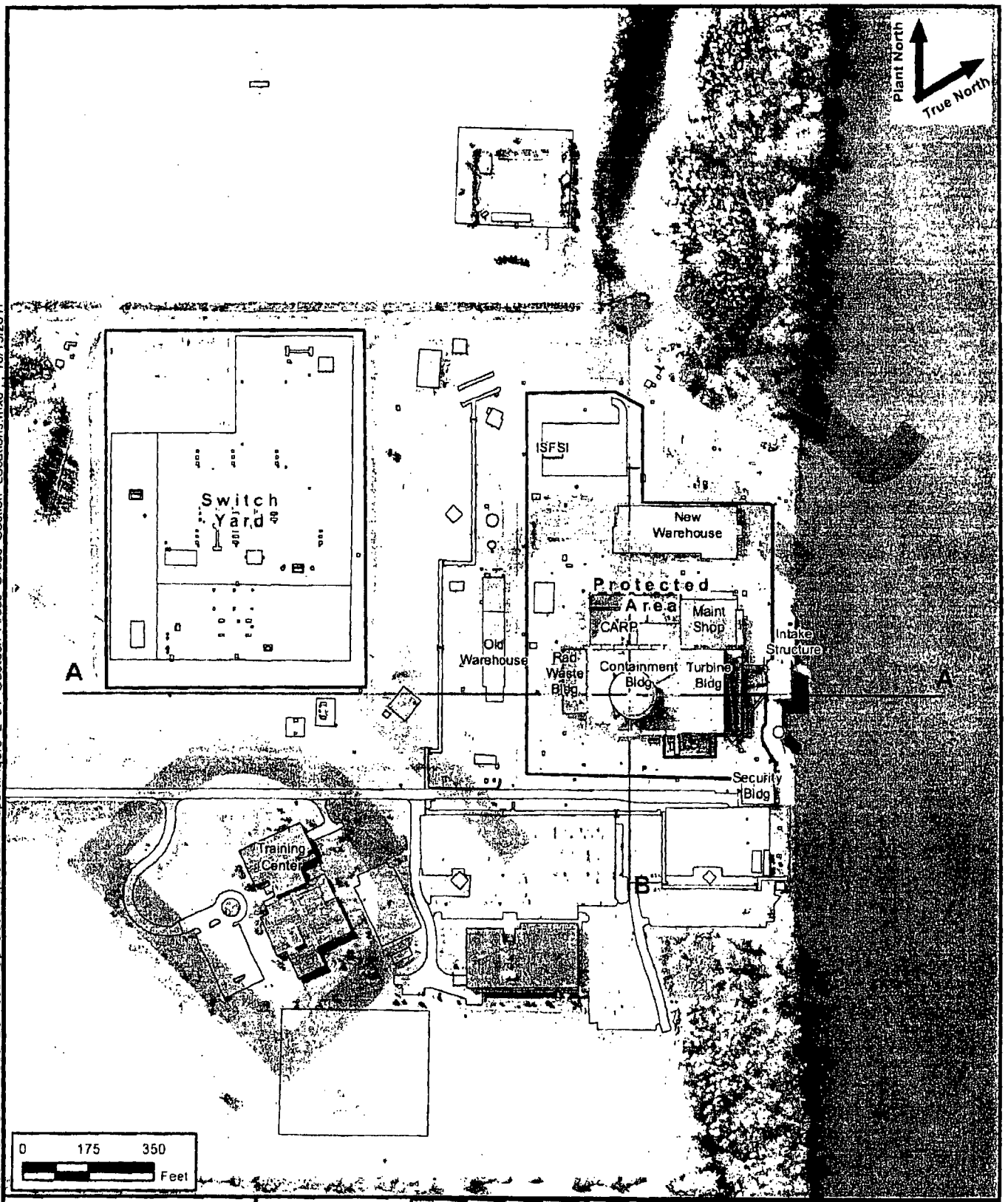
2.1.4 Site Geologic Hazards

Several geologic hazards have been identified at the FCS site and discussed in previous design reports by Dames & Moore (1968) and Gibbs, Hill, Durham, and Richardson (1967). These hazards include the existence of karst features associated with dissolution of the Winterset Member of the Dennis Formation Limestone, liquefaction of the loose poorly graded sands identified at the site, bank slope stability adjacent to the Missouri River, and scour and erosion of near-surface soils.

2.1.4.1 Karst

Dames & Moore (1968) identified at least two significant karst features in the Winterset Member of the Dennis Formation Limestone that apparently have developed along existing fractures. The features were estimated to be as much as 5 ft wide, 16 ft deep, and 45 ft long and consist of an upper 1.5- to 3-ft void and a lower zone of decomposed limestone and detritus. The approximate location of these features is shown in Figure 2-1, Geotechnical Areas and Cross-Section Locations. Cross-sectional views of the geologic setting are presented in Figures 2-2 and 2-3. Figure 2-2, Section A-A, shows where these karst features approximately intersect the subsurface section.

Pile installation at FCS for the Containment, Auxiliary Building, Turbine Building, and Intake Structure was designed to penetrate any overlying layer of limestone that covers the karst feature and to found the pile on sound rock at the bottom of these features. The potential influence of these karst features on foundation stability is considered minimal. It is likely that additional karst features exist across the site, but the overlying alluvial cover of a minimum of 61 ft offers a buffer to the influence of these features on any structure. Further dissolution of limestone is an assumed process given that the limestone is in contact with groundwater. The most aggressive dissolution of limestone by groundwater occurs in the vadose zone (Mylroie, 1984). The fact that the karst features at the FCS site are covered by approximately 60 ft of alluvial material and are in contact with groundwater that has experienced some subsurface residence time dictates that the rate of karst feature development (limestone dissolution) is low. In addition, the karst features encountered in the 1967 Dames & Moore drilling program were primarily filled with decomposed limestone and detritus. The volume of space needed to allow significant collapse of overlying soils is not present. Therefore, within the expected service life of FCS, the process of limestone dissolution is not significant.



Approximate Extent and Orientation of Linear Karst

Zone of Vibroflotation

Zone of Pile Installation

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Geotechnical Areas and Cross Section Locations
Fort Calhoun Station

Plant and Facility Geotechnical and Structural Assessment

HDR

DATE
Oct 2011

FIGURE
2-1

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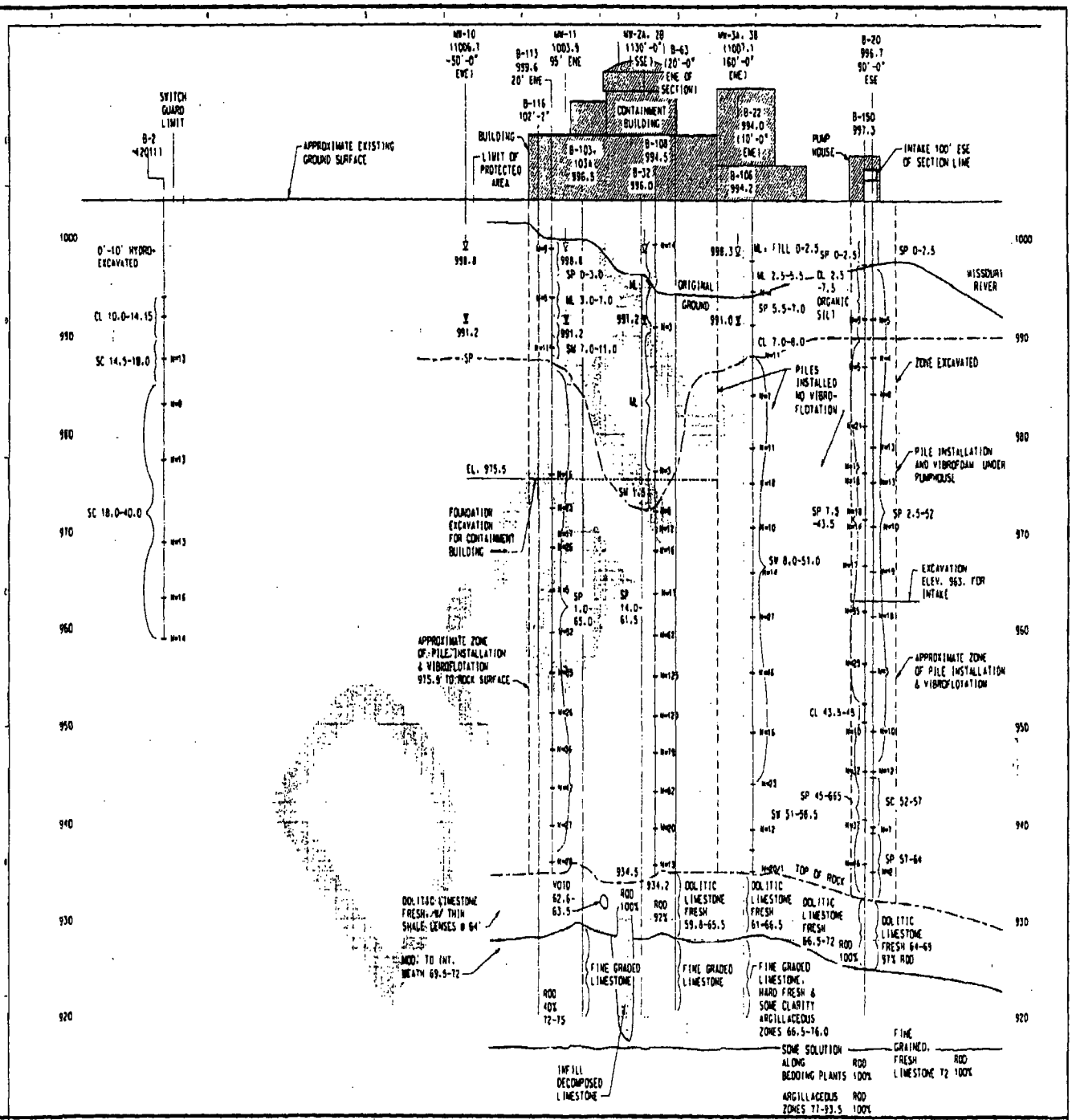

NOTES:
STRUCTURE HEIGHTS SHOWN ARE CONCEPTUAL.
▽ GROUND WATER ELEVATION 12-10-10
▽ GROUND WATER ELEVATION 12-10-10
HORIZONTAL SCALE 1" = 100'
VERTICAL SCALE 1" = 10'

OOLITIC LIMESTONE

FINE GRAINED LIMESTONE

Omaha Public Power District

Section A-A
Fort Calhoun Station

Plant and Facility Geotechnical and Structural Assessment

HDR

DATE: Sep 2011

FIGURE: Figure 2-2

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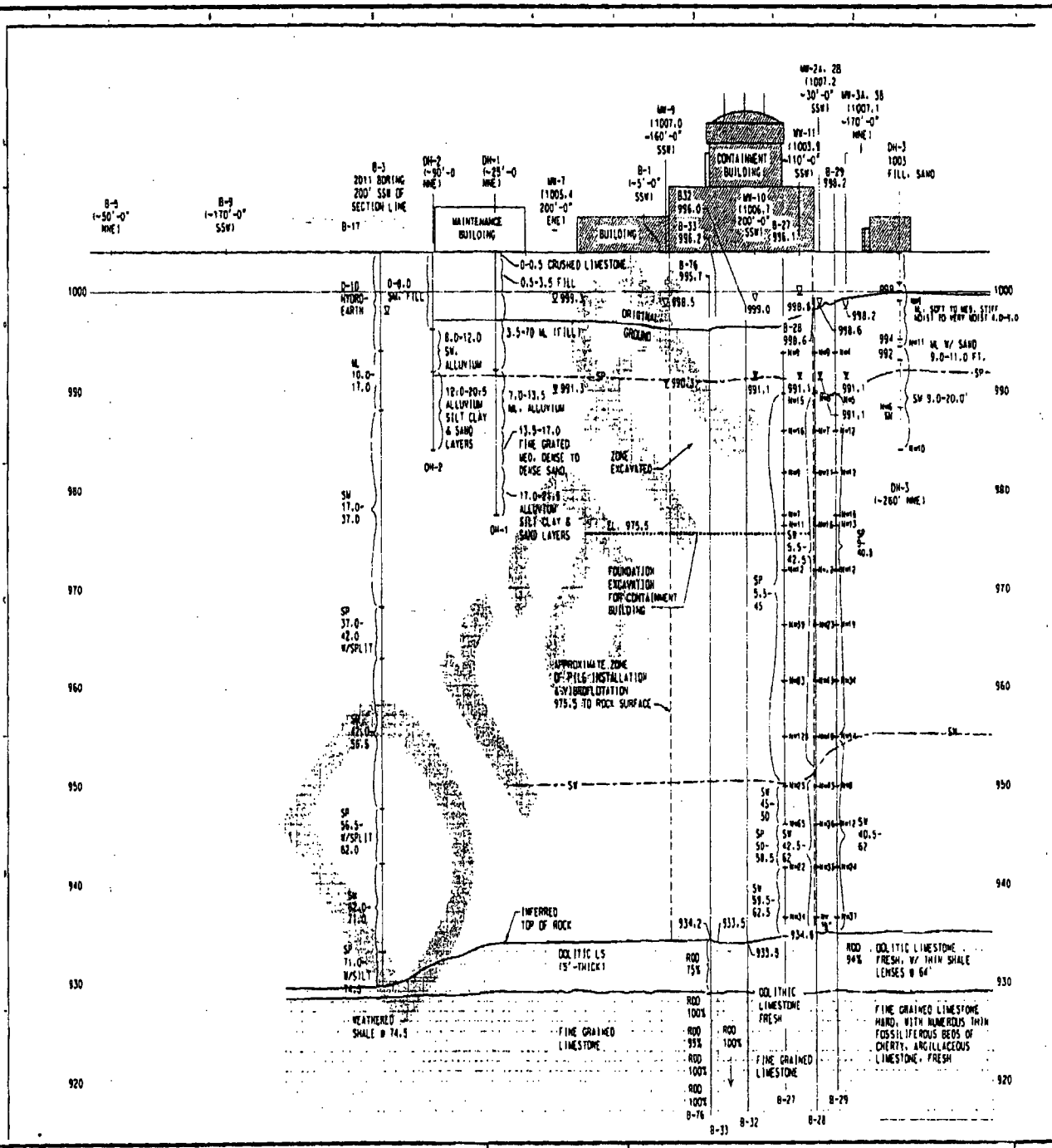

NOTES:
STRUCTURE HEIGHTS SHOWN ARE CONCEPTUAL.

▽ GROUND WATER ELEVATION 12-10-10

▽ GROUND WATER ELEVATION 12-10-10

HORIZONTAL SCALE = 1" = 100'

VERTICAL SCALE = 1" = 10'

OOLITIC LIMESTONE

FINE GRAINED LIMESTONE

Omaha Public Power District

Section B-B
Fort Calhoun Station

Plant and Facility Geotechnical and Structural Assessment

HDR

DATE: Sep 2011

FIGURE: Figure 2-3

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A further understanding of the karst features at the FCS site would require drilling and installation of sampling wells to sample water near the limestone and soil contact in order to assess the chemical characteristics of the groundwater at this interface. This effort is not considered necessary as part of this Assessment Report because the plant has functioned without evidence of foundation subsidence due to karst feature collapse and resulting collapse of overlying soil prior to and during the 2011 flood.

2.1.4.1 Liquefaction of Non-Cohesive Soils

Liquefaction studies have been performed by others for the FCS site using post-construction conditions. The assumptions used in performing the liquefaction analyses and results of those studies have not been reviewed by HDR, but it is believed that the largely non-cohesive, saturated soil materials at the site would be subject to liquefaction given sufficient seismic loading. The pertinent question for this study is whether the potential exists that the 2011 flood changed the saturation and soil density sufficiently to increase liquefaction potential under the maximum credible earthquake (MCE). Ongoing site exploration will quantify the condition of the site soils where drilling is accessible.

2.1.4.2 Bank Slope Stability

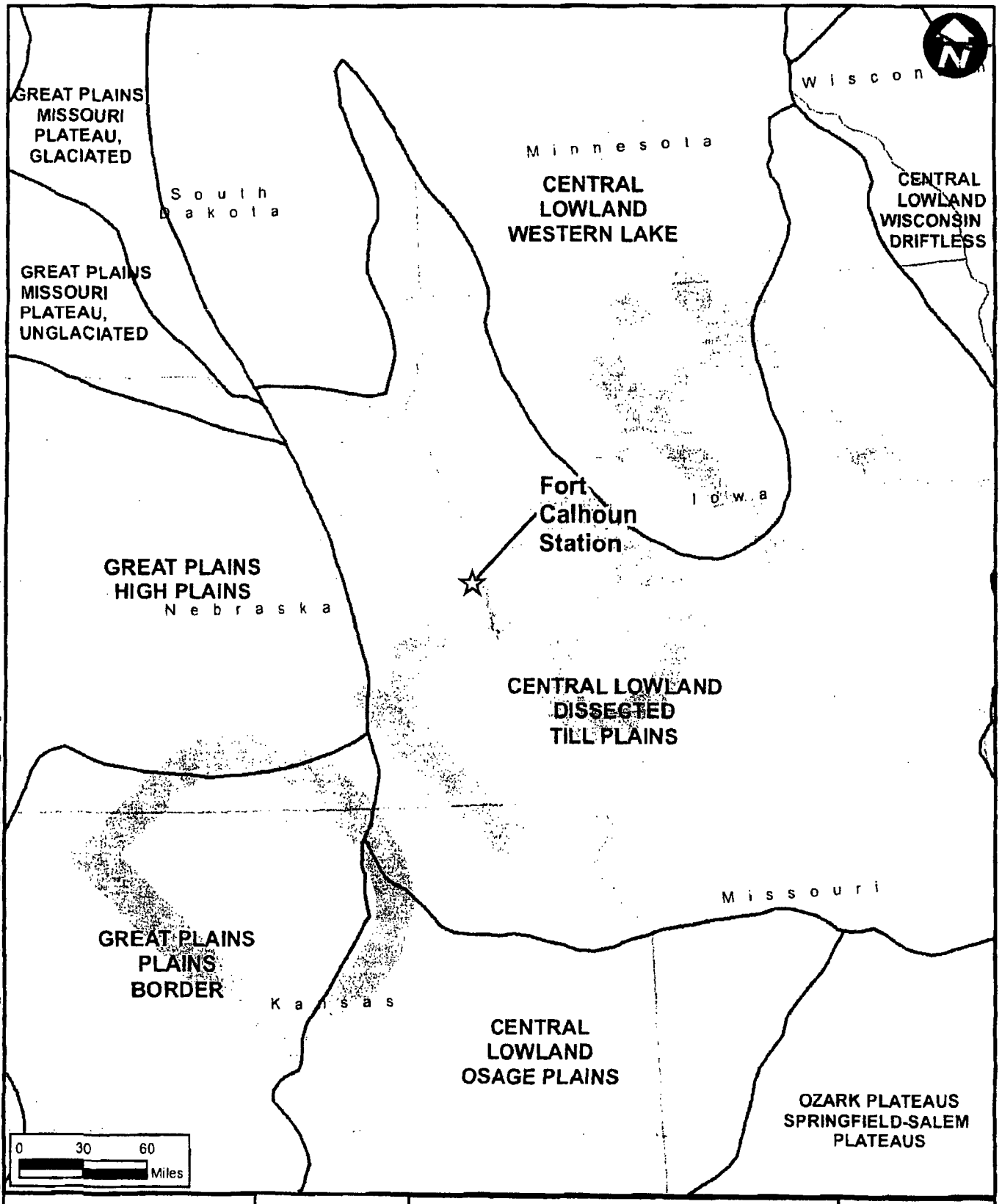
The site has slopes along the Missouri River that could experience stability problems due to river-level increase and then rapid drawdown, resulting in excessive pore pressures in the slopes of the river bank that are adjacent to any of the FCS structures. The mostly non-cohesive nature of the soils will likely allow drainage and dissipation of pore pressure without significant effects on channel slopes. Once river levels have receded, inspection of the Missouri River banks adjacent to the site will provide a visual assessment of this potential slope stability hazard. In addition, five inclinometers were installed to monitor bank slope stability.

2.1.4.3 Scour and Erosion

The inundation of the site has the potential to scour and erode the existing grade and remove soil material from around and beneath structures that are founded near the ground surface. The non-cohesive nature of the site soils indicates scour potential given sufficient water velocity and capacity to carry sediment.

2.2 Geomorphology and Physiographic Setting

FCS is located in northeastern Washington County, Nebraska, approximately 4 miles southeast of Blair, Nebraska. The site lies within the Central Lowland portion of the Interior Plains Physiographic Province, as shown in Figure 2-4 (USGS, 2003). More specifically, the site is classified as part of the Dissected Till Plains, a subdivision of the aforementioned province, a region covered by Pleistocene glacial events that deposited till during glacial advance as well as during glacial retreat. The till has since been partially covered with eolian (wind-deposited) loess deposits and dissected by erosion caused by the Missouri River and its tributaries.



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Omaha Public Power District

Physiographic Setting of Interior Plains Region
Fort Calhoun Station

Plant and Facility Geotechnical and Structural Assessment

HDR

DATE
Sep 2011

FIGURE
2-4

Washington County is also recognized as having two distinct physiographic divisions: 1) uplands formed in loess and glacial till; and 2) floodplains along the Elkhorn and Missouri rivers (U.S. Department of Agriculture, Natural Resources Conservation Service [USDA NRCS], 2004). In addition, the floodplains of the Missouri River are subdivided into the low bottom, which consists of a frequently flooded zone of meander scars and oxbow cutoffs, and the flood basin, which lies between the low bottom and the uplands. The flood basin is less frequently flooded than the low bottom.

2.2.1 Site Soils

The soils of the site are mapped by USDA NRCS (2004) as belonging to the following:

- Haynie silt loam (coarse silty alluvium), 0 to 2 percent slopes, well drained, adjacent to the Missouri River
- Wathena fine sandy loam (sandy alluvium), 0 to 2 percent slopes, moderately well drained
- Onawa silty clay (clayey-loamy alluvium), 0 to 2 percent slopes, somewhat poorly drained
- Albaton silty clay (clayey alluvium), 0 to 2 percent slopes, poorly drained
- Onawa silty clay loam (clayey alluvium), 0 to 2 percent slopes, somewhat poorly drained
- Judson silty clay loam (colluvium), 2 to 5 percent slopes (colluvium), well drained
- Ida silt loam (loess), 5 to 11 percent slopes, well drained

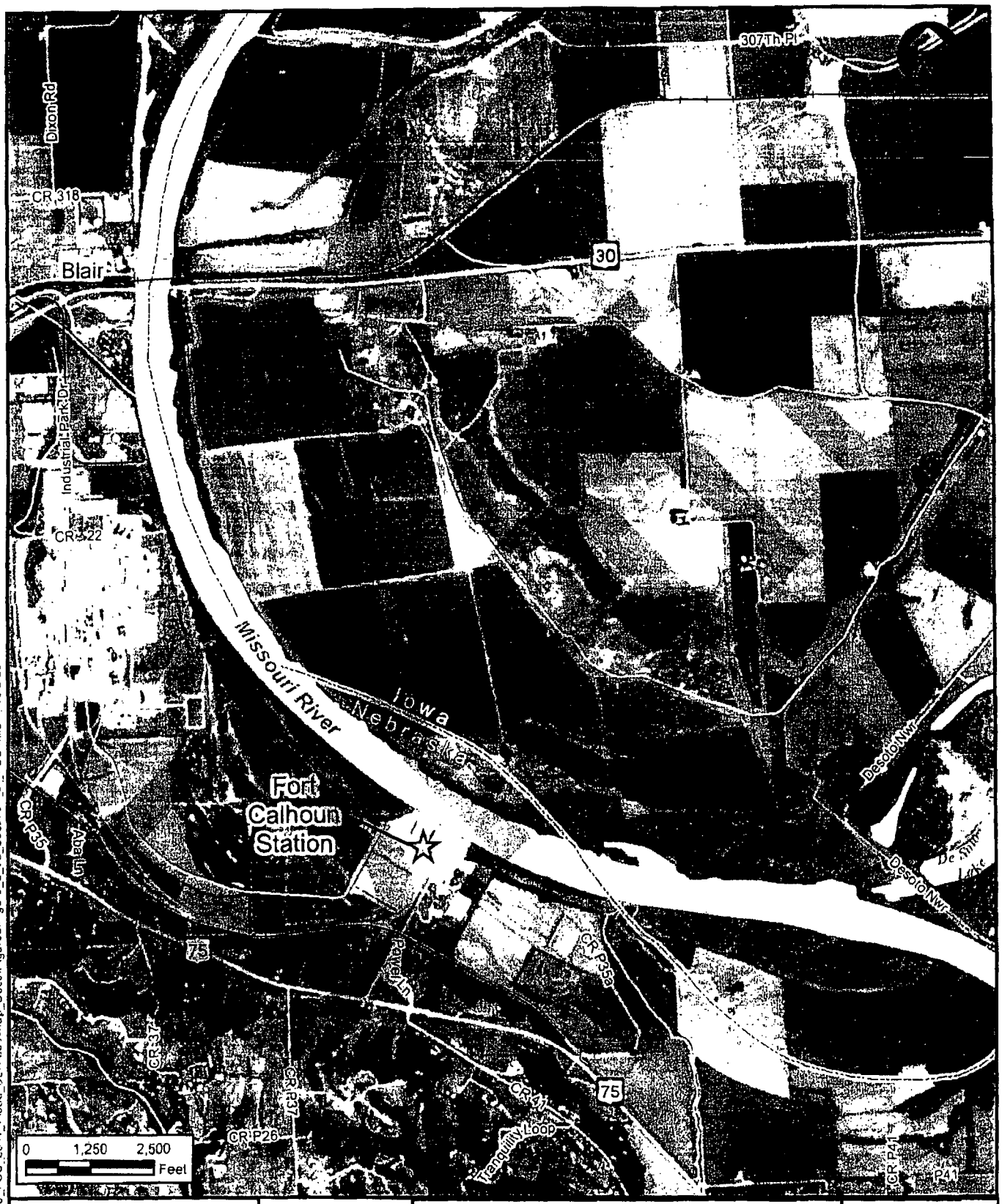
The site soils in the low bottom are derived from the Missouri River alluvial material. Soils of the flood basin are primarily derived from alluvial material but also include some colluvium and wash from the uplands, and soils of the uplands located along the south and southwest limits of the site are derived entirely from glacial till and loess.

2.2.2 Geomorphic Features

The notable geomorphic features of the site include the Missouri River channel, the meander scars and oxbow cutoffs of the Missouri River floodplain, and the rolling hills consisting of glacial till with varying thickness of eolian loess deposits.

2.3 Hydrologic Baseline

FCS is situated directly along the Missouri River at River Mile (RM) 646, as shown in Figure 2-5. FCS is not protected by a levee and is therefore subject to flooding during extreme flood events. The average elevation of the FCS site is approximately 1004 ft. Table 2-3 presents data from USACE from its November 2003 report, "Upper Mississippi River System Flow Frequency Study, Hydrology and Hydraulics, Appendix F, Missouri River." According to these data, el. 1004 ft correlates to a flood recurrence interval of slightly over 25 years or an annual probability of flooding of 0.040. This differs from USAR-2.7, Hydrology, where a stage of 1004.2 ft is reported as being a 0.1 percent annual chance event (1000-year recurrence interval) (OPPD, April 29, 2011). USAR 2-7 acknowledges that multiple flow frequency studies have been performed by USACE subsequent to the development of the design peak flood stage.



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Location of FCS along Missouri River
Fort Calhoun Station

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HDR

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FIGURE: 2-5

Table 2-3 – Missouri River Flood Recurrence Intervals at RM 646 (FCS)			
Recurrance Interval (years)	Probability	Discharge (cfs)	Stage (ft)
2	0.500	62,000	996.4
5	0.200	82,600	999.4
10	0.100	117,000	1003.0
25	0.040	127,000	1003.9
50	0.020	142,900	1005.1
100	0.010	168,700	1006.5
200	0.005	197,200	1008.0
500	0.002	238,800	1009.3
Source: USACE. November 2003. "Upper Mississippi River System Flow Frequency Study, Hydrology and Hydraulics, Appendix F, Missouri River."			

Data on historic floods and the 2011 flood are discussed below as are potential Missouri River flood impacts and damages at FCS.

2.3.1 Historic Missouri River Flooding

FCS went online in 1973 along the Missouri River at RM 646. Before FCS was constructed, the site likely experienced flooding in 1881 and 1883, and the site definitely experienced flooding in 1943 and 1952. Since it was constructed, FCS has experienced flood events in 1984, 1993, 1997, 2007, 2010, and 2011. Data on these historic floods on the Missouri River are presented in Table 2-4.

Discharge and water surface elevations at USGS stream gage locations at Sioux City, Iowa, and at Decatur, Blair, and Omaha, Nebraska, are provided in Table 2-4. In addition, water surface elevations at FCS, which were estimated using stage information at Decatur, Blair, and Omaha, are included. Using the stage-discharge relationships defined in the "Upper Mississippi River System Flow Frequency Study" (USACE, November 2003), a discharge of approximately 130,000 cfs results in a stage of 1004.0 ft at RM 646. As shown in Table 2-3, this is approximately a 25-year flood event. Again, this differs from the probability associated with el. 1004 ft as reported in USAR-2-7 (OPPD, April 29, 2011). Although FCS has experienced flood events in 1984, 1993, 1997, 2007, 2010, and 2011, the data show that the Missouri River water surface elevation exceeded the average site elevation of 1004 ft only once since construction, that being in 2011. The data also show that the water surface was within 1 ft of reaching the average site elevation during 1984 and 1993.

Table 2-4 – Historic Flood Events on the Missouri River at Fort Calhoun Station, RM 646

USGS Gage Location on the Missouri River	Gage Datum (ft)		Historic Flood Events[A]									
			1881[B]	1883	1943	1952	1984	1993	1997	2007	2010	2011
Sioux City[C]	1056.98	Discharge (cfs)			212,000	441,000	104,000	72,000	100,000	42,100	86,600	192,000
		WSEL[D] (ft)			1095.69	1101.29	1087.88	1084.28	1082.48	1075.58	1082.48	1092.23
Decatur	1010.00	Discharge (cfs)						76,400	100,000	46,800	80,600	191,000
		WSEL (ft)			1053.50			1042.20	1042.00	1035.40	1041.40	1050.24
Blair	977.58	Discharge (cfs)										
		WSEL (ft)					1005.08	1004.98	1002.48	998.08	1004.48	1010.31
FCS		WSEL (ft)	>1004	>1004	>1004	>1004	1003.3	1003.3	1000.7	996.6	1002.7	1006.85
Omaha	948.24	Discharge (cfs)			200,000	396,000	116,000	115,000	110,000	86,100	103,000	216,000
		WSEL (ft)				988.46	977.24	978.54	974.64	974.74	975.84	984.53

[A] - Instantaneous peaks/stages from USGS.

[B] - 1881 discharge of 370,000 cfs estimated at St. Joseph, Missouri. Information from this table was used to estimate stage at FCS.

[C] - Sioux City gage datum was 20 ft higher in 1943 and 1952.

[D] - WSEL = water surface elevation.

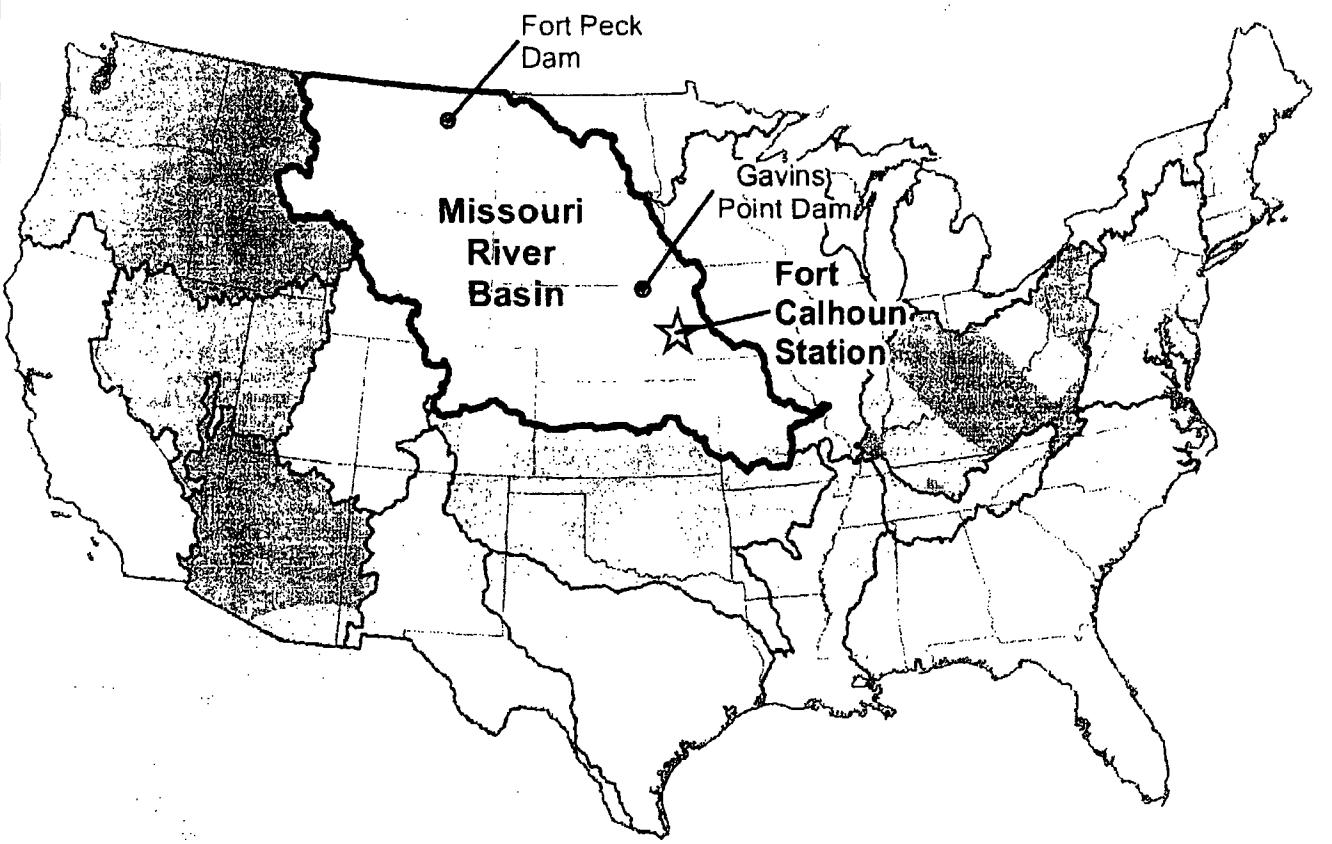
A stage recorder located at the FCS Intake Structure documented water surface elevations during the 2011 flood event. These data indicate that the maximum stage occurred on June 25, 2011, at el. 1006.85 ft. In addition, the staff gage on the landward side of the FCS Intake Structure (observed on July 12, 2011) showed a high water mark at around el. 1007.1 ft.

2.3.2 2011 Missouri River Basin Flood

Massive flooding in the Missouri River basin, shown in Figure 2-6, occurred in 2011 because of a combination of above-normal snowpack in the plains in the Northern U.S., above-normal snowpack in the mountains above Fort Peck Dam on the Missouri River, and excessive upstream spring rains in eastern Montana and North and South Dakota. USACE's forecast on November 1, 2011, estimated that in 2011, runoff into the Missouri River above Sioux City would be nearly 61 MAF. This is the highest amount since 1898, eclipsing the previous high runoff of 49 MAF.

At the end of February 2011, the plains snowpack contained as much as 6 to 8 inches (in.) of equivalent water across parts of Montana, North Dakota, and South Dakota. At the end of March, the mountain snowpack above Fort Peck Dam was close to the 30-year historic average. However, by May 2, 2011, the total snowpack was 141 percent of the 30-year historic average. During May 2011, the snowmelt combined with 10 to 15 in. of precipitation centered in Southern Montana and 6 to 10 in. of precipitation across the remainder of the watershed above Sioux City to produce record runoff amounts.

USACE began releasing record discharges from Gavins Point Dam in late May 2011. The release was increased to 160,000 cfs by June 26, 2011, and remained at this level until mid-August. Beginning on August 19, 2011, USACE began reducing releases daily in 5,000 cfs increments, reaching 90,000 cfs on August 30, 2011. Further reductions began on September 18, 2011, reaching 40,000 cfs on October 2, 2011. USACE has indicated that the 40,000 cfs release will be maintained until at least mid-December, when winter weather conditions set in and the risk of ice jams increases.



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Missouri River Basin
Fort Calhoun Station

Plant and Facility Geotechnical
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FIGURE
2-6

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2.3.3 Missouri River Flood Impact at FCS

Because FCS is located along the Missouri River (see Figure 2-5), as the releases at Gavins Point Dam were increased, floodwater encroached on the FCS site. Figure 2-7 presents the water surface elevations as surveyed on site at RM 646 and the flow rate as predicted by USACE and interpolated to RM 646 by HDR. As discussed previously, the peak water surface elevation at FCS occurred on June 25, 2011, at an elevation of 1006.85 ft.

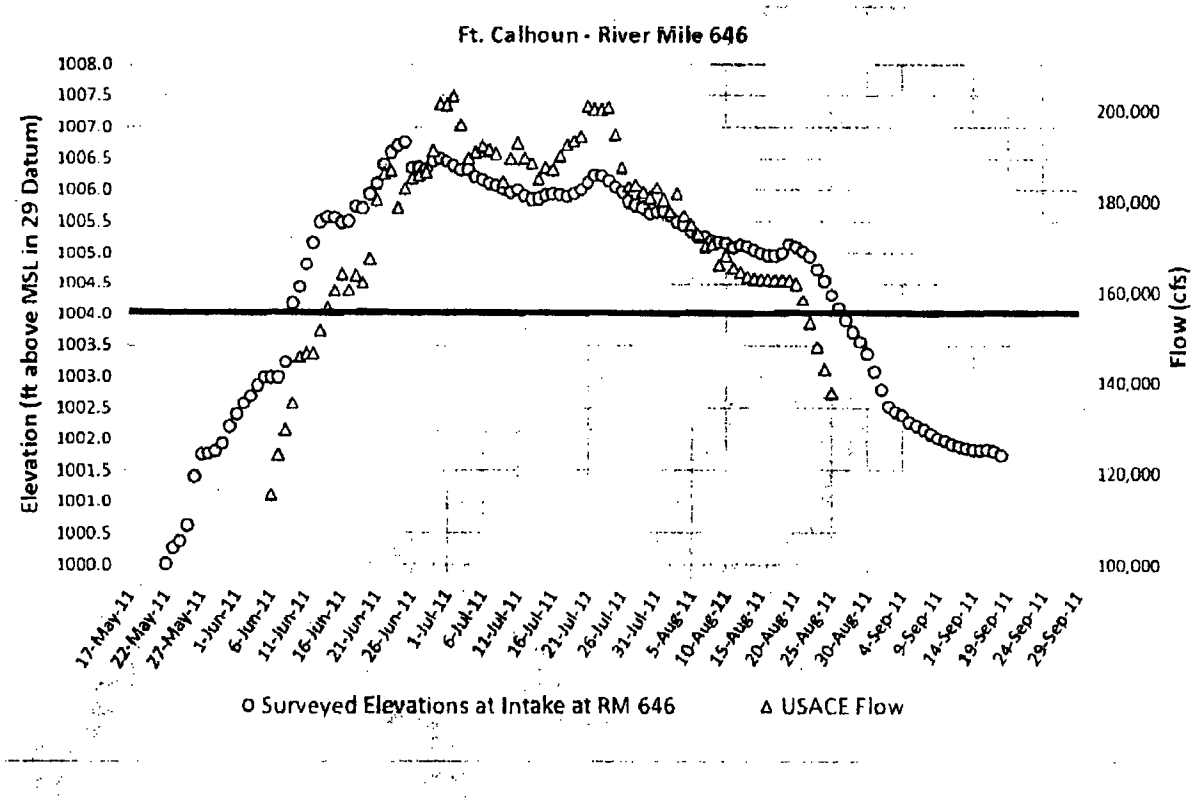


Figure 2-7 – Flow and Water Surface Elevations (June through August) for Fort Calhoun Station, RM 646

The 11 years in which flooding occurred on the Missouri River at Omaha from 1928 to 2011 are compared visually in Figure 2-6. Each plot starts on January 1 and finishes on December 31. The Omaha gage has the longest and most complete period of record of Missouri River discharges of any gage near FCS. Though this gage is 30 miles downstream from FCS, the data are applicable to the FCS site in the context of comparing flood durations. The rating curves used to estimate the Missouri River stage for a given discharge have adjusted significantly over the past 70 years. For example, using USACE's "Missouri River Stage Trends" technical report (2010) as a reference, at the Omaha gage since 1940, the rating curve adjustment range is on the order of plus or minus 2 ft for river stage at discharges of 100,000 cfs. The FCS site initially becomes flooded at an elevation of 1004 ft, and applying this same 4-ft range in stage at FCS (1006 to 1002 ft) translates to a discharge of 180,000 to 130,000 cfs (see Figure 2-7). This discharge range is bracketed in Figure 2-8 to define the range of

flows that flooded the site in 2011. Of the five flood events at the FCS site (1929, 1943, 1949, 1952, and 2011), the first four all receded from the site within 7 to 14 days. The 2011 event covered the FCS site for almost 75 days.

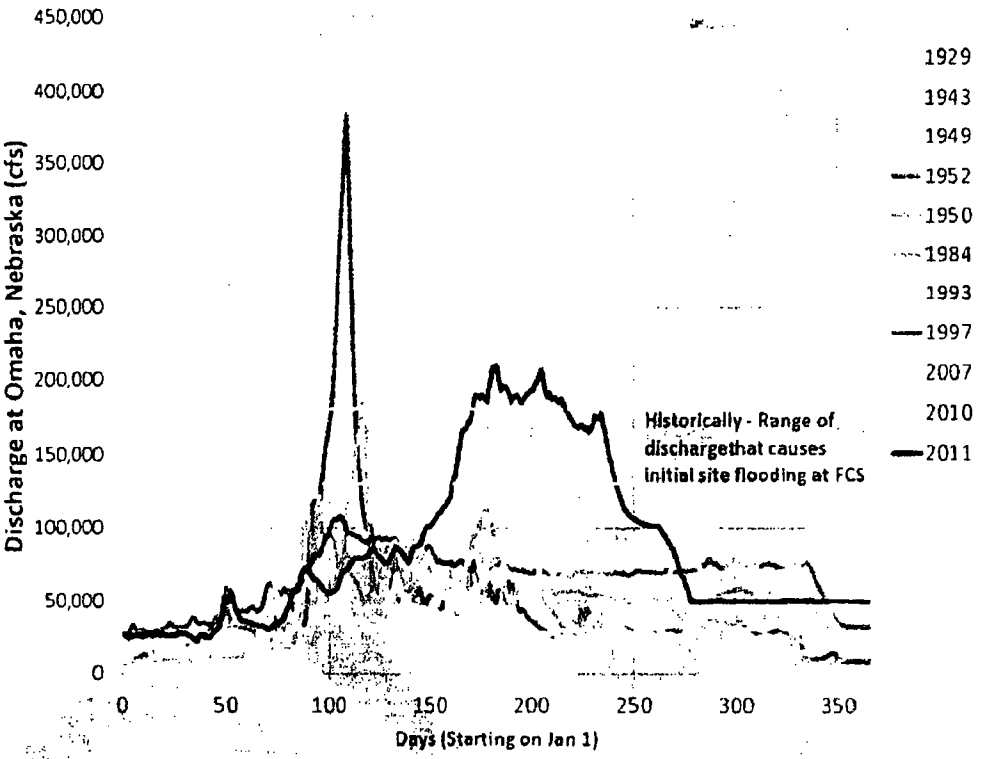
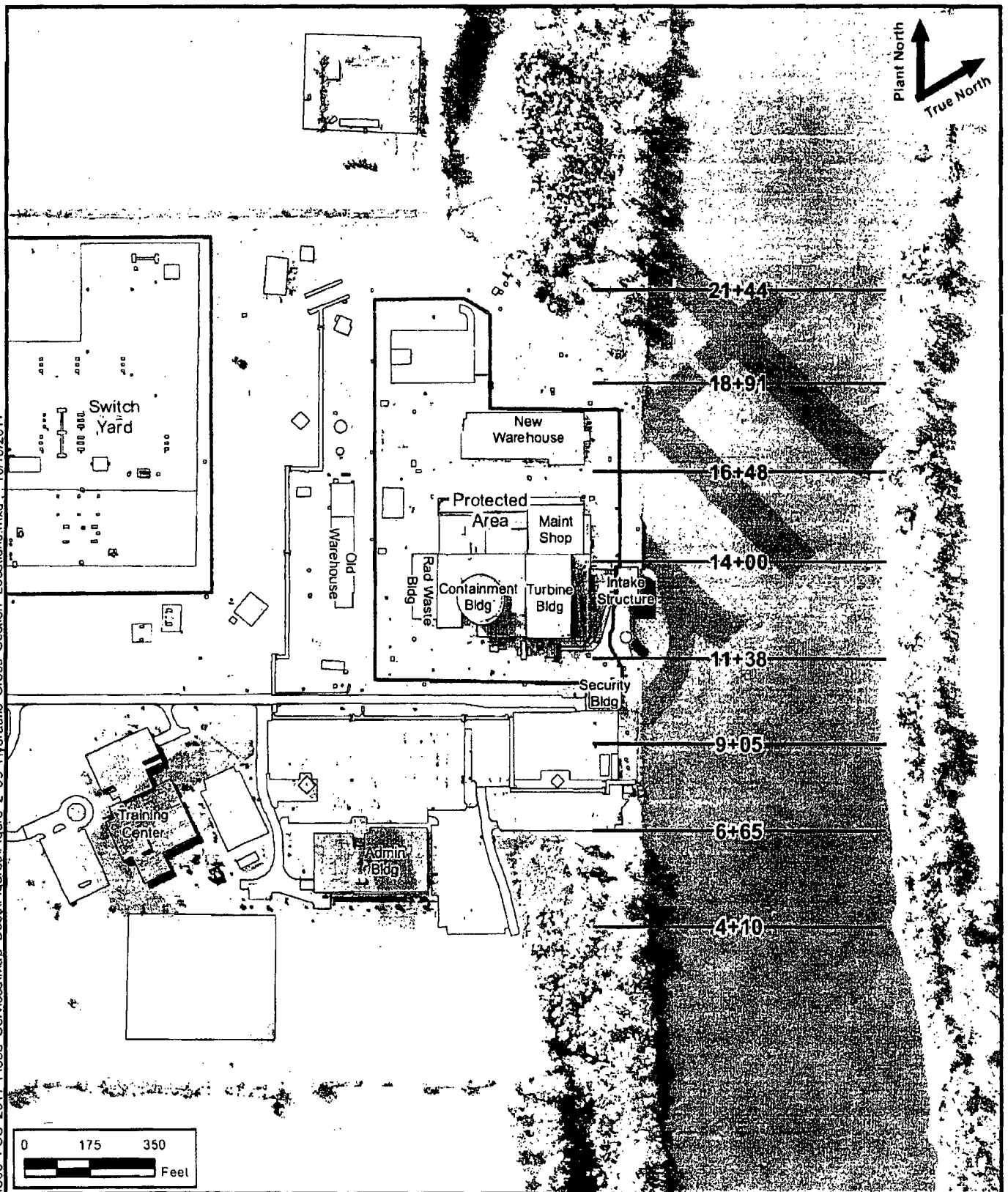


Figure 2-8 – Comparison of Discharges on the Missouri River at Omaha in Years when Flooding Occurred (1928 to 2011)

As a result of flood flows, additional channel degradation and bank erosion have occurred in the vicinity of FCS. A detailed evaluation of changes in the stage-discharge rating curves applicable to the Missouri River near FCS is being performed at this time. USGS surveyed the river in the vicinity of FCS in fall 2008 and again on July 25, 2011. The survey in 2008 was performed in National Geodetic Vertical Datum of 1929 (NGVD 29), and the survey in 2011 was performed in North American Vertical Datum of 1988 (NAVD 88) and converted to NGVD 29. Figure 2-9 shows the locations of the surveyed hydraulic cross sections, and Figure 2-10 shows a comparison of the channel bathymetry throughout the surveyed reach between 2008 and 2011 at Stations 4+10 and 6+65. Figures 2-11, 2-12, and 2-13 provide comparisons of the remaining surveyed hydraulic cross sections. It is clear that the channel has degraded by 10 ft or more across most of the channel. This is true in all the cross sections from station 4+10 to 21+44.



Z:\Projects\OPPD\164565 FCS 2011 Flood Services\Map Docs\Figures\Figure 2 09 Hydraulic Cross Section Locations.mxd 10/10/2011

Omaha Public Power District

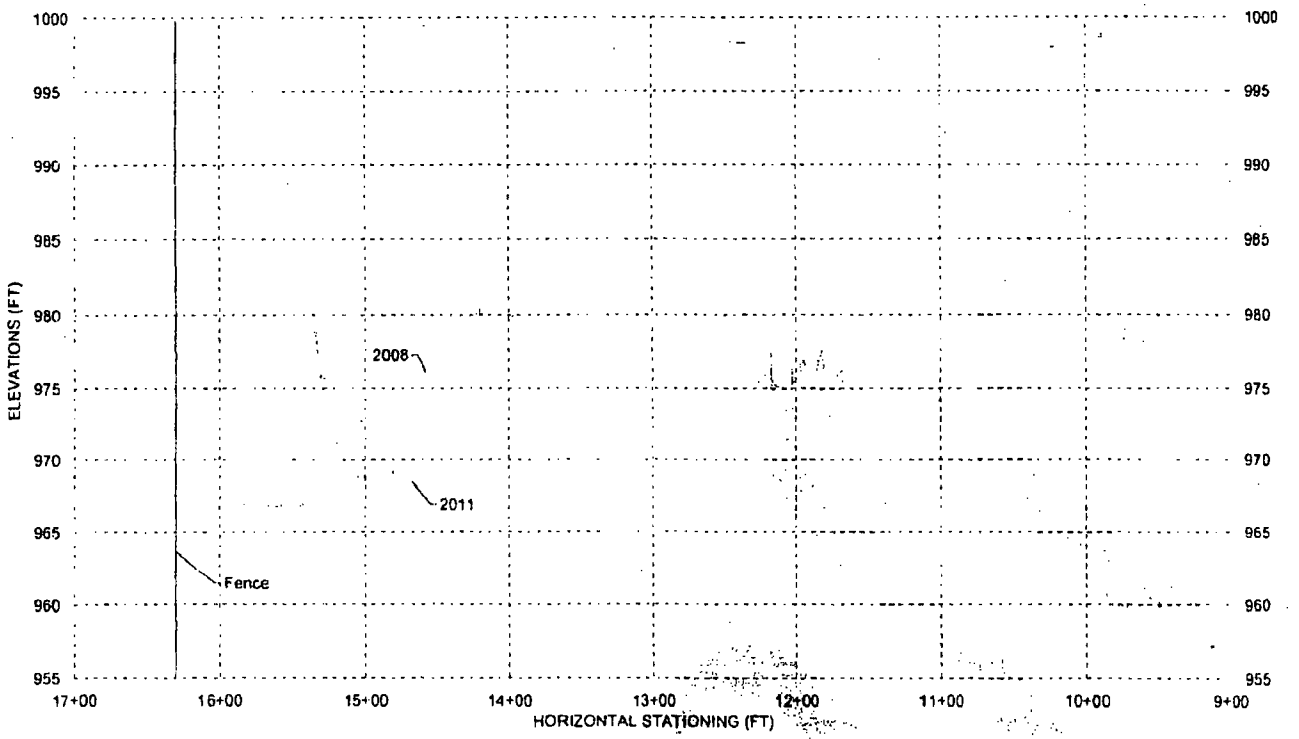
Hydraulic Cross-Section Stations
Fort Calhoun Station

Plant and Facility Geotechnical and Structural Assessment

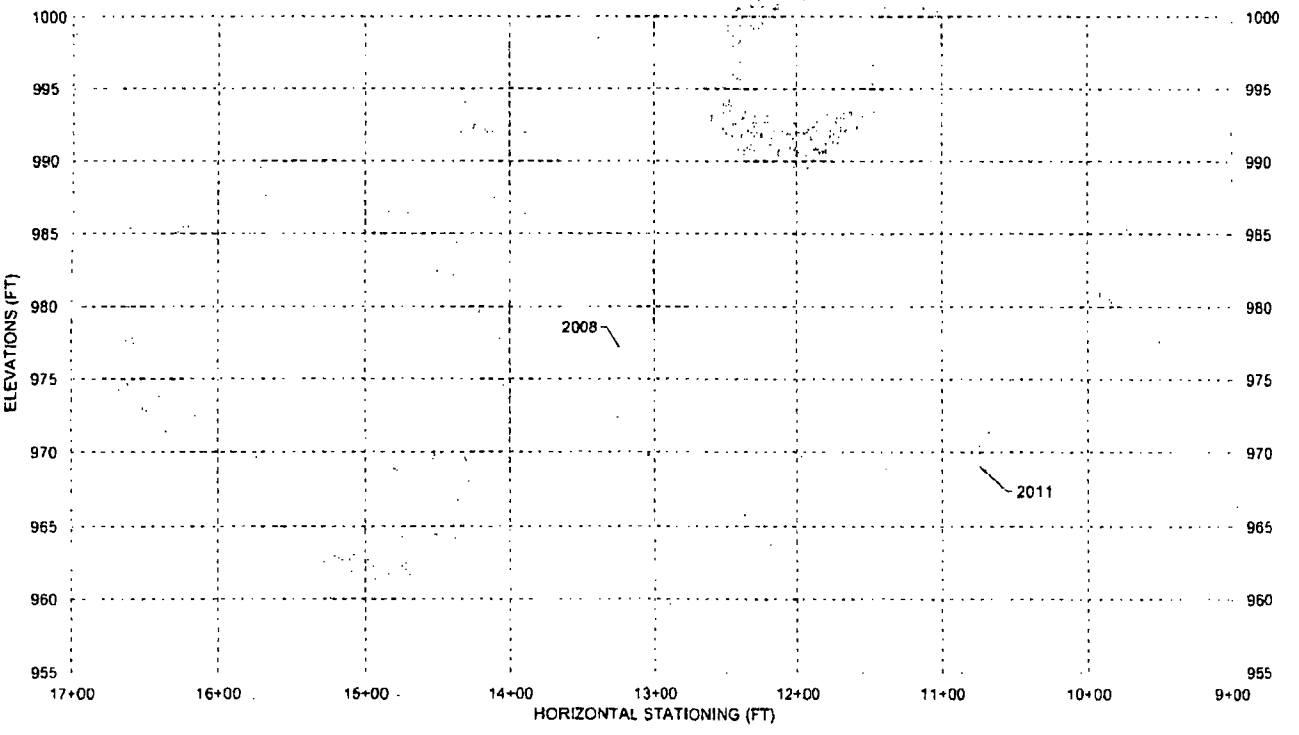
HDR

DATE
Oct 2011

FIGURE
2-9



6+65



4+10

NOTE: VERTICAL SCALE IS 10:1 EXAGGERATED AND SECTIONS ARE LOOKING UPSTREAM (PLANT NORTH).

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Comparison of Cross Sections at Stations 4+10 and 6+65 Fort Calhoun Station

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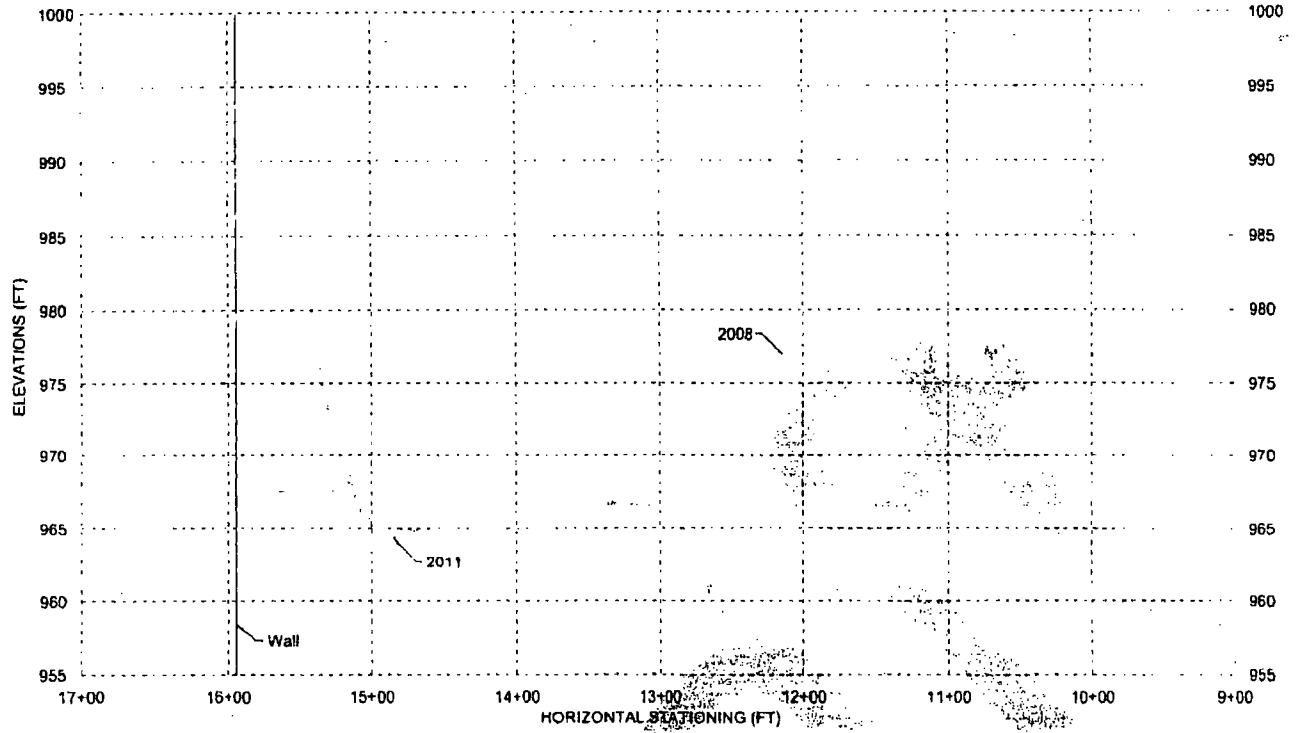
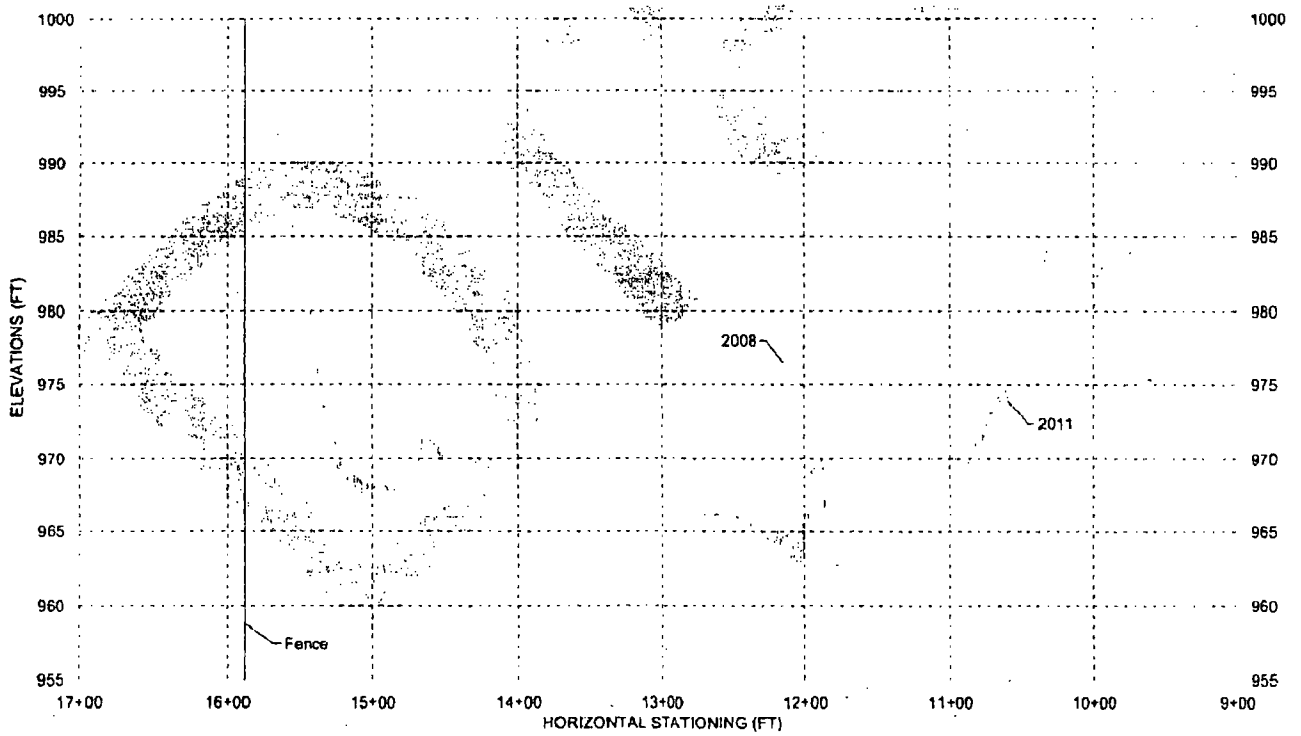
DATE: Oct 2011

FIGURE: 2-10



11+38



9+05

NOTE: VERTICAL SCALE IS 10:1
EXAGGERATED AND SECTIONS
ARE LOOKING UPSTREAM
(PLANT NORTH).

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Comparison of Cross Sections at Stations 9+05 and 11+38 Fort Calhoun Station

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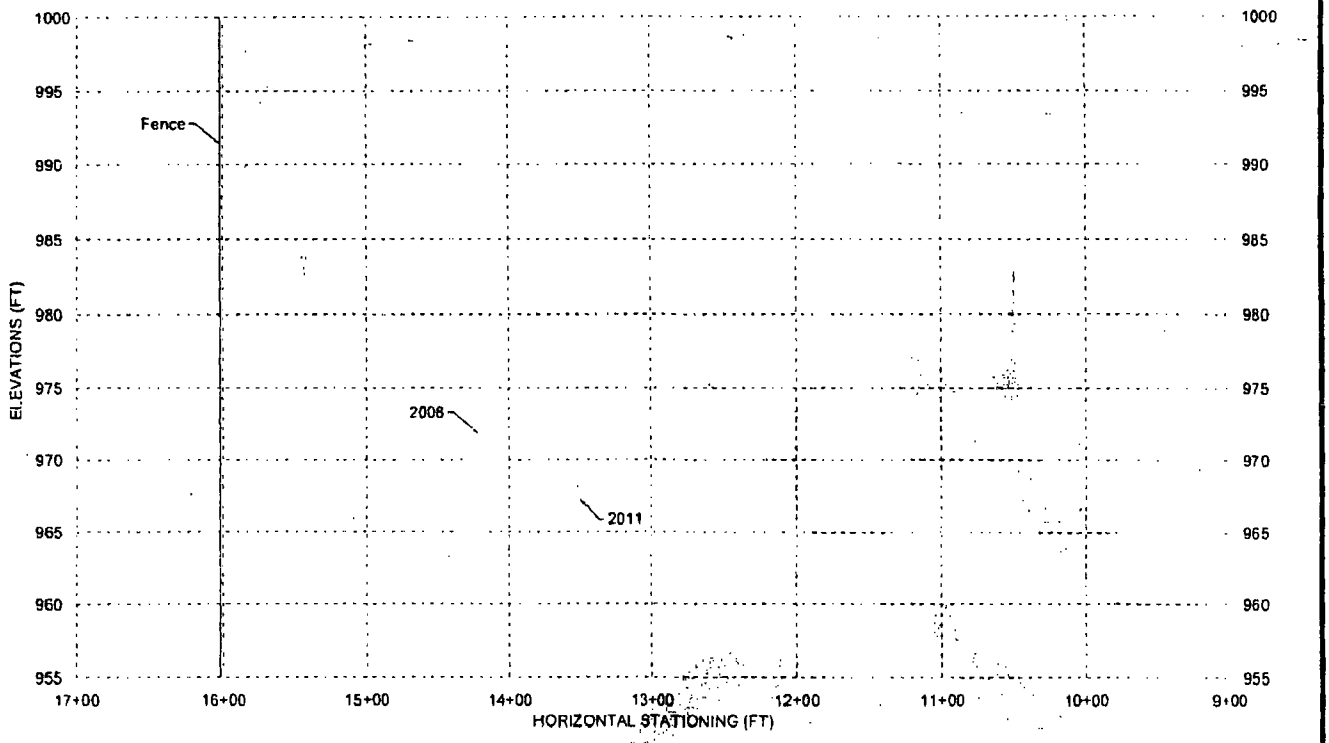
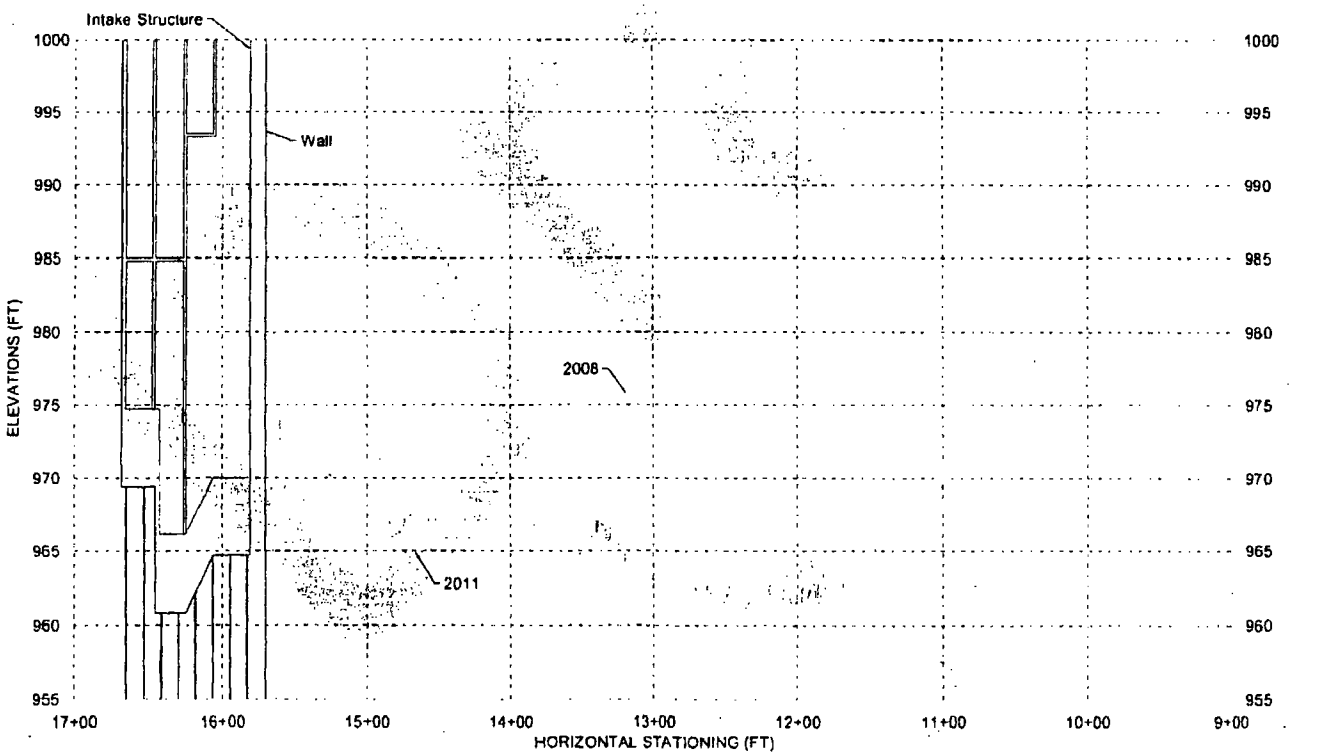
FIGURE
2-11



16+48



14+00

NOTE: VERTICAL SCALE IS 10:1 EXAGGERATED AND SECTIONS ARE LOOKING UPSTREAM (PLANT NORTH).

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Comparison of Cross Sections at Stations 14+00 and 16+48 Fort Calhoun Station

Plant and Facility Geotechnical and Structural Assessment

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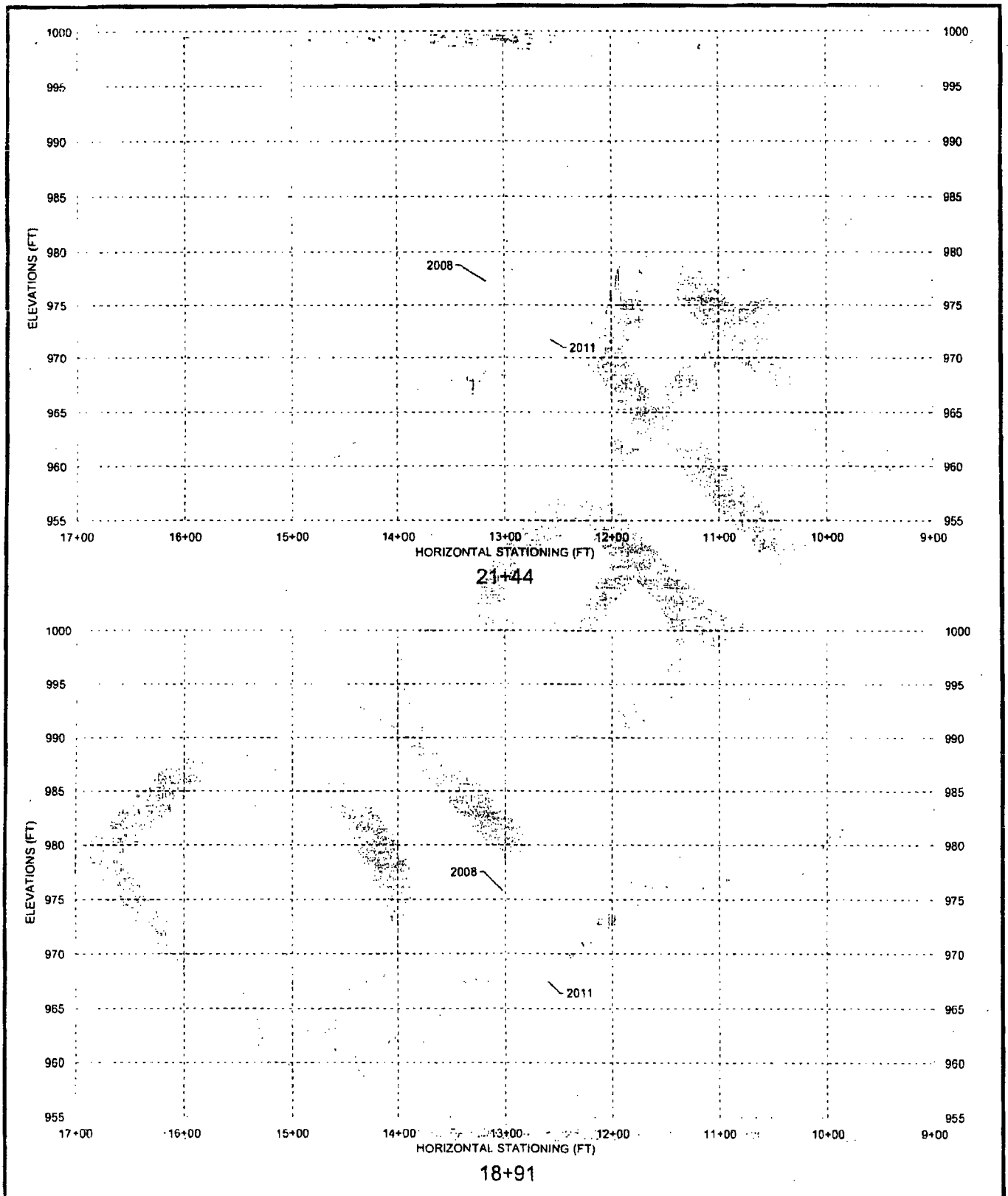
FIGURE: 2-12



NOTE: VERTICAL SCALE IS 10:1 EXAGGERATED AND SECTIONS ARE LOOKING UPSTREAM (PLANT NORTH).

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Comparison of Cross Sections at Stations 18+91 and 21+44 Fort Calhoun Station

Plant and Facility Geotechnical and Structural Assessment

HDR

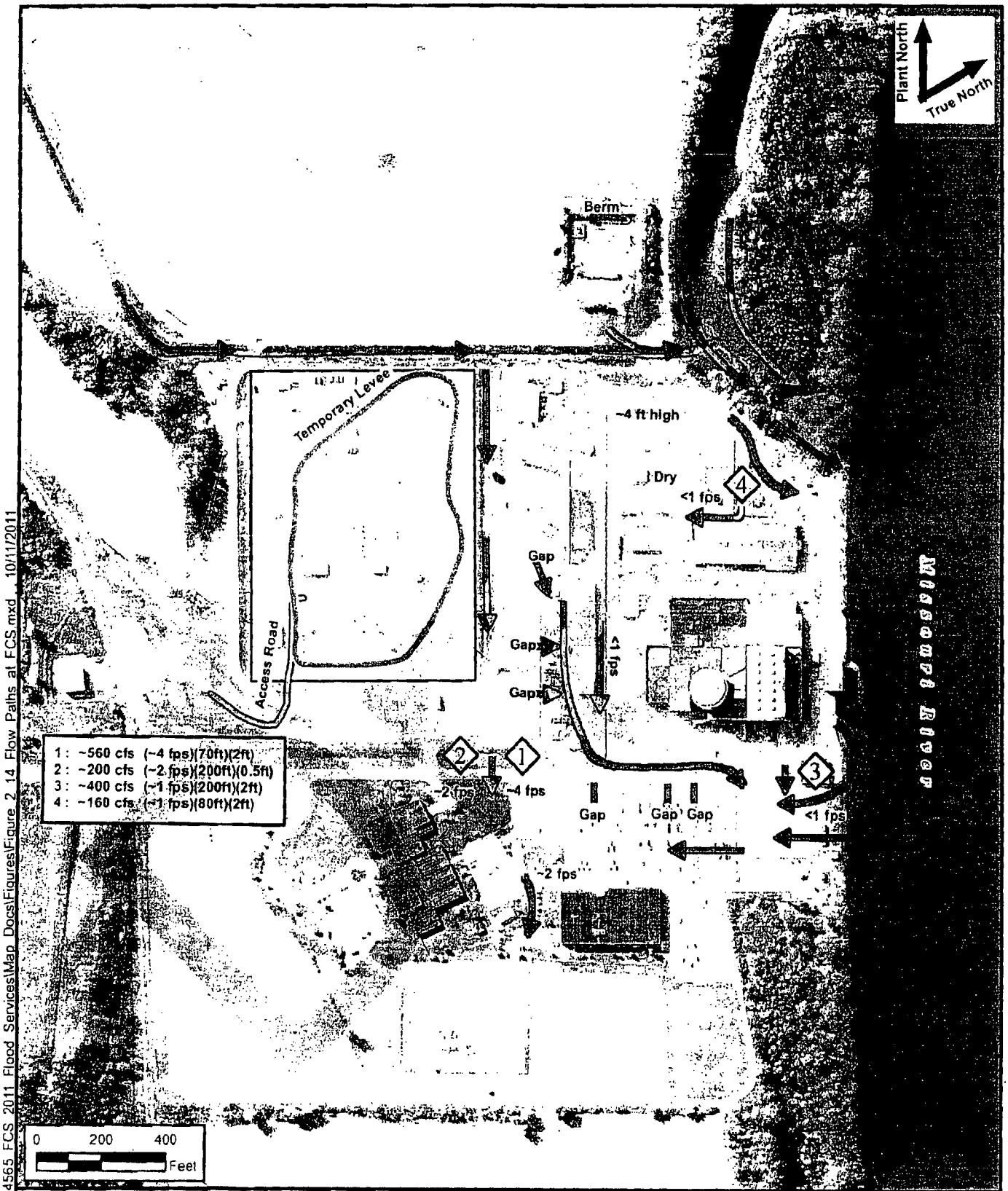
DATE: Oct 2011

FIGURE: 2-13

On July 12, 2011, personnel from HDR visited FCS to observe and investigate the impact of floodwater on FCS. Photos 1 and 2 are images of floodwater at FCS. Flow paths and velocities through FCS as observed are shown in Figure 2-14. A figure depicting the high water elevations as surveyed is provided in Figure 2-15.

Photo 1 – Floodwater at FCS, Looking North from the Administration Building toward the Old Warehouse

Photo 2 – Floodwater at FCS, Looking East toward the Containment



Z:\Projects\OPPD\164565 FCS 2011 Flood Services\Map Docs\Figures\Figure 2 14 Flow Paths at FCS.mxd 10/11/2011

Surface Water Flow Path

Omaha Public Power District

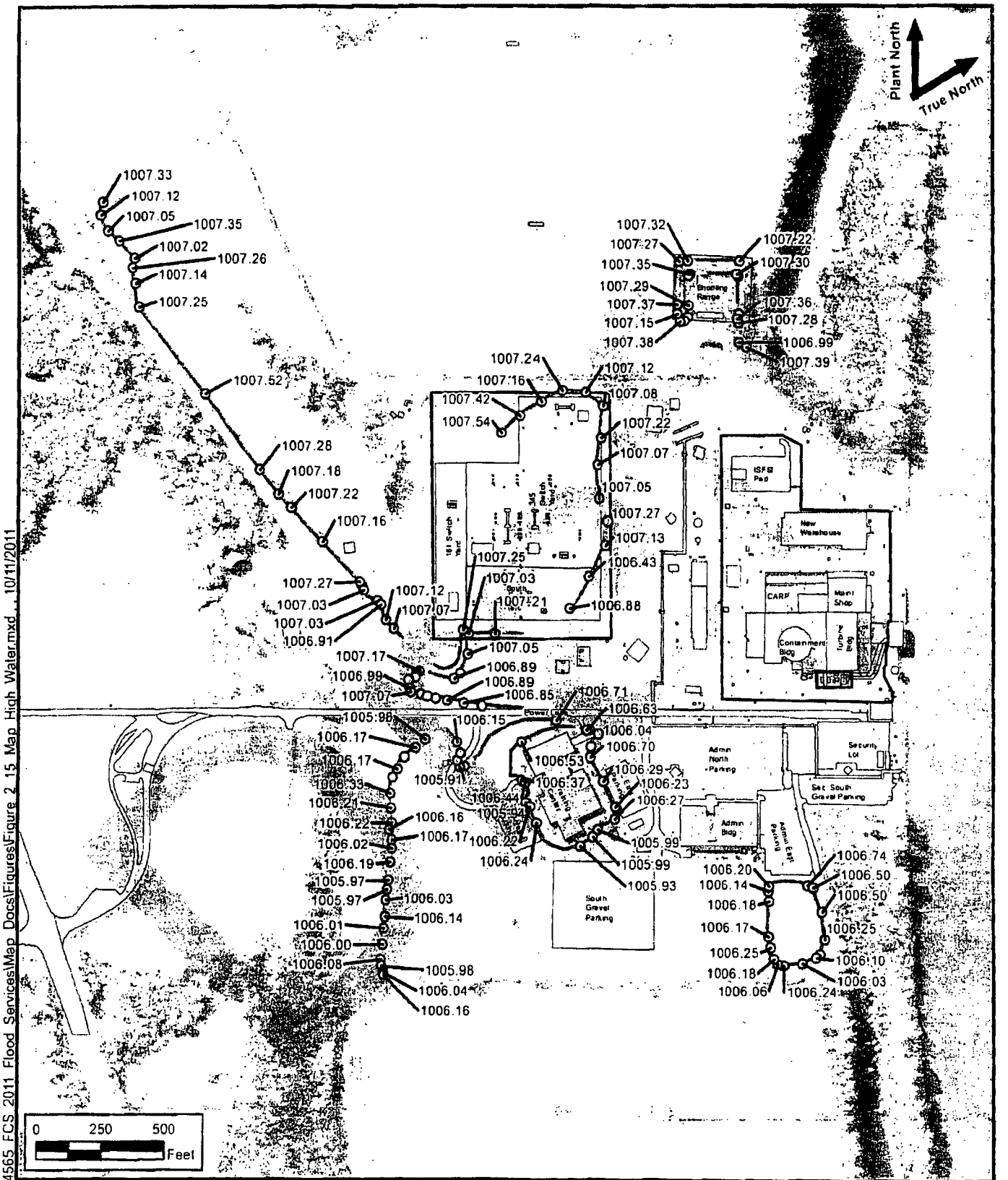
Flow Paths on July 12, 2011
Fort Calhoun Station

Plant and Facility Geotechnical and Structural Assessment

HDR

DATE
Aug 2011

FIGURE
2-14



Z:\Projects\OPPD\164565_FCS_2011 Flood Services\Map Docs\Figures\Figure 2-15 Map High Water.mxd 10/11/2011

Survey Point

High Water Mark Line

Omaha Public Power District

Surveyed High Water Line
Fort Calhoun Station

Surveyed by Lamp Rynerson & Ass. 9/1/2011

Plant and Facility Geotechnical and Structural Assessment

HDR

DATE
Sep 2011

FIGURE
2-15

2.3.4 Potential Flood Damages at FCS

The FCS site was inundated by floodwater for nearly 3 months (see Figure 2-7, Flow and Water Surface Elevations (June through August) for Fort Calhoun Station, RM 646) by approximately 3 ft of water as a result of 2011 flooding. Buildings and property at FCS have been subject to a variety of forces as a result of Missouri River floodwater. Hydrostatic and buoyancy forces due to inundation, hydrodynamic forces due to moving water, scour and erosion around building foundations, and to a lesser extent, wave forces and forces imparted by the impact of moving debris such as large trees, are described as follows (FEMA, 2008).

2.3.4.1 Hydrostatic Forces

A hydrostatic load is imparted to the walls and foundation of a structure when floodwater builds up along a structure. A hydrostatic force acts laterally or vertically (if the structure is submerged). Hydrostatic forces can become strong enough to cause deflection when there is a substantial difference in water elevation on opposite sides of the structure.

2.3.4.2 Buoyancy Forces

As floodwater rises, a structure can experience a buoyant force that has to be counteracted by the weight of the structure and any anchorage forces.

2.3.4.3 Hydrodynamic Forces

Water flowing around a structure during a flood event imparts a load on the affected structure. The load is the combination of the force imposed by the moving floodwater hitting the frontal area of the structure, the drag forces imparted along the walls of the structure, and the negative pressure acting on the downstream side of the structure. The negative pressure is located in the wake zone created by flow separation as the floodwater moves past the structures. If a structure is not rigid, there is also a lift force imparted on the structure by the moving floodwater.

2.3.4.4 Scour and Erosion

High velocities from water flowing across a flooded area can cause soil erosion if the soil or material at the ground surface does not have a greater resistive force than the shear stress imparted to the ground surface by the floodwater. Local scour is also possible at or along structure foundations. As floodwater impacts a structure, the water is forced downward and around the structure. The resulting increase in velocity and turbulence characteristics can result in localized scour. The magnitude of scour and erosion depends on flood velocity, depth, soil characteristics, ground characteristics, flow direction in relation to the structure, and structure type and dimensions.

2.3.4.5 Waves

With a substantial wind fetch, structures can experience additional hydrodynamic loading by the impact of waves against the structure walls and foundations.

2.3.4.6 Debris Impact

Floodwater carries debris ranging from large branches and trees to storage tanks and mobile homes. Debris that impacts a structure imparts a load on the structure that depends on the weight of the debris object, the velocity of the floodwater, the location on the structure where impact occurs, and the duration of the impact.

2.4 Geotechnical Baseline

2.4.1 In-Situ Soil Characteristics

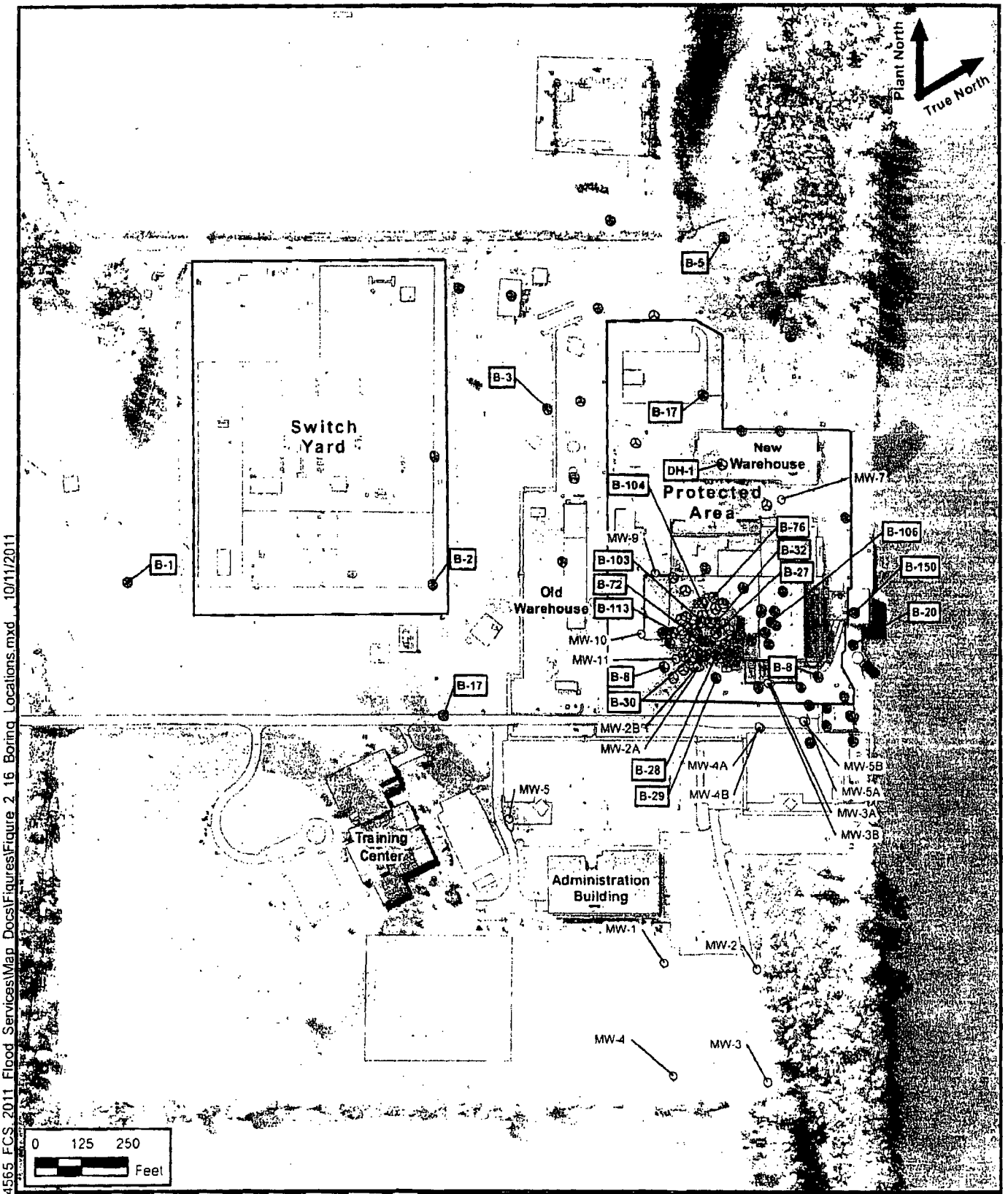
Dames & Moore conducted a site subsurface investigation in 1967. A total of 89 borings were drilled during this field investigation to assess the properties of the site soils and bedrock, as show in Figure 2-16. Dames & Moore published the results of their 1967 field work in a 1968 report titled "Foundation Studies, Fort Calhoun Station Number One, Near Fort Calhoun, Nebraska," in which they drew the following general conclusions regarding the subsurface soil characteristics:

- The surficial soils consist of loose fine sands with varying amounts of silt to approximately 10 ft.
- Depths from 10 ft to approximately 30 to 35 ft generally consist of loose to compact (dense) fine sand.
- A 5- to 10-ft layer of compact (dense) fine sand lies below the loose to dense fine sand.
- Below the dense layer is a less compact (dense) layer of poorly graded to well-graded sand with thin layers of silty clay and some gravel.

Based on laboratory-determined relative densities, the relative density of the subsurface soils ranged from 47 to 82 percent. The field investigation involved standard penetration tests (SPTs) and the recording of N values for the soils. The N value, reported in blows per foot, is the number of blows required to drive the sampler for the last 1 ft of the sampling interval. There is no indication as to whether the values are normalized N60 values (corrected to 60 percent of the theoretical energy delivered by an SPT safety hammer) or are uncorrected values, so the values are assumed to be uncorrected. In addition, a standard SPT sampler and the Dames & Moore Type U soil sampler were used to record N values, and a 300-pound hammer at a 24-in. fall and a 140-pound hammer at a 30-in. fall were used to impart the energy to drive the samplers. The net effect on N values is not documented. N values are depicted in Figure 2-2, Section A-A, and Figure 2-3, Section B-B.

These findings are generalized to represent overall site conditions, but localized variations are presented in Figures 2-2 and 2-3. The locations of the section lines and the approximate plan view location of the known karst features are presented in Figure 2-1, Geotechnical Areas and Cross-Section Locations.

Much of the upper 10 to 15 ft of in-situ material was actually logged as low-plasticity silt with varying amounts of sand. N values from this zone were generally lower than 10. The zone below this, described by Dames & Moore (1968) as loose to dense fine sand 30 to 35 ft thick, is shown as poorly graded sand (SP) in Figures 2-2 and 2-3. This zone appears to be consistent across the FCS site; however, the zone of dense fine sand is not as consistent as the Dames & Moore report implies. N values in borings B-27 and B-108 range from 79 to 125 at depths ranging from 35 to 50 ft from existing (at the time of the exploration) ground surface, while borings B-29 and B-28 show N values of 14 to 48 for a comparable depth range less than 100 ft away from borings B-27 and B-108.



Z:\Projects\OPPD\164565_FCS_2011_Flood_Services\Map_Docs\Figures\Figure 2_16 Boring_Locations.mxd 10/11/2011

Boring Location

Monitoring Well Location

Omaha Public Power District

Soil Boring and Monitor Well Locations
Fort Calhoun Station

Plant and Facility Geotechnical and Structural Assessment

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DATE
Sep 2011

FIGURE
2-16

The zone of less dense, poorly graded to well-graded fine sand with varying amounts of silt and some gravel is generally consistent across the site and makes up the 15 to 20 ft of alluvial material on top of bedrock.

Limited laboratory testing was completed for soil samples and includes particle size analyses. Particle size analyses showed predominantly fine sands with minor fractions of silt and medium-grained sand.

2.4.2 Rock Mass Characteristics

According to the Dames & Moore (1968), bedrock was encountered at depths ranging from 58 to 67 ft and varied from el. 931 to 935 ft. The rock encountered was identified as the Winterset Member of the Dennis Formation Limestone of the Pennsylvanian Kansas City Group. The bedrock at the site was described as having an upper zone 4 to 8 ft thick and consisting of massive, gray, thickly bedded, medium- to fine-grained oolitic limestone. Below this zone was a zone of light gray, thinly to moderately bedded, fine-grained limestone (referred to as aphanitic in the Dames & Moore report) having 0.5- to 2-in.-thick shale layers. Karst features were found in this lower "aphanitic" layer as briefly discussed in Section 2.1.4.1, Karst, above, but also included part of the overlying oolitic limestone as recorded in borings B-104 and B-104B. Figure 2-2, Section A-A, and Figure 2-3, Section B-B, present representative subsurface depth and thickness of the site bedrock. The locations of the section lines and the approximate plan view location of the known karst features are presented in Figure 2-1, Geotechnical Areas and Cross-Section Locations.

The rock mass was logged as "unweathered" ("fresh" using the U.S. Bureau of Reclamation Engineering Geology Field Manual) and hard, and rock quality designation (RQD) values ranged from 97 to 100 percent with few exceptions related to solution features (karst). Specific findings were as follows:

- A zone of moderately to intensely weathered limestone in boring B-116 was logged at the bottom of the oolitic limestone and 4 ft into the underlying fine-grained limestone, and an RQD value of 40 percent was recorded within this zone. This was a solution feature that had not yet, through chemical dissolution of the limestone, developed into a void and a zone of completely decomposed limestone.
- A large solution feature was intercepted by borings B-104, B-104A, and B-104B from depths of 63 to 79.2 ft (el. 932.3 to 916.2 ft) that had an upper 2 to 3 ft of void and the remaining lower portion filled with decomposed limestone.
- Borings B-72 through B-72H were drilled to define the extent of a large solution feature that ranged in depth from 65.6 to 77.7 ft (el. 932.1 to 920.0 ft).
- Borings B-30 through B-30Q were drilled to define the extent of a solution feature that ranged in depth from 67 to 83 ft (el. 929.7 to 913.7 ft).
- Borings B-103 and B-103A encountered a more limited but possibly connected zone of dissolution that ranged from el. 934.5 to 936 ft.
- A zone of increased weathering, RQD values ranging from 42 to 55 percent, and a 1.5-ft void were encountered in boring B-141 from depths of 70 to 77 ft (el. 926 to 919 ft).
- Boring B-108 drilled through a cavity from depths of 65.7 to 75.0 ft (el. 928.8 to 919.5 ft).

These noted solution features were recognized by Dames & Moore as following predominant fracture sets that were reportedly mapped at a local quarry. The orientation of these fracture sets is reportedly N50E and N58W.

The potential for the enlargement of solution features (karst) in the bedrock portion of the foundation to be a foundation failure mechanism due to flooding events is minimal. The pile design for the Containment, Auxiliary Building, Turbine Building, and Intake Structure called for pile installation past any weathered zone to the bottom of any known or encountered solution feature. In addition, the limestone bedrock is covered by a minimum of 61 ft of soil cover, so acidic atmospheric water is not likely to reach the karst features. The only plausible mechanisms for continued karst development are 1) a connection to the river bottom that allows chemically aggressive (acidic and not saturated with respect to calcium) water into a karst feature, and 2) a scenario in which the overlying soils do not alter the chemistry of the groundwater so that it maintains the potential to dissolve the limestone. These mechanisms take significant time relative to the operating life of the FCS structures and are not significantly related to a plausible failure mechanism.

2.4.3 Groundwater

Prior to construction, groundwater was described by Gibbs, Hill, Durham, and Richardson (1967) as generally within 2 ft of the surface at the site and sloping gently to the east toward the Missouri River. Groundwater elevations and river elevations prior to the 2011 flood event and after the onset of the flood event are presented in Table 2-5. An increase in groundwater elevation on the order of 10 ft has been recorded as a result of the 2011 flood. The data do not include groundwater elevations at the peak flood elevation of 1006.85 ft because groundwater measurements were not recorded during peak flood levels. Groundwater and river elevations for December 10, 2010, and June 4, 2011, are shown in Figure 2-2, Section A-A, in order to present the general response of groundwater elevations relative to the increased river elevations.

The effect of pore pressure changes due to a water level elevation across the site of approximately 1006.85 ft compared to the pre-flood groundwater elevation of approximately 990 ft must be evaluated with respect to each structure.

Table 2-5 – Groundwater and River Level Elevations

Date	12/10/2010	3/22/2011	6/4/2011	9/1/2011
River Elevation[A]	993.994	995.33	1002.86	1002.18
Monitoring Well ID	Groundwater Elevation (ft)			
MW-1A	990.76	989.15	998.7	999.55
MW-1B	990.74	989.12	998.7	999.54
MW-2A	991.18	990.12	998.55	998.93
MW-2B	991.23	990.14	998.74	999.2
MW-3A	990.93	990.82	998.25	998.77
MW-3B	991.07	990.77	998.15	998.68
MW-4A	991.5	990.85	999.75	1000.4
MW-4B	991.48	990.73	999.63	1000.23
MW-5A	991.88	991.18	1000.15	1000.67
MW-5B	991.81	991.14	1000.12	1000.6
MW-6	991.71	992.08	1000.45	1001.13
MW-7	991.32	990.89	999.26	999.98
MW-9	990.82	989.28	998.68	999.49
MW-10	991.16	989.53	998.98	999.83
MW-11	991.21	989.93	998.88	999.48

[A] - River elevations include FCS data and interpolated stages between Omaha and Blair and between Omaha and Decatur, Nebraska.

2.4.4 Ground Improvement Methods

2.4.4.1 Pile Installation

According to OPPD records, a total of 951 piles were installed under the footprint of the Containment, Auxiliary Building, Turbine Building, Intake Structure, Service Building, and Circulating Water System. Each pile was installed to bedrock (Winterset Member of the Dennis Formation Limestone), and some were installed through voids in the limestone to a competent rock bottom. Figure 2-2, Section A-A, and Figure 2-3, Section B-B, show the general location and depth of the pile installation. Piles were installed from existing ground elevation, and excavation progressed around the piles to target elevations. Final cutting and capping of the piles was completed when target excavation level was reached.

Figure 2-1, Geotechnical Areas and Cross-Section Locations, shows the area of pile installation. Pile as-built records showing actual installation depths have not been located for this study, so the design proposed in the Dames & Moore 1968 report was used as the basis for pile installation depth.

2.4.4.2 Soil Densification Using Vibroflotation

The design criteria for the Containment, Auxiliary Building, and Intake Structure required an average relative density of 85 percent and a minimum relative density of 70 percent for the foundation soils. As documented by Gibbs & Hill in a report titled "Summary of Vibroflotation," dated January 27, 1972, the process of vibroflotation was used to densify soils between the foundation piles in the areas under the Containment and the Intake Structure. Vibroflotation involves inserting a vibrating probe into the ground while introducing gravel into the void that is created around the probe. This process densifies the surrounding soil, forms a vertical column of dense gravel, and increases the overall strength of the in-situ material.

Following the vibroflotation densification process, a total of 83 SPT borings were completed by the contractor to assess the effectiveness of densifying the fine-grained sand and fine-grained silty sand. The Gibbs & Hill report states that a 96.6 percent confidence level was attained that the average relative density was not less than 85 percent. SPT data from these test borings indicated that the soil densification was moderately successful when compared to the SPT N values from 1967 exploratory borings at the site. SPT values recorded after the vibroflotation for successful soil densification generally ranged from 12 to 91 blows per foot, which indicated that relative densities ranging from 70 to 110 percent were achieved in these soils. However, some zones of relative density ranging from 35 to 68 percent remained after the vibroflotation, as noted in verification borings V-42, V-46, V-68, V-70, V-71, and V-76. Therefore, existing soil density conditions should be noted as having average relative density not less than 85 percent but as also having notable zones of relative density significantly lower than the average and lower than the minimum relative density requirement of 70 percent. A plan view showing the post-vibroflotation verification borings is not in the construction records.

2.4.5 Excavation and Backfill

Based on the Dames & Moore 1968 report titled "Foundation Conditions," preliminary excavation depths for each structure were targeted to the following elevations:

- Intake Structure – el. 963 ft
- Auxiliary Building – el. 981 ft
- Containment – el. 983 ft
- Turbine Building – el. 987 ft
- Turbine Generator Mat – el. 982 ft

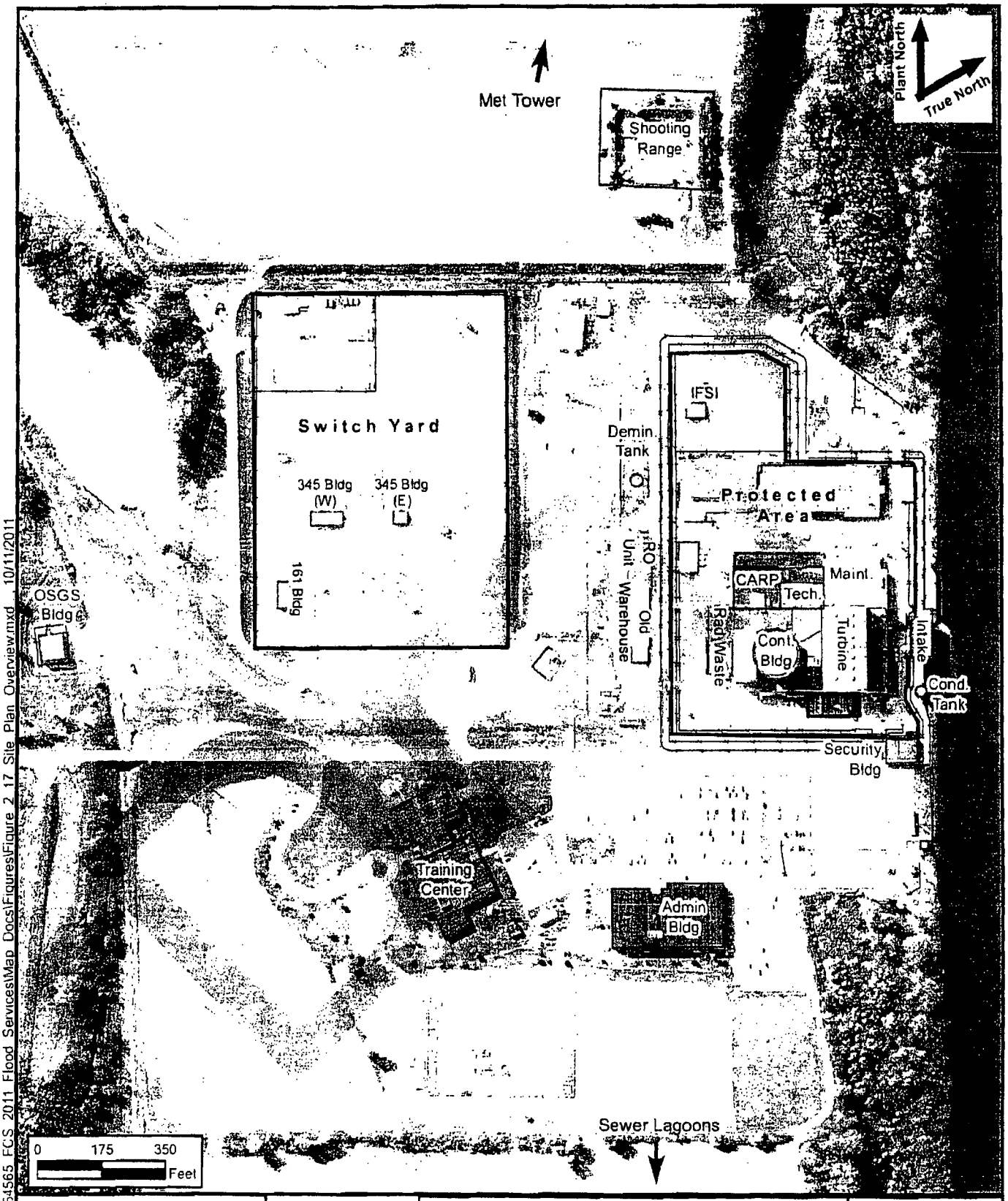
As-built drawings record excavation depths that vary somewhat from the previously listed target excavation elevations, as follows:

- Intake Structure (sluice intake) – el. 966.7 ft; approximate Intake Structure foundation – el. 963 ft (Intake Structure Building Panels and Intake Details, Drawing Number 11405-A-281)
- Auxiliary Building – el. 965.5 ft (Auxiliary Building Sections, Drawing Number 11405-S-64)
- Containment – approximate el. 975.5 ft (Primary Plant Section A-A, Drawing Number GHDR 11405-A-13)

The properties of fill material have been documented by borings that were completed after construction. Borings were completed by Geotechnical Services, Inc. for the foundation assessments for the Maintenance Building Addition (1977), Security Building (1977), and the New Security Building (1987). Fill material is composed of silty clay, clayey silt, poorly graded sand with silt, and sandy silt. SPT N values range from 5 to 20 within the fill material. Documentation of the fill material, placement densities, thickness, and extent adjacent to structures built within excavated areas is not available for analysis.

2.5 Structural Baseline

The structural baseline was established for Priority 1 and Priority 2 structures based on the review of existing documentation, including condition reports, design basis documents, the original design drawings, and structural assessments. The condition reports and structural assessments together are referred to as pre-flood structural reports. A list of OPPD documents used in establishing the structural baseline for each structure is provided as Attachment 2. Dimensions presented in the structural baseline discussion are generally expressed in decimal feet. The term "structure" may refer to a specific building, such as the Turbine Building, or may refer to a group of independent non-building structures, such as the Turbine Building South Switchyard. The location of each structure is shown in Figure 2-17, Site Plan Overview.



Z:\Projects\OPPD\164565 FCS 2011 Flood Services\Map Docs\Figures\Figure 2-17 Site Plan Overview.mxd 10/11/2011

— Fence
Priority 1
Priority 2
Protected Area Boundaries

Omaha Public Power District

Site Plan Overview
Fort Calhoun Station

Plant and Facility Geotechnical and Structural Assessment

HDR

DATE
Sep 2011

FIGURE
2-17

2.5.1 Intake Structure

2.5.1.1 Location, Description, and Function

The Intake Structure is a Class I structure located adjacent to the Missouri River and directly east of the Service Building. The major functions of the Intake Structure are to provide water from the Missouri River that is required for component cooling and fire fighting at FCS, and to provide the structural support and environmental protection necessary to ensure the functional integrity of the Critical Quality Element (CQE) systems and components under all operational and environmental conditions. Specifically, the Intake Structure must appropriately protect against the effects of projectiles that may result from equipment failures and from events and conditions outside the nuclear power unit.

From the bottom of the foundation mat at el. 960.8 ft to el. 1014.5 ft, the Intake Structure consists of large, heavy, reinforced-concrete-box-type construction with internal bracing provided by the dividing walls that form the water passages. This results in a massive rigid structure set mostly below grade, which is inherently resistant to seismic and tornado activity.

Without special provisions, the Intake Structure is designed to accommodate flood levels up to el. 1004.5 ft without water entering the structure. For higher flood levels up to the maximum probable flood of el. 1009.3 ft, protection is provided by steel flood barriers equipped with seals that provide protection to el. 1009.5 ft. These flood barriers are stored adjacent to the openings that they protect and are put in place when the river level reaches certain elevations. When the water level of the Missouri River exceeds the elevation of the operating floor (1007.5 ft), it is necessary to close the sluice gates to prevent water from flowing in around the tops of the traveling screens and flooding the Intake Structure.

2.5.1.2 Foundation

The Intake Structure is a multi-floored structure below operating floor el. 1007.5 ft. From the bottom of the foundation mat at el. 960.8 ft to el. 1014.5 ft, the Intake Structure consists of large, heavy, reinforced-concrete-box-type construction. A mat foundation on steel pipe piles driven to bedrock supports the Intake Structure.

2.5.1.3 Structural Frame

From el. 1014.5 ft to the roof el. 1035.6 ft, the Intake Structure is a braced-steel frame clad with Ar-lite sandwich panels supported from a system of horizontal steel girts. The roof is a multi-layer built-up roof supported by metal decking spanning between open-web steel joists. The structural steel frame supports equipment necessary for building operation, including an overhead bridge crane on steel crane girders.

2.5.1.4 Building Envelope

The structure is clad with concrete sandwich panels supported from a system of horizontal steel girts and the primary structural frame members. The panels form a parapet at the top of the building wall at roof level. The roof is a multi-layer built-up roof supported by metal decking spanning between open-web steel joists.

2.5.1.5 Pre-Flood Structural Reporting

There are structural condition reports, prepared by OPPD, with drawings marked, available from the years 1996, 1999, 2002, and 2009. These reports document minor structural phenomena such as minor cracks in walls and ceilings, cracks that radiate from corners in square concrete openings, and minor spalling.

2.5.2 Auxiliary Building

2.5.2.1 Location, Description, and Function

The Auxiliary Building is a Class I structure located adjacent to and west of the Turbine Building, with the Technical Support Center attached to the north wall. The Auxiliary Building has an irregular shape in plan, with maximum ground floor dimensions of 224 by 243 ft and envelopes the Containment on the east, north, and west sides. The Auxiliary Building has multiple flat roofs at different elevations, and all are lower than the roof of the Containment.

Ground floor elevation is 1007 ft with a maximum roof elevation of 1083 ft. The building has one full floor level below grade at 989 ft and a partial floor level at 971 ft.

2.5.2.2 Foundation

The foundation of the Auxiliary Building consists of 5.5 ft of reinforced concrete mat supported by steel pipe piles. The piles are spaced approximately 7 to 9 ft on center and driven to bedrock that ranges in elevation from 931 to 935 ft. The drawings show that the foundation walls below grade are 3 ft thick, covered with waterproofing, and keyed at the top and bottom joints with water stops.

2.5.2.3 Structural Frame

The Auxiliary Building consists of reinforced concrete moment frame on the exterior elevations with architectural resin precast concrete panels as infill between the moment frames. Interior walls are reinforced concrete ranging in thickness from 8 to 48 in., with shield walls at select door openings.

The floors and roof deck consist of 6-in. deck with a 2-in. concrete topping. The 8 in. of concrete are composite to the reinforced concrete beams, the dimensions of which are based on the span and floor loading.

2.5.2.4 Building Envelope

The exterior concrete moment frame is exposed and has a rubbed concrete surface. The resin precast concrete panels have an architectural finish and form the primary weather barrier. There is no detail available for the roof material.

2.5.2.5 Pre-Flood Structural Reporting

Structural assessments of the Auxiliary Building were conducted by OPPD in 1996, 1999, 2004, and 2008. Based on the documents reviewed, the inspections indicate mostly fine cracks and peeling paint of concrete elements such as walls, floors, and ceilings. All reports indicated that there was no significant structural deterioration of elements inspected.

2.5.3 Containment

2.5.3.1 Location, Description, and Function

The Containment is a Class I structure located west of the Turbine Building and enveloped on three sides by the Auxiliary Building. The Containment is cylindrical with a nominal outside diameter of 120 ft and a nominal top of dome height of 140 ft. Ground floor elevation ranges from 1007 to 1013 ft with a lower level of 976.5 ft. The eave elevation at the domed roof eave is 1119 ft. The grade around the building, based on the design documents, is 1004 ft.

The Containment houses a substantial amount of mechanical and electrical equipment, and there are a number of mechanical piping and electrical penetrations through the Containment.

2.5.3.2 Foundation

The primary foundation mat of the Containment consists of 10 to 12 ft of reinforced concrete supported by 20-in.-diameter steel pipe piles placed in a radial pattern and spaced at about 10 ft around the perimeter, with spacing decreasing to about 5 ft near the center of the structure. The primary mat is topped with a 3-ft- to 4-ft-6-in.-thick reinforced concrete mat.

2.5.3.3 Structural Frame

The reinforced concrete shell of the Containment is shown to be keyed into the mat foundation at the base. The shell has a nominal wall thickness of about 8 ft at the base and 12 ft at the eave-to-dome transition. Minimum thickness is about 3 ft 10.5 in. The shell is post-tensioned with access to the cables by means of a removable stainless steel panel at the roof eave and a small access gallery located below el. 979 ft and under the primary base mat foundation.

2.5.3.4 Building Envelope

The exterior concrete of the Containment is rubbed concrete with a 22-ft-wide band of architectural steel panels at the eave. The available drawings do not show the type of roofing membrane.

2.5.3.5 Pre-Flood Structural Reporting

Structural assessments of the Auxiliary Building were conducted in 2009 and 2010. The inspections reports indicated no significant structural deterioration of the elements inspected.

2.5.4 Rad Waste Building

2.5.4.1 Location, Description, and Function

The Rad Waste Building is a single-story building with internal mezzanine levels, drive-in truck bay, and depressed area to store waste drums. It is located next to and west of the Auxiliary Building and power block area. The design drawings indicate that the building was constructed after 1987. The building plan dimensions are shown as 73 ft by 175 ft. The floor slab finish elevation ranges from 1002 to 1007 ft. The flat roof high point is shown to be at el. 1045 ft.

2.5.4.2 Foundation

The design drawings available indicate that the Rad Waste Building is on a reinforced concrete floating mat foundation with a ground-floor elevation of 1007 ft and the lowest top/concrete elevation at 1002 ft in the drum storage area. A foundation curb extends up to el. 1010 ft, and the drawings indicate that openings below 1010 ft are flood protected. The thickness of the mat was not provided in the available documentation.

2.5.4.3 Structural Frame

The drawings indicate that the Rad Waste Building is a pre-engineered steel-braced frame with precast aggregate concrete panels to match the existing Auxiliary Building. The roof structure consists of metal deck spanning between steel joists. The metal deck appears to be designed as a diaphragm. Lateral loads from wind or earthquake are carried to the foundation by the roof deck diaphragm and are transferred to the foundation through the steel columns.

2.5.4.4 Building Envelope

Exterior walls are shown to be precast aggregate concrete panels that form the main weather barrier with a masonry block wall internal liner. There is no detail for the roofing material.

2.5.4.5 Pre-Flood Structural Reporting

Pre-flood structural reports were not available in the referenced documentation.

2.5.5 Technical Support Center

2.5.5.1 Location, Description, and Function

The Technical Support Center is a single-story administrative building located within the power block area immediately north of the Auxiliary Building and west of the Maintenance Shop. The original structure was designed in 1980, and there have been subsequent revisions according to available documentation.

The original building plan dimensions are shown as 54 ft by 78 ft, and an addition to the building was constructed in 1988 with nominal dimension of 40 ft by 68 ft to the east and 14 ft by 78 ft to the south. The grade floor elevation is 1005 ft, and the rooftop is at el. 1020 ft.

2.5.5.2 Foundation

The original Technical Support Center foundation is a reinforced concrete mat foundation, which varies in thickness from 2 to 4 ft. The original mat foundation was constructed with top-of-concrete el. 1004 ft and either concrete fill or false floor built up to el. 1005 ft. The 1988 addition slab-on-grade elevation was 1005 ft. The building addition has spread footings bearing approximately 4 ft below grade.

2.5.5.3 Structural Frame

The original construction consists of cast-in-place concrete walls to roof. The addition was constructed of concrete masonry units. Walls extend from the top of the foundation to the top of the parapet wall.

The floor slab is located at grade level and is constructed of reinforced concrete. Interior non-bearing walls are supported from thickened slab sections.

2.5.5.4 Building Envelope

The roof is constructed of reinforced concrete on metal deck supported from steel joists and steel beams. Tapered insulation is located above the roof slab.

Exterior walls are typically constructed of 12-in.-wide reinforced concrete masonry units, with rigid insulation on the exterior side of the masonry. In part of the building addition, exterior walls are shown to have a masonry veneer finish.

2.5.5.5 Pre-Flood Structural Reporting

Pre-flood structural reports were not available in the referenced documentation.

2.5.6 Independent Spent Fuel Storage Installation

2.5.6.1 Location, Description, and Function

The Independent Spent Fuel Storage Installation (ISFSI) consists of spent fuel modules placed inside 3-ft-thick reinforced concrete shield walls and ceiling, and an associated small Electrical Equipment Building, situated to the northwest of the power block, adjacent to the New Warehouse.

The storage modules are concrete-box structures and are 9 ft 8 in. wide by 20 ft 8 in. long and 18 ft 6 in. tall, placed on a concrete mat foundation. The ISFSI footprint is 42 ft by 211 ft in plan, and the Electrical Equipment Building is 13 ft 4 in. by 17 ft 4 in. in plan with an 11 ft 2 in. eave height above grade.

2.5.6.2 Foundation

The ISFSI foundation is a reinforced concrete mat foundation that is 2 ft thick. The Electrical Equipment Building foundation is shown as a 1-ft-thick concrete mat/depressed slab with a floor elevation nominally 3.0 ft below grade, with concrete walls extending up to grade level.

2.5.6.3 Structural Frame

Information on the structural frame was not available for the ISFSI storage modules, which are supported by the concrete mat foundation.

The Electrical Equipment Building has reinforced masonry block walls extending from the top of the foundation walls at grade to the underside of the roof slab, 11 ft 2 in. above the top of grade wall.

The roof structure consists of a concrete slab on metal de[illegible] masonry walls, sloped 0.5 in. per foot from the center of the structure t[illegible]eave in t[illegible] dimension of the structure.

2.5.6.4 Building Envelope

The ISFSI building envelope is as discussed in Section 2.5.6.3.

2.5.6.5 Pre-Flood Structural Reporting

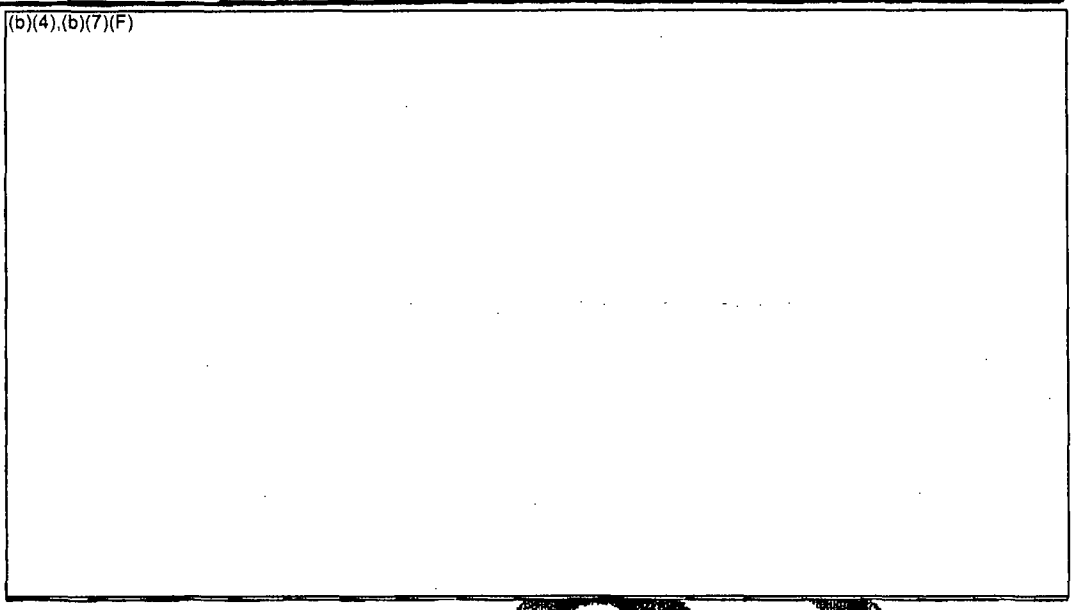
Pre-flood structural reports were not availabl[illegible]he refer[illegible] documenta[illegible]

2.5.7 Security Building

(b)(4),(b)(7)(F)

(b)(4),(b)(7)(F)

(b)(4),(b)(7)(F)



2.5.8 Turbine Building

2.5.8.1 Location, Description, and Function

The Turbine Building was design[illegible]1969. The Turbine Building is noted as a major appurtenant facility. It is structurally connected to the Service Building to the east, adjacent to a contained exterior transformer switchyard (transformers T1A1, T1A2, T1A3, and T1A4) to the south, adjacent to the Auxiliary Building to the [illegible] adjacent to the Maintenance Shop to the north.

The Turbine Building is an open crane bay room that is approximately 90 ft in height above [illegible] and approximately [illegible] across from main column to main column. The building footprint is 122 ft by 227 ft [illegible] dimensions, with twin turbines on separate pedestal-type foundations. Floor and important elevations are as follows:

- [illegible]ade: 1004.5 ft +/-
- [illegible]ment: 990.0 ft
- Fi[illegible]r: 1007.5 ft
- Mezz[illegible]level: 101[illegible]
- Operati[illegible]: 1[illegible] ft
- Top of crane [illegible]073.9 ft (+66.5 ft +/- above floor)

2.5.8.2 Foundation

The top of the basement floor is at el. 990.0 ft. The top of the pile caps is el. 989.4 ft. The typical cap for each major building column is 6.0 ft thick and is supported by a cluster of steel pipe piles. Main equipment such as the turbine/generator is also supported on mat/cap foundations and pipe piles of similar diameter and depth as the building piles.

2.5.8.3 Structural Frame

The Turbine Building structure is a structural steel moment-resisting engineered frame with tapered steel sections and is approximately 90 ft tall with three interior floors. Building columns are supported on reinforced-concrete wall piers. The top of the wall pier is at el. 1007.5 ft. Wall piers extend down to pile caps in the basement and are approximately 17.5 ft in height.

2.5.8.4 Building Envelope

The building envelope consists of exterior walls suppo[illegible]y steel g[illegible] sheathed with insulated resin panels. Panels are fire-rated from grade[illegible]pproxi[illegible]bove grade in height. The building roof is constructed with similar ma[illegible]s suppo[illegible] open-web steel joists spanning between main building frames. The hi[illegible]nt of the roo[illegible] centerline ridge, which runs north-south, is el. 1095.4 ft at top of ste[illegible] of steel at th[illegible] west ends (low points) is el. 1092.9 ft.

2.5.8.5 Pre-Flood Structural Reporting

Periodic inspections of the Turbine Buildin[illegible] schedule[illegible] 3 years. A[illegible] procedure was instituted in 1997 to perform visual in[illegible]tion and p[illegible]uctural condition of the Turbine Building. OPPD inspected the st[illegible]re in 19[illegible]2000,[illegible]2007, and 2010.

In the 1997 report, no superstruct[illegible]ems (structu[illegible]teel and a[illegible]vegrade items) were listed as a concern. Several cracks wi[illegible]oisture seepa[illegible]ere noted[illegible]the poured reinforced concrete walls (below grade[illegible]e cracks were[illegible]mined[illegible]to be of significant structural deterioration. A crack in the [illegible]te corbel at the [illegible]corner, el. 1000.0 ft, of the Heather[illegible]grid TB-[illegible]ated an Engineering Assistance Request for repair.

Th[illegible]0 report indic[illegible]t a revie[illegible]initiated to determine the repair process for the [illegible]ural item above. It[illegible]d that the[illegible]ioration is only surficial. There was no reported [illegible]idence of other significan[illegible]ctural dete[illegible]ion.

The 2004 report does not indic[illegible]any significant findings of structural deterioration.

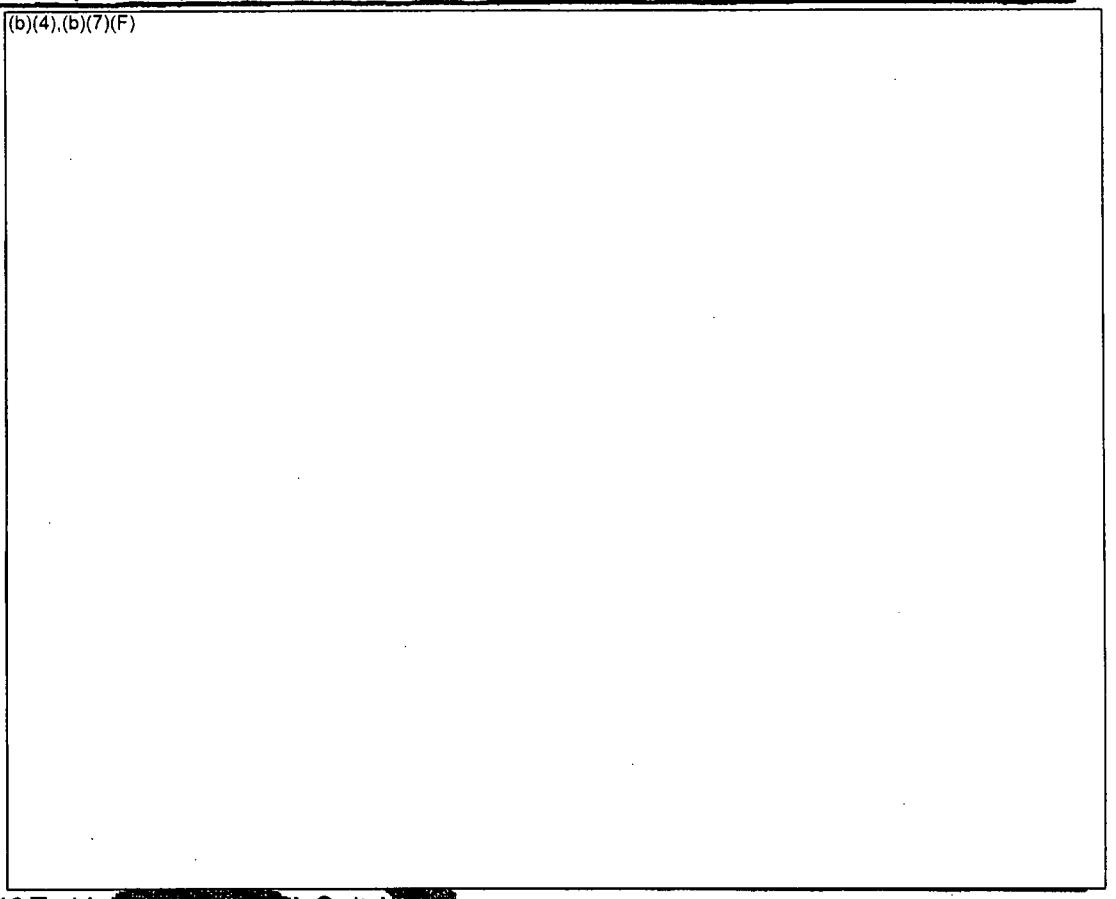
The[illegible] report does not indi[illegible]any significant findings of structural deterioration but lists several[illegible]s for minor repa[illegible]h as repainting or re-application of protective coating.

The 2010 r[illegible]oes n[illegible]icate any significant findings of structural deterioration but mentions that[illegible]caulking on the Turbine Building is aging.

2.5.9 Security Barricaded Ballistic Resistant Enclosures

(b)(4),(b)(7)(F)

(b)(4),(b)(7)(F)



2.5.10 Turbi[illegible] Switchy[illegible]

2.[illegible].1 Location, De[illegible]ion, and [illegible]tion

The Turbine Building South Switchyard is located south of the Turbine Building and consists of several transformers, transmission structures, and an underground duct bank.

2.[illegible].2 Foundation

The fou[illegible]ons for the co[illegible]ents of the Turbine Building South Switchyard are as follows:

- Transfor[illegible]
  - Transfor[illegible]s approximately 12 ft by 25 ft in plan dimension.
  - The founda[illegible]n for T1 is a 1-ft-6-in.-thick mat, 14 ft by 34 ft, supported on piles.
  - T/Mat foundation is el. 1005.5 ft.

- Dead End/161 Structure
  - Two-column frame is approximately 27 ft in height with interconnecting cross beam.
  - There are two foundations for each octagonal column. The piers have a 5 ft 0 in. by 5 ft 0 in. by 3 ft 0 in. height. Top of pier is el. 1004.0 ft.
  - T/Foundation cap is el. 1001.0 ft. Each cap is 4 ft 0 in. thick, 7 ft 0 in. by 20 ft 0 in. in plan dimensions, supported by piles.

- Underground Duct Bank
  - Underground duct bank is 7 ft 0 in. wide, running east-west just south of main Turbine Building.
  - Duct details are shown in Drawing 11405-E-315.

- Trench System
  - Main collector trench runs east-west with branches between electrical units T1A-2, T1A-3, and T1A-4; locations are shown in Drawing 11405-E-314.
  - Grounding grid is established circling all transformers in switchyard.
  - The conduit trench is a cast-in-place U-shaped trench with removable covers. Trench walls have drain holes throughout. The west end has a drain pipe through the slab with buried perforated pipe labeled as "to storm sewer manhole."

- Transformers T1A-1 and T1A-2
  - The foundations for T1A-1 and T1A-2 are a 1-ft-6-in.-thick mat, 5 ft by 8 ft, supported on piles.
  - T/Mat foundation is el. 1005.5 ft.

- Transformers T1A-3 and T1A-4
  - The foundations for T1A-3 and T1A-4 are a 1-ft-6-in. thick mat, 8 ft by 13 ft, supported on piles.
  - T/Mat foundation is el. 1005.5 ft.

- Transformer T1C-3B
  - The foundation for T1C-3B is an 8-in.-thick mat, 4 ft by 6 ft 8 in., supported on piles.
  - T/Mat foundation is el. 1004.8 ft.

- Enclosure Wall
  - The structures are enclosed by an 8-in.-thick cast-in-place concrete wall cast in insulated wall forms up to el. 1005.0 ft.

2.5.10.3 Structural Frame

The Dead End/161 Structure consists of two bents, approximately 27 ft in height, with interconnecting cross beam.

2.5.10.4 Building Envelope

A building envelope is not applicable to this structure.

2.5.10.5 Pre-Flood Structural Reporting

Pre-flood structural reports were not available in the referenced documentation.

2.5.11 Condensate Storage Tank

2.5.11.1 Location, Description, and Function

The 150,000-gallon plate-steel Condensate Storage Tank is located east of the power block and south of the Intake Structure. The tank is nominally 30 ft tall by 30 ft in diameter.

Tank drawings indicate that the design is in accordance with all the applicable paragraphs of the American Water Works Association standard D100-65 for welded steel standpipe-type tank. Tank design shall be for atmospheric pressure plus a full tank of water.

2.5.11.2 Foundation

The tank foundation is a 2-ft-minimum-thickness concrete mat supported on 13 10BP42 steel piles driven to bedrock at approximate el. 934 ft. The top-of-concrete elevation is 1005 ft 6 in. This concrete slab is approximately 41 ft in diameter, resulting in a walkway around the tank. This slab is cast within a steel sheet pile system that is driven into the riverbank to el. 944 ft 9 in., which is approximately 10 ft above bedrock.

2.5.11.3 Structural Frame

A structural frame is not applicable to this structure.

2.5.11.4 Building Envelope

A building envelope is not applicable to this structure.

2.5.11.5 Pre-Flood Structural Reporting

Pre-flood structural reports were not available in the referenced documentation.

2.5.12 Demineralized Water Tank, Pump House, and RO Unit

2.5.12.1 Location, Description, and Function

The Demineralized Water System provides demineralized water to the Containment and Auxiliary Building and makeup water to the Turbine Building and Service Building, supplying water to various loads. The demineralized water is produced with a reverse osmosis (RO) unit in the Old Warehouse as both aerated and non-aerated water supplies. The non-aerated water supply is stored in the primary storage tank.

The Demineralized Water Storage Tank is adjacent to the Missouri River at the southeast corner of the power block.

The Demineralized Water Storage Tank is a 33-ft-inside-diameter storage tank that extends approximately 31 ft above grade. This tank is located to the north of the Old Warehouse and to the west of the PA.

The Pump House is a small pre-engineered metal building adjacent to the Demineralized Water Storage Tank.

The RO Unit resides in the northern section of the Old Warehouse. The Old Warehouse is a pre-engineered metal building supported on a cast-in-place slab and perimeter stem wall on continuous footings that extend below frost depth.

2.5.12.2 Foundation

The Demineralized Water Storage Tank is supported around its perimeter on a continuous cast-in-place concrete ring wall that is 1 ft 2 in. wide by 2 ft tall. The interior of the tank bears on a layer of sand on top of a geotextile filter fabric, which in turn is on top of a free-draining crushed limestone aggregate. The crushed limestone aggregate is drained by three 1.5-in.-diameter foundation drains spaced equally around the concrete ring wall.

The Pump House is supported on a 6-in slab on grade.

The entire tank footprint, including the concrete ring wall and the interior crushed rock along with the Pump House slab, is supported on a rammed aggregate piers soil improvement system.

There is no foundation documentation available for the Old Warehouse.

2.5.12.3 Structural Frame

The Demineralized Water Storage Tank is fabricated of stainless steel to meet the requirements of the API Standard 650.

The Pump House is a pre-engineered metal building consisting of rigid steel moment frames. The building is clad with corrugated metal roofing and wall panels.

The Old Warehouse is a pre-engineered metal building consisting of rigid steel moment frames. The structure is braced perpendicular to the frames with tension only cable bracing. The building is clad with corrugated metal roofing and wall panels.

2.5.12.4 Building Envelope

A building envelope is not applicable to this structure.

2.5.12.5 Pre-Flood Structural Reporting

Pre-flood structural reports were not available in the referenced documentation.

2.5.13 Meteorological Tower

2.5.13.1 Location, Description, and Function

The Met Tower is a 360-ft-tall triangular guyed structure designed for 100-mile-per-hour wind and radial ice on all fixtures of 1.0 in. The tower is located approximately 2800 ft north of the power block. There is a small masonry structure adjacent to the Met Tower for instrumentation storage and protection.

The onsite meteorological monitoring system provides observations of wind speed, wind direction, precipitation, barometric pressure, temperature, and temperature change with height. The system is operated continuously. The Met Tower is an essential part of the meteorological data collection system, allowing sensors to be placed at varying heights above ground so that observations can be acquired at elevations important to facility operations.

The Met Tower incorporates an inside climbable ladder with a safety climbing device and has Federal Aviation Administration (FAA) marking and lighting and a lightning and transient voltage protection system. Meteorological instruments are mounted at various levels on the tower, with some instruments mounted on booms extending laterally from the tower.

2.5.13.2 Foundation

The base footing for the Met Tower is 7-ft-0-in.- by 7-ft-0-in.- by 4-ft-6-in.-thick reinforced concrete. The tower is guyed at several locations along its height, with the guys extending in a triangular pattern at 120 degrees to one another. The guy wires are collected at points 145 and 290 ft from the tower base and anchored to concrete deadmen at grade level. The deadmen are reinforced concrete 4 ft 0 in. by 8 ft 0 in. by 3 ft thick with 4 ft 0 in. of concrete fill above the footing at the three 145-ft guy anchor locations and 6-ft-0-in.- by 8-ft-0-in.- by 4-ft-0-in.-thick reinforced concrete with 4 ft 0 in. of concrete fill above the footing at the three 290-ft guy anchor locations.

2.5.13.3 Structural Frame

The Met Tower is constructed of a bolted tubular steel frame with a nominal plan dimension of 3 ft 0 in. between the three vertical frame members. The tower has the same cross section for the entire height, with guys fastened to the frame at various intervals of the structure height to provide vertical stability to the structure.

2.5.13.4 Building Envelope (Instrumentation Shelter)

An instrumentation shelter is located adjacent to the base of the tower. This building is nominally 11 ft 4 in. by 11 ft 4 in., constructed of 8-in. partially reinforced concrete masonry unit walls 9 ft 2 in. high, supported by a reinforced concrete base slab with thickened footings along the perimeter. The roof is constructed of precast concrete planks spanning between the exterior walls.

2.5.13.5 Pre-Flood Structural Reporting

Pre-flood structural reports were not available in the referenced documentation.

2.5.14 Original Steam Generator Storage Building

2.5.14.1 Location, Description, and Function

The OSGS houses the original steam generator, designed by Bechtel in 2007. The OSGS is located to the west of the plant, north of the main plant entry drive.

2.5.14.2 Foundation

The foundation is a reinforced concrete mat which is shown in the drawings to be placed in two phases with a horizontal construction or cold joint between the separate concrete placements. The top of the mat slab is shown in the documents as el. 1022 ft. Dowels are shown extending up from the top of slab into the wall above. No documentation is available for the plan layout, dimensions, or details above the top of slab.

2.5.14.3 Structural Frame

Information on the structural frame was not available in the referenced documentation.

2.5.14.4 Building Envelope

Information on the building envelope was not available in the referenced documentation.

2.5.14.5 Pre-Flood Structural Reporting

Pre-flood structural reports were not available in the referenced documentation.

2.5.15 Switchyard

2.5.15.1 Location, Description, and Function

The Switchyard comprises the 161 kilovolt (kV) switchyard and 345 kV switchyard. There are three enclosed buildings in the Switchyard. However, there is no documentation that details the aboveground superstructure for these three buildings.

There are numerous stands for equipment (e.g., switches, bus supports) as well as equipment that is directly supported by a reinforced concrete foundation, but there is no documentation that details any of the aboveground superstructure:

- 161 kV Control and Switchgear Building
  - Built in 1990, located west of 345 kV switchyard
  - One-story enclosure, approximately 30 ft by 70 ft overall plan dimension
  - Floor and important elevations:
    Grade: 1004.5 ft +/-
    Basement: Not applicable
    Floor: 1005.6 ft

- 345 kV East Control Building
  - Built in 1968, located east of 161 kV switchyard
  - One-story enclosure, approximately 32 ft by 40 ft overall plan dimension
  - Floor and important elevations:
    Grade: 1004.5 ft +/-
    Basement: Not applicable
    Floor: 1007.5 ft

- 345 kV West Control Building
  - Built in 1998, located east of 161 kV switchyard
  - One-story enclosure, approximately 35 ft by 85 ft overall plan dimension
  - Floor and important elevations:
    Grade: 1004.5 ft +/-
    Basement: Not applicable
    Floor: 1005.75 ft

2.5.15.2 Foundations

There are three enclosed buildings in the Switchyard. The following succinctly summarizes the foundations provided for these three buildings as well as the numerous stands for equipment (e.g., switches, bus supports) and equipment that is directly supported on a reinforced concrete foundation:

- Building Foundations
  - 161 kV Building Foundation
    Perimeter wall footing, 3 ft 0 in. wide, approximately 5 ft below grade and top of wall to bottom of footing is 6 ft 0 in.
    Floor slab is at el. 1005.6 ft, constructed of 5-in. reinforced concrete supported on 6 in. of compacted sand over compacted soil
  - 345 kV East Control Building Foundation
    Perimeter wall trench footing, 8 in. wide and 6 ft 6 in. from top of wall to bottom of footing
    Floor slab is at el. 1007.5 ft, constructed of 4-in. reinforced concrete supported on 4 in. of Styrofoam above top of 6 in. of compacted soil
  - 345 kV West Control Building Foundation
    Perimeter wall footing, 4 ft 0 in. wide and 5 ft 6 in. from top of wall to bottom of footing
    Floor slab at el. 1005.75 ft, constructed of 5-in. reinforced concrete supported on 6 in. of compacted rock over compacted soil
- Equipment Foundations
  - 161kV Transformer Foundations
    T-1 Transformer foundations
    Built in 1968
    3 ft 0 in. thick by 9 ft 0 in by 9 ft 0 in. mat supported by 11 14-in.-diameter reinforced-concrete piles
    T-2 Transformer foundations
    Built in 1990
    2 ft 0 in. thick by 10 ft 0 in. by 18 ft 0 in. mat supported by 11 18-in.-diameter reinforced-concrete piles
  - 161kV Breaker Foundations
    Built in 1968
    6 ft 6 in. by 26 ft 0 in. mat supported by six 2-ft-0-in.-diameter piers with 42-in. bells, 4 ft 6 in. deep
    Breakers 1 and 2 foundations
    Built in 1993
    1 ft 6 in. thick by 9 ft 0 in. by 9 ft 0 in. mat supported by four shallow reinforced-concrete piers, approximately 18 in. in diameter, 5 ft 0 in. deep

Breaker Station Service Emergency R foundations
Built in 1990
16 in. thick by 5 ft 0 in. by 10 ft 0 in. mat supported by four 6-in. reinforced-concrete piles
Breaker Station Service Normal Y foundations
Built in 1990
16 in. thick by 5 ft 0 in. by 6 ft 0 in. mat supported by four 6-in. reinforced-concrete piles 3 ft 0 in. in overall length
Breaker Station E and F foundations
Built in 1990
1 ft 6 in. thick by 9 ft 0 in. by 9 ft 0 in. mat supported by four 12-in. reinforced-concrete piles
Typical 161 kV circuit breaker foundations
Built in 1990
2 ft 0 in. thick by 6 ft 6 in. by 8 ft 0 in. mat supported by opposite-end ratwalls 18 in. thick and 4 ft 0 in. deep

- 161kV Equipment Foundations
Line Terminal Structure foundations
Built in 1968
7 ft 0 in. thick by 7 ft 0 in. by 16 ft 0 in. mat supported by ten reinforced-concrete piles.
Switch Structure foundations
Built in 1968
2-ft-0-in.-diameter pier with 42-in. bell, 6 ft 0 in. in overall length
Bus Support and Pot. Trans. foundations
Built in 1968
3-ft-0-in.-diameter pier, 7 ft 0 in. in overall length
9 ft 6 in. and 10 ft 6 in. Q.V. Bus Support Stand foundations
Built in 1990
2-ft-6-in.-diameter pier, 19 ft 0 in. in overall length
17 ft 6 in. and 18 ft 6 in. S.W. Bus Support Stand foundations
Built in 1990
2-ft-6-in.-diameter pier, 25 ft 0 in. in overall length
9 ft 0 in. N, N1 Switch Stand foundations
Built in 1990
2-ft-6-in.-diameter pier, 19 ft 0 in. in overall length
17 ft 0 in. H Switch Stand foundations
Built in 1990
2-ft-6-in.-diameter pier, 25 ft 0 in. in overall length
L.A. and CCVT K, U Stand foundations
Built in 1990
2-ft-0-in.-diameter pier, 12 ft 0 in. in overall length
Pothead G foundations
Built in 1990
2-ft-0-in.-diameter pier, 6 ft 0 in. in overall length

CVT foundation
Built in 1993
Single 2-ft-0-in.-diameter by 12-ft-0-in.-deep reinforced concrete pier
Bus Support Stand foundation
Built in 1993
Single 2-ft-6-in.-diameter by 25-ft-0-in.-deep reinforced concrete pier
Dead End Tower L foundations
Built in 1990
6-ft-0-in.-diameter pier, 40 ft 0 in. in overall length

- 345kV Breaker Foundations
  345 kV Power Circuit Breaker foundation
  Built in 1968
  Two parts: four 2-ft-0-in.-diameter piers, 7 ft 0 in. in overall length; 1-ft-6-in.-thick mat supported by four 1-ft-0-in.-diameter piers, 5 ft 0 in. in overall length
  Top-of-mat el. 1006.75 ft
  CB-6 Breaker foundation
  Built in 1968
  2 ft 0 in. thick by 6 ft 0 in. by 18 ft 0 in. mat
  Supported by four shallow reinforced-concrete piers
  Cir Switcher foundation
  Built in 1968
  Single 5-ft-0-in.-diameter by 8-ft-6-in.-deep reinforced concrete pier
  Top-of-pier el. 1005.75 ft
  Switch Structure foundations
  Built in 1968
  2-ft-0-in.-diameter pier with 42-in. bell, 6 ft 6 in. in overall length
  CCVT
  Built in 1968
  Single 2-ft-0-in.-diameter by 7-ft-0-in.-deep reinforced-concrete pier
  Pot Trans and Cap Pot Device foundations
  Built in 1968
  2-ft-0-in.-diameter pier with 42-in. bell, 6 ft 6 in. in overall length
  CB-2, -4 and -5 Breaker foundations
  Built in 1993
  2 ft 0 in. thick by 6 ft 0 in. by 18 ft 0 in. mat supported by four shallow reinforced-concrete piers

- 345kV Foundations

  345 kV T3 and T4 Transformer foundations
  Built in 1998
  3 ft 6 in. thick by 16 ft 0 in. by 28 ft 0 in. mat supported by 11 16-in. reinforced auger-cast concrete piles, 50 ft in overall length
  345 kV FCS Spare GSU Transformer foundation
  Built in 2002
  3 ft 6 in. thick by 14 ft 0 in. by 34 ft 0 in. mat supported by ten 16-in. reinforced-concrete piles

Line Terminal Structure foundations
Built in 1968
6 ft 0 in. thick by 14 ft 0 in. by 30 ft 0 in. mat supported by 13 unknown-diameter reinforced-concrete piles
345 kV Shunt Reactor foundation
Built in 1968
3 ft 0 in. thick by 9 ft 0 in. by 12 ft 0 in. mat supported by four 14-in. reinforced-concrete piles
345 kV Station Service foundations
Built in 1968
8 in. thick by 4 ft by 9 ft mat supported by four 1-ft-0-in. reinforced concrete piles

2.5.15.3 Structural Frame

Information on the structural frame was not available in the referenced documentation.

2.5.15.4 Building Envelope

A building envelope is not applicable to this structure.

2.5.15.5 Pre-Flood Structural Reporting

Pre-flood structural reports were not available in the referenced documentation.

2.5.16 Transmission Towers

2.5.16.1 Location, Description, and Function

The Transmission Towers are defined as a system of structures supporting lines 70 and 76 from the plant dead end to the substation dead end west of the plant, and lines 66, 146, 148, and 165 beyond the substation to the west within the plant fence.

There is no documentation available for the structures above grade, and partial documentation is available for the foundations supporting the structures.

2.5.16.2 Foundation

There are foundation drawings dated May 26, 2004, that indicate an augered pier foundation for line 76, and a drawing that indicates varying configurations of pile-supported pile cap foundations identified for the 345 kV line, but the pile foundations are not correlated to the line numbers available in other documents.

The pier foundations are 5 ft 6 in. in diameter to 6 ft 6 in. in diameter, with design depths up to 35 ft 6 in. The piers are designed as reinforced concrete piers with varying anchor bolt arrangements for different transmission tower structures.

The pile foundations are shown as 6-, 7-, 8-, 9-, or 10-pile foundations with pile caps of reinforced concrete varying in thickness from 3 ft 0 in. to 3 ft 3 in. Reinforced concrete piers

are supported by the pile caps that extend above grade and have a structural steel column stub extending out of the pier.

2.5.16.3 Structural Frame

Information on the structural frame was not available in the referenced documentation.

2.5.16.4 Building Envelope

A building envelope is not applicable to this structure.

2.5.16.5 Pre-Flood Structural Reporting

Pre-flood structural reports were not available in the referenced documentation.

2.5.17 New Warehouse

2.5.17.1 Building Location, Description, and Function

The New Warehouse is located adjacent to the river and north of the power block. Drawings indicate it was built in 1987. The current building is approximately 322 ft by 126 ft in overall plan with a parking area to the north. The floor slab is shown to be 4 to 6 in. thick, depending on the location, with thickened concrete under interior CMU partition walls. Exterior grade is shown as being approximately 1003.7 ft, and the finish floor is shown at 1007.70 ft. There is a full building expansion joint located between column grid lines G and H; the expansion joint is located approximately 40 percent of the building length as measured from the east wall line. A cast-in-place concrete manhole MH-17 is shown between column grid lines L.3 and M in the east–west direction and between 2 and 2.3 in the north–south direction.

2.5.17.2 Foundation

Reinforced concrete spread footings are located under columns with continuous reinforced concrete footings at the wall perimeter. Details indicate the use of both reinforced concrete and reinforced masonry foundation walls. The soil under the building was over-excavated down to 994 ft, and engineered fill was placed to finish grade.

2.5.17.3 Structural Frame

The structural frame on the building indicates the use of steel columns. Further details were not available in the referenced documentation.

2.5.17.4 Building Envelope

Complete information on the building envelope was not available in referenced documentation. Details on the foundation drawings indicate precast panels may form the building walls.

2.5.17.5 Pre-Flood Structural Reporting

Pre-flood structural reports were not available in the referenced documentation.

2.5.18 Service Building

2.5.18.1 Building Location, Description, and Function

The Service Building is to the east of and adjoins the Turbine building. Drawings indicate it was built in 1967. The current building is approximately 50 ft by 224 ft in overall plan dimension. The structure is a two-story ridged steel frame constructed on deep foundations. The roof is metal deck with insulation and three-ply roofing. Grade is shown to be 1004 ft; the ground-floor level is approximately 3.5 ft above grade at el. 1007.5 ft and the second is at el. 1019.5 ft.

2.5.18.2 Foundation

The foundation is shown as deep pile foundation with reinforced pile caps placed to 10 ft below the top-of-foundation elevation at 1006.5 ft. Reinforced grade beams span between pile caps and support reinforced concrete slab with a thickness ranging from 6 to 12 in. Exterior columns and walls are on continuous grade beams.

2.5.18.3 Structural Frame

The structural frame is a rigid steel moment frame.

2.5.18.4 Building Envelope

The roof is shown as a metal deck with insulation and three-ply roofing. Information on the walls was not available in the referenced documentation.

2.5.18.5 Pre-Flood Structural Reporting

Pre-flood structural reports were not available in the referenced documentation.

2.5.19 CARP Building

2.5.19.1 Building Location, Description, and Function

The Chemistry/Radiation Protection (CARP) Building was originally built in 1988 and adjoins the Auxiliary Building and Technical Support Center to the south and the Maintenance Building to the east. The west wall forms an exterior wall with an asphalt paved area immediately west of the building. A cafeteria composing the full east–west length of the CARP Building was added later and is separated from the CARP Building by a two-hour fire rated masonry block wall. The current CARP Building is approximately L-shaped, 112 ft 6 in. (north–south) by 248 ft 8 in. (east–west) in overall plan dimension, surrounding the Technical Support Center to the southeast, which is approximately 60 ft (north–south) by 125 ft (east-west). Exterior grade is shown as elevation 1004 ft with the first-floor level at 1007 ft.

2.5.19.2 Foundation

Interior and exterior building columns are supported on shallow spread-footing foundations. Exterior columns and walls are on continuous wall footings, constructed in a manner similar to that of the interior building columns.

2.5.19.3 Structural Frame

The CARP Building is a single-story steel framed structure, with a partial mezzanine level in the southern half. Typical structural bays are approximately 25 ft by 25 ft.

2.5.19.4 Building Envelope

Details for walls are varied but generally consist of concrete masonry construction. The roof is single-ply membrane over rigid insulation.

2.5.19.5 Pre-Flood Structural Reporting

Pre-flood structural reports were not available in the referenced documentation.

2.5.20 Maintenance Shop

2.5.20.1 Building Location, Description, and Function

The Maintenance Shop was originally built in 1978 and adjoins the Service and Turbine Buildings to the south in the PA. The current building is approximately 120 ft by 150 ft in overall plan dimension. The original building was a rectangular-shaped structure with dimensions of 60 ft (north–south) by 150 ft (east–west). The structure consisted of a pre-engineered metal building with a mezzanine level. The main-floor level is at el. 1007.5 ft, which is approximately 3 ft above exterior grade. A rectangular-shaped addition was made to the northern portion of the Maintenance Shop in 1987. The approximate size of the addition was 60 ft (north–south) by 150 ft (east–west). The addition structure consisted of a pre-engineered metal building with a partial mezzanine level. The Maintenance Shop is bordered on the north and east by concrete paved areas.

2.5.20.2 Foundation

Interior and exterior building columns are supported on shallow spread footings, and exterior columns and walls are on continuous wall footings.

2.5.20.3 Structural Frame

The structural frame is a single-story steel framed structure with an added mezzanine level in the southern half. Typical bays are approximately 20 ft by 20 ft.

2.5.20.4 Building Envelope

The building envelope is shown to be an insulated wall system with metal siding on girts for supporting both and interior and exterior wall system. The roof is shown as a standing seam metal roof on purlins with batt type insulation held in place by a finished interior wall panel that was not identified from the information available.

2.5.20.5 Pre-Flood Structural Reporting

There are two reported incidence of column settlements (Column TE-15) within the Maintenance Shop building. The first report, CR-2010-4755, occurred before the 2011 Flood

and notes that Column TE-15 had settled approximately one plus (1+) inches. The second report, CR-2011-5895, occurred in July 2011, and notes that Column TE-15 had settled additionally. The settlement was reported to be a sudden, dramatic settlement, approximately one plus (1+) inches, with accompanying cracking noises and following dust. A follow-up investigation by Ground Penetrating Radar Systems, Inc., in August 2011, using ground penetrating radar (GPR), discovered that there was a possible void beneath the adjacent column; however, the exact thickness of the void was not determined but reported as a minor.

2.5.21 Maintenance Fabrication Shop

2.5.21.1 Building Location, Description, and Function

The Maintenance Fabrication Shop is located to the west of the CARP and cafeteria building. Documents indicate the Maintenance Fabrication Shop was built in 1987. The building is shown to be approximately 20 ft by 36 ft in overall plan dimension and is 12 ft in height with a low slope roof.

2.5.21.2 Foundation

Exterior building columns are supported on reinforced concrete shallow foundations (spread footings) placed 3.5 ft below grade and integral with a continuous reinforced concrete foundation wall on spread footings. The floor slab is 8 in. thick reinforced concrete and approximately 2 in. above grade.

2.5.21.3 Structural Frame

The structural framing is a single-story, open-span, rigid frame steel structure with braced bays on the exterior walls.

2.5.21.4 Building Envelope

The building envelope is shown to consist of a double-sided insulated wall panel and roof panels. The material skin on the building panel is not identifiable. Openings include one 8 ft by 8 ft overhead door and two man doors.

2.5.21.5 Pre-Flood Structural Reporting

Pre-flood structural reports were not available in the referenced documentation.

2.5.22 Maintenance Storage Building

2.5.22.1 Building Location, Description, and Function

Information on the building was not available in the referenced documentation.

2.5.22.2 Foundation

Information on the foundation was not available in the referenced documentation.

2.5.22.3 Structural Frame

Information on the structural frame was not available in the referenced documentation.

2.5.22.4 Building Envelope

Information on the building envelope was not available in the referenced documentation.

2.5.22.5 Pre-Flood Structural Reporting

Pre-flood structural reports were not available in the referenced documentation.

2.5.23 Old Warehouse

2.5.23.1 Building Location, Description, and Function

The Old Warehouse is located approximately 160 ft west of the power block. The current building is approximately 300 ft by 60 ft in overall plan. The floor slab is about 4 in. thick based on areas where the floor had core samples taken.

2.5.23.2 Foundation

Information on the foundation was not available in the referenced documentation.

2.5.23.3 Structural Frame

Information on the structure was not available in the referenced documentation.

2.5.23.4 Building Envelope

Information on the building envelope was not available in the referenced documentation.

2.5.23.5 Pre-Flood Structural Reporting

Pre-flood structural reports were not available in the referenced documentation.

2.5.24 Training Center

2.5.24.1 Building Location, Description, and Function

The Training Center is a single-story administrative building located southwest of the power block area and next to the plant access road. The original structure was built after 1987 based on the design documents.

The preconstruction building plan dimensions provided in the referenced documentation indicate plan dimension of 110 ft by 370 ft. The preconstruction finished floor elevation is 1008.5 ft with the cafeteria and auditorium depressed to 1007 ft. The original site grade within the building area ranges from el. 1000 to 1003 ft.

2.5.24.2 Foundation

The Training Center foundation was original recommended to be reinforced concrete spread footing placed at a minimum depth necessary for frost protection.

2.5.24.3 Structural Frame

The preconstruction referenced documentation indicates that the building has a steel frame with precast wall panels. No information is provided on the roof structure.

2.5.24.4 Pre-Flood Structural Reporting

Pre-flood structural reports were not available in the referenced documentation.

2.5.25 Administration Building

2.5.25.1 Building Location, Description, and Function

The Administration Building was built in 1989 and is located southwest of the PA. It is a two-story, steel framed structure, 172 ft by 308 ft overall plan dimension. The Administration Building is bordered on the north by parking lots, on the south by wastewater treatment lagoons, on the east by chemical stabilization lagoons and marsh, and on the west by the Training Center. Floor and important elevations are as follows:

- Grade: 1007 ft +/-
- No basement
- First floor: 1007.0 ft

There also is a loading dock on one side with slightly lower elevation of 1004 ft with low retaining walls.

2.5.25.2 Foundation

Interior building columns are supported on individual spread footings constructed on top of a 2-ft-thick layer of new engineered fill above native soils. Exterior columns and walls are on continuous wall footings, constructed in a manner similar to that of the interior building columns.

The site is on the west bank of the Missouri river flood plain approximately 600 ft from the riverbank. Bedrock was reported at 60 to 75 ft below existing grade before development. The entire building site has been raised 3 ft to 5 ft to place the floor elevations above flood plain. The site was preloaded with 7 ft of fill to compress softer layers of soils and reduce long-term settlements.

2.5.25.3 Structural frame

The structural framing is a two-story steel framed structure. Interior columns are located on a grid, typically 34 ft by 34 ft.

2.5.25.4 Building Envelope

Information on the building envelope was not available in the referenced documentation.

2.5.25.5 Pre-Flood Structural Reporting

Pre-flood structural reports were not available in the referenced documentation.

2.5.26 Hazardous Material Storage Building

2.5.26.1 Building Location, Description, and Function

The Hazardous Material Storage Building (Haznat Shed) is located adjacent to and west of the Old Warehouse. Documents indicate this structure was built in 1987. The building is shown to be approximately 20 ft by 36 ft in overall plan dimension and is 12 ft in height with a low slope roof.

2.5.26.2 Foundation

Exterior building columns are supported on reinforced concrete shallow foundations (spread footings) placed 3.5 ft below grade and integral with a continuous reinforced concrete foundation wall on spread footings. The floor slab is 8-in.-thick reinforced concrete and shown approximately 2 in. above the adjacent grade elevation.

2.5.26.3 Structural Frame

The structural framing is a single-story, open-span, rigid frame steel structure with braced bays on the exterior walls.

2.5.26.4 Building Envelope

The building envelope is shown to consist of a double-sided insulated wall panel and roof panels. The material that forms the building panel is not identifiable on the documents. Openings include one 8 ft by 8 ft overhead door and two man doors.

2.5.26.5 Pre-Flood Structural Reporting

Pre-flood structural reports were not available in the referenced documentation.

2.5.27 Maintenance Garage

2.5.27.1 Building Location, Description, and Function

The Maintenance Garage is located approximately 250 ft west of the southern end of the Old Warehouse. According to the documentation available, the Maintenance Garage was built in 2005, and documents indicate the foundation was originally built for the Head Assembly Facility (HAF) used for the steam generator project.

2.5.27.2 Foundation

The reinforced concrete foundation is shown to be a 2-ft-thick reinforced mat foundation with the top-of-concrete place approximately at grade with thickened haunches at the perimeter extending 2 ft 6 in. below grade.

2.5.27.3 Structural Frame

The information available indicates the structure is a steel semicircular bent frame. Details on the member shape and space were not available in the referenced documentation.

2.5.27.4 Building Envelope

The building envelope is identified on the documentation as a fabric cover over the steel frame.

2.5.27.5 Pre-Flood Structural Reporting

Pre-flood structural reports were not available in the referenced documentation.

2.5.28 Tertiary Building

2.5.28.1 Building Location, Description, and Function

The Tertiary Building (Boat Storage) was built in 1984 originally as a neutralization building as indicated in the geotechnical report. The building is shown to be approximately 24 ft by 20 ft in plan. The structure is a one-story prefabricated building on shallow foundations with a reinforced concrete floating slab placed at 1001.1 ft with grade shown as 1000.5 ft. The building covers a submerged tank that sits on a reinforced concrete mat placed approximately 12 ft below grade.

2.5.28.2 Foundation

The foundation consists of reinforced grade walls extending approximately 4 ft below grade.

2.5.28.3 Structural Frame

The steel structural frame consists of a prefabricated steel braced frame.

2.5.28.4 Building Envelope

Information on the building envelope was not available in the referenced documentation.

2.5.28.5 Pre-Flood Structural Reporting

Pre-flood structural reports were not available in the referenced documentation.

2.5.29 Spare Transformer Pads

2.5.29.1 Building Location, Description, and Function

The Spare Transformer Pads are located just off the main plant entrance road and south of the Switch Yard. Drawings indicate that one pad was built in 2002 and another in 2005. One pad consists of reinforced concrete cap supported on ten 1-ft-6-in. reinforced concrete piles, which are placed to 73 ft below grade, and is located between the second pad and the Maintenance Garage. The second pad is a 1-ft-thick reinforced concrete mat 50 ft by 52 ft in plan with a hauched perimeter thickness of 2 ft and a top-of-concrete elevation of 1006 ft.

2.5.29.2 Foundation

See Section 2.5.29.1.

2.5.29.3 Structural Frame

A structural frame is not applicable to this structure.

2.5.29.4 Building Envelope

A building envelope is not applicable to this structure.

2.5.29.5 Pre-Flood Structural Reporting

Pre-flood structural reports were not available in the referenced documentation.

2.5.30 Shooting Range

2.5.30.1 Building Location, Description, and Function

The Shooting range is located 400 ft north of the PA and approximately 750 ft west of the river and separated from the river by a wooded patch of land. The land area for the firing range is approximately 100 ft wide by 150 ft deep. A shelter on the southern end of the range spans the full 100-ft width of the range. The shooting range is surrounded by a berm on three sides and, the entire area of the range from crest-of-berm to crest-of-berm is approximately 225 ft by 200 ft.

2.5.30.2 Foundation

A foundation is not applicable to this structure.

2.5.30.3 Structural Frame

A structural frame is not applicable to this structure.

2.5.30.4 Building Envelope

A building envelope is not applicable to this structure.

2.5.30.5 Pre-Flood Structural Reporting

Pre-flood structural reports were not available in the referenced documentation.

2.6 Civil Baseline

Civil infrastructure provides functional support for Priority 1 and Priority 2 structures at FCS. Underground utilities, electrical lines, and structures are essential components of facility operation. Many of these components were part of original plant construction and have been modified when and where necessary, including for plant upgrades as well as repairs. As a result, numerous plant drawings show underground utilities at the site. Drawing 25036-C-008 (File 60559) is a composite plan of existing (as of 2006) buried utilities, primarily those north of the main FCS access road. This drawing and other existing available drawings were reviewed to identify the existing civil infrastructure relating to Priority 1 structures at FCS prior to the beginning of the flood. The following aspects were targeted for each component:

- Underground Piping
  - Materials of Construction
  - Range of Sizes
  - Bedding Type

- Underground Electrical
  - Type of Burial
  - Range of Sizes
  - Bedding Type (if applicable)

In addition to these underground components, the civil infrastructure at FCS includes some aboveground structures, including the Camera Towers and High Mast Lighting, fencing, the Met Tower, and the Transmission Towers.

Data obtained are discussed and/or referenced throughout this civil baseline description. Targeted aspects that were not found during the course of the data review are noted as unknown. Drawings showing civil infrastructure are identified herein for reference purposes.

2.6.1 Underground Piping Utilities

OPPD's Program Basis Document (PBD) 28, "Buried Piping and Components Program," was developed to establish and maintain "a program that will detect, monitor and mitigate corrosion in plant buried piping and components." PBD-28 outlines program objectives, including the following:

- Identifying susceptible buried piping
- Examining piping components
- Evaluating components to determine degradation
- Establishing piping/component replacement criteria
- Reducing system degradation

In 2010, as part of PBD-28, Enercon delivered to OPPD the "Fort Calhoun Buried Pipe Program BPWORKS™ Document" (PBD-28, Attachment D). The Enercon BPWORKS™ document details "the risk ranking of buried pipe segments at the Fort Calhoun Station using EPRI's BPWORKS™ software in support of the (Nuclear Energy Institute) NEI Initiative." The intent of the Enercon BPWORKS™ document was to develop priorities for future inspection as part of the FCS program for mitigating issues with buried piping.

Underground piping utilities are located throughout the FCS site. A general description of each of the major underground systems is provided in Table 2-6.

Table 2-6 – Underground Piping Utilities

Buried Piping System	Piping Material[A]	Range of Sizes	Bedding Type[B]	Drawing Reference
Auxiliary Feedwater	Carbon steel	4 in., 10 in.	Unknown	Unknown
Auxiliary Steam	Carbon steel	3 in.	Unknown	Unknown
Auxiliary Steam Fuel Oil	Carbon steel	1 in., 1.5 in.	Unknown	Unknown
Circulating Water	Cast-in-place tunnel	Up to 8 ft 6 in. by 8 ft 6 in.	Pile	93-590-2-199 11405-S-299 11405-S-300 11405-S-301
Compressed Air	Carbon steel	3 in.	Unknown	Unknown
Condensate	Carbon steel	2 in.	Unknown	Unknown
Demineralized Water	Carbon steel	3 in.	Unknown	Unknown
	PVC	8 in.	Unknown	Unknown
Fire Protection	Ductile and cast iron	6 to 12 in.	Unknown	E-4182 11405-M-313
	Asbestos cement	6 to 12 in.	Unknown	
Fuel Oil	Carbon steel	3 in.	Unknown	11405-M-312 11405-M-314
Instrument Air	Copper	1.5 in.	Unknown	Unknown
Potable Water	PVC	6 to 8 in.	Unknown	Ehrhart Griffin & Associates, Sheets C-1 through C-7
	FRP	1.5 in.	1	11405-M-312
	304 stainless steel	2 in.	Unknown	
	Carbon steel	1.5 in.	Unknown	
	Copper	0.75 to 2 in.	Unknown	
Raw Water	Carbon steel	6 in., 20 in.	Concrete encased	11405-M-312 11405-M-313 11405-M-314 11405-M-315
Sanitary and Storm Sewer	Ductile and cast iron	4 in.	2	11405-S-402 11405-M-312 11405-M-331 E-4014 E-4096 7753-03-A-20 SKE-09-05-01
	PVC	4 to 6 in.	2	
	VCP	4 to 15 in.	2	
	CMP (Storm only)	8 in.	2	
	CHDPE (Storm only)	15 in.	2	
	RCP (Storm only)	12 to 24 in.	2	

10

Table 2-6 – Underground Piping Utilities

Buried Piping System	Piping Material[A]	Range of Sizes	Bedding Type[B]	Drawing Reference
Service Water	Copper	3 in.	2	11405-M-312
	Carbon steel	0.75 to 3 in.	2	
Vents and Drains	Carbon steel	6 in.	Unknown	11405-M-312
Waste Disposal	304 stainless steel	2 in.	Concrete encased	11405-M-313 11405-M-314

[A] - PVC = polyvinyl chloride
FRP = fiberglass reinforced plastic
VCP = vitrified clay pipe
CMP = corrugated metal pipe
CHDPE = corrugated high density polyethylene
RCP = reinforced concrete pipe

[B] - Bedding types for underground piping utilities are listed below, and the sources are given in parentheses:

1. Pipe placed on 3 in. of sand fill and backfilled with 3 in. of sand, followed by common fill up to grade and compacted to 95 percent of maximum density; gradation is unknown. (Drawing 11405-M-312; American Society for Testing and Materials (ASTM) standard for compaction is not known.)
2. Pipe placed on compacted subgrade in 24-in.-wide trench, backfilled with 1 ft Select Fill Type A Coarse Stone (0.75 in. minimum size), common fill up to finished grade placed in 12-in. loose lifts and compacted to 95 percent of maximum density; gradation is unknown. (Drawing E-4093 Sheet 2; ASTM standard for compaction is not known.)

During development of the Enercon BPWORKS™ document, soil samples were taken from six locations throughout the FCS site to determine the soil type to be entered into the BPWORKS™ software. The assumptions associated with using a representative sample were not considered in developing the civil baseline descriptions below. Rather, bedding specifications and/or details for buried utilities were researched for inclusion in the baseline descriptions. Specifications and/or details that were found are listed under Bedding Type in Table 2-6, above; Bedding Type is listed as "Unknown" for systems that did not have trenching or bedding details included in available documentation.

Underground systems identified as Priority 1 systems are discussed below.

2.6.1.1 Circulating Water System

Circulating water is directed from the Intake Structure to the Turbine Building and from the Turbine Building to the river through cast-in-place concrete tunnels that are up to 8 ft 6 in. by 8 ft 6 in. in size. Piping and instrumentation diagrams (P&ID) as well as a general flow diagram are shown in Drawings 11405-M-257 (File 44336) and 93-590-2-199 (File 2512), respectively. In November 2010, the Enercon BPWORKS™ document identified the Circulating Water System for inspection subsequent to priority inspections.

2.6.1.2 Demineralized Water System

Demineralized water piping is routed to the Service Building from a new water treatment system near the Old Warehouse. Blair Water provided HDR with information about this piping system. However, the Enercon BPWORKS™ document identifies the piping as 3-in. steel and 8-in. PVC. In November 2010, five segments of demineralized water piping were identified as priority segments for investigation and one segment for subsequent investigation.

2.6.1.3 Fire Protection System Piping

The fire protection system piping is a buried loop around the main buildings, intended to provide water for fire suppression. Original construction of the loop was 6- to 12-in. asbestos-cement piping. Eight yard hydrants are located around the site along with multiple isolation valves. In addition to external fire protection, there are connections from the loop to interior fire protection piping for the following FCS structures:

- Intake Structure
- Rad Waste Building
- Security Building
- Turbine Building
- New Warehouse
- Service Building
- Maintenance Shop
- Maintenance Fabrication Shop
- Old Warehouse

Since original construction of FCS, several sections of asbestos-cement piping have been replaced with ductile iron piping. Not all locations of replaced piping could be determined from the information available. Drawing E-4182 notes that 20 ft of asbestos cement piping (also known in the industry as transite piping) were replaced with ductile iron pipe, located approximately from 1170N/2212W to 1190N/2212W (using coordinates shown in Drawing E-4182). The Maintenance Shop and the Chemical/Radiation Protection (CARP) Building were constructed over a section of abandoned fire main. This section of fire protection system piping, located approximately 35 ft south of the north wall of the CARP and extending from 75 ft west of the CARP to approximately 10 ft east of the Maintenance Shop, was abandoned in place; a new section was constructed between the New Warehouse and the CARP Building, with additional sections extending to the north side of the New Warehouse. In November 2010, the Enercon BPWORKS™ document identified the fire protection piping as a priority for inspection.

2.6.1.4 Fuel Oil Storage Tanks and Piping

Three diesel generator fuel-oil tanks and associated piping are on site within the PA. Tank FO-1 is located south of the Auxiliary Building. Two 2-in. steel pipes connect the tank to the fuel pump located within the building. Tank FO-10 is located between the Intake Structure and the Service Building. Piping for FO-10 is not shown in the drawings available. FO-27 is an aboveground tank located adjacent to the west wall of the Intake Structure. The Enercon BPWORKS™ document identifies this piping as 3-in. steel. Additionally, FO-32 (security

back-up tank, located south of the New Warehouse) and FO-43 (aboveground gas tank, located at the northeast corner of the PA) are within the PA but not listed as Priority 1 structures.

In November 2010, the Enercon BPWORKS™ document identified 35 segments of fuel-oil water piping as priority segments for investigation.

2.6.1.5 Potable Water

In 1993, approximately 4800 ft of 8-in. PVC water main was installed to provide a new connection between the City of Blair Water System and the main FCS buildings. In addition, approximately 1000 ft of 6-in. water service line off the 8-in. main were installed to serve the southern area of FCS, including the Administration Building. The primary function of the new water main is to serve the reverse osmosis water treatment system for demineralized water production. The new water main is shown in detail in the 1993 drawings by Ehrhart Griffin & Associates titled "OPPD FCS Water Plant Tie-In to Blair Water System."

2.6.1.6 Raw Water

Raw water piping is routed between the Intake Structure and the Auxiliary Building through two steel pipelines. Both pipes have a 20-in. diameter. Near Auxiliary Building penetrations, the piping is routed through 28-in.-diameter sleeves; sleeve material is unknown. To the west of the Intake Structure, a 6-in.-diameter raw-water line extends off of the main line to water-treatment equipment located in the Service Building.

In November 2010, the Enercon BPWORKS™ document identified 21 segments of raw water piping as priority segments for investigation and seven segments for subsequent investigation.

2.6.1.7 Waste Disposal

Waste disposal piping is shown in Sheet 11405-M-313. The 2-in. stainless-steel pipeline is routed between the Turbine Building and the discharge tunnel of the Intake Structure. In November 2010, the Enercon BPWORKS™ document identified 11 segments for investigation subsequent to priority investigations.

2.6.2 Underground Electrical Utilities

Underground electrical lines are located throughout the FCS site. Electrical utilities are buried as direct buried cable, buried conduit, cast-in-place concrete duct bank, or prefabricated trench. A general description of each of the major underground electrical systems is provided in Table 2-7.

Table 2-7 – Underground Electrical Utilities

Underground Electrical Utility	Material[A]	Conduit Size[B]	Bedding Type	Drawing Reference
Underground Cable Trench (Trenwa)	Precast concrete trench	W: 60 to 84 in. D: 22 to 38 in.	See Section 2.6.2.1	9364-C-0106 Files 46459, 46463, 47449, 47643-46, 49669-70, 49717, 49750-54
Main Underground Cable Bank	Concrete encased	4 in. (6 ft by 6 ft) 8 to 16 in.	Unknown	D-4353, Sheet 1 11405-E-319 13007.01-EE-3F 11405-M-312 E-4096 11405-S-411
Duct Bank (Abandoned)	Concrete encased	Unknown	Unknown	11405-S-410
PVC Conduit	PVC	4 to 5 in.	Unknown	D-4353, Sheet 1 CE-79-2
13.8 kV Distribution Duct Bank	Concrete encased	Varies	Unknown	D-4353, Sheet
Three 1/0 15kV Direct Buried	Cable	NA	Direct Bury	D-4353, Sheet 1
Three 1/0 #2-15kV EMP AL (Abandoned)	Cable	NA	Direct Bury	11405-S-319
2989 & Communications (Abandoned)	Unknown	Unknown	Unknown	11405-E-319
2/C #6 (Abandoned)	Unknown	Unknown	Unknown	11405-S-410
Underground Power Line	Cable	Unknown	Unknown	C-333 Ehrhart Griffin & Associates Sheets C-3
Three 500 MCM AL 600V (Abandoned)	Aluminum	Unknown	Unknown	11405-E-319
480V Direct Buried Cable	Cable	NA	Direct Bury	11405-M-312
4-in. VCP (Abandoned)	VCP	4 in.	Unknown	11405-S-402
Telephone Cable	Unknown	Unknown	Unknown	CE-79-1 Ehrhart Griffin & Associates Sheets C-3
Underground Electric	Unknown	Unknown	Unknown	F-4001 SH.1
One 32SM Fiber Cable	Fiber cable	Unknown	Unknown	CE-79-1
ISFSI Cable Trench	Precast concrete trench	Unknown	Unknown	59058-EE-6A & -6B

[A] - PVC = polyvinyl chloride
VCP = vitrified clay pipe
[B] - NA = Not applicable

For four of the major systems listed in Table 2-7, additional details were available and are provided as follows.

2.6.2.1 Underground Cable Trench

The Underground Cable Trench is a Trenwa, Inc., trench system that contains the site cabling for FCS. The Underground Cable Trench (Trenwa) is a precast concrete cable trench that follows the PA perimeter. The Trenwa varies between 60 and 84 in. wide and is between 22 and 38 in. deep, depending on location. Drain holes to subgrade are interspersed along the Trenwa alignment. In areas with poor drainage soil, the Trenwa was recommended to be installed over a perforated drain pipe below the Trenwa. However, the actual installation method could not be determined because the available drawings were general in nature. The Trenwa is covered with precast lids. At traffic crossings, specialized lids are in place to allow vehicular traffic to cross the Trenwa. The Trenwa section is modified for these locations; such modifications include a thicker base and uni-strut inserts at both legs. Trenwa bedding at typical road crossings was specified to be compacted subgrade and backfill, with a 95 percent minimum dry density per American Society for Testing and Materials (ASTM) D1557.

Trenwa bedding is compacted subgrade soil. Per the drawing notes, engineered bedding was not specified except at particular locations. Soil compaction beneath the Trenwa was to be equal to the undisturbed average soil, with minimum compaction of 4000 pounds per square foot (psf). Pedestrian crossings and drain-pipe crossings included a minimum bedding of 3 in. of crushed rock underlain with geotextile fabric. Drawings 88-185-1 and 9364-C-0012, files 47643 and 46463, respectively, include notes and details for Trenwa bedding and subgrade.

2.6.2.2 Main Underground Cable Bank

The Main Underground Cable Bank is aligned inside and outside of the PA through 6-ft-by-6-ft concrete-encased duct bank. Six electrical manholes (MH-1 through MH-5 and MH-31) along the alignment of the Main Underground Cable Bank are labeled in Sheet 11405-E-319. One additional manhole on the Main Underground Cable Bank alignment is located north of MH-1, just east of the Control Building.

2.6.2.3 13.8 kV Power Distribution

Medium voltage (13.8 kV) power is distributed throughout the site through buried duct bank and conduit. Drawing D-4353 shows a plan of the power distribution, focusing on the areas closest to the PA. A 13.8 kV Switchgear at the north end of the Old Warehouse distributes power through a concrete-encased duct bank that extends east and PVC conduits that extend to the north and south.

2.6.2.4 Independent Spent Fuel Storage Installation

The ISFSI, located northwest of the New Warehouse, includes underground trenching and conduit for electrical power, temperature, and instrumentation systems between the ISFSI, the Electrical Equipment Building at the southeast corner of the ISFSI and the New Warehouse. Drawing 59058-EE-6A shows the ISFSI cable trench and raceway plan. The cable trench is similar to the Underground Cable Trench discussed in Section 2.6.2.1. Additional buried conduit is located on the north, west, and south sides of the ISFSI for the High Mast Lighting.

2.6.3 Underground Structures

2.6.3.1 Lift Stations and Sewage Lagoons

Four lift stations are located on site and are shown in drawing E-4093: SD-10, SD-11, SD-16, and the Administration Building Lift Station. Lift station SD-10, located south of the Security Building near the Missouri River, has been abandoned in place. Lift station SD-16 is located just north of SD-10.

Lift station SD-11 is located inside of the PA near the New Warehouse. A 4-in.-diameter PVC force main conveys sanitary flow from SD-11 around the Old Warehouse to the sewage lagoons located south of the Administration Building. The Administration Building Lift Station conveys flow to the Sanitary Lagoon Intake/Splitter Structure located south of the Administration Building.

The sewage lagoons, shown in Drawing 579J-M-2, provide treatment for the domestic wastewater generated on site. The new lagoon is a two-cell lagoon with a berm elevation of 1007.00, high water elevation of 1004.00, and bottom elevation (at deepest point) of 996.50. Drawings 579J-M-1, -2, -3, and -4 show additional details of the sewage lagoon and associated structures.

2.6.3.2 Septic Tank

An underground septic tank, shown in Drawing E-4093, is located near the south end of the Old Warehouse. Additional drawings and details were not available for use in establishing the civil baseline for the post-flood assessment.

2.6.3.3 Sanitary and Storm Sewer Manholes

Numerous sanitary and storm sewer manholes are located throughout the FCS site. Five sanitary sewer manholes are located within the PA. Drawing E-4093, Sheet 1, shows the location of known manholes and other structures throughout the site. Drawing E-4093, Sheet 2, which was to contain various details for sanitary and storm sewers and manholes, was not available for use in establishing the civil baseline for the post-flood assessment. Drawing 25036-C-008, Buried Utilities Composite Plan, shows additional components of the sanitary and storm systems. A storm drainage catch basin (noted as "New" in Drawing 25036-C-008) is located at the far north end of the PA. No other existing catch basins were identified in the available drawings.

2.6.4 Aboveground Structures

Civil infrastructure located aboveground at the FCS site includes the following:

- Camera towers and high mast lighting are located throughout the site. These are components of the site security system and, due to security requirements, are not shown in any drawings.
- Fencing is located throughout the site as part of the overall security system. Fenced areas include the PA, the Original Steam Generator Storage Building (OSGS), the Switchyard, and the perimeter of the site. Other fencing might exist at FCS, but it was not immediately identified in available drawings or other information.
- Weather Tower ME-1, known as the Met Tower, is shown in Drawing F-4000. The Met Tower is a 110-meter weather tower, located approximately 2600 ft north of the PA. Direct-buried fiber optic cable is routed from MH-30 at the northeast corner of the PA, along the east road to an access road to the weather building located at the base of the Met Tower. Power and communication cabling is routed in trenches south of the Met Tower toward the northeast corner of the Switchyard where it transitions to aboveground cabling. The building near the base of the Met Tower is a 12-ft-by-12-ft concrete block building for housing tower instrumentation.
- Transmission towers for 161 kV and 345 kV power are located throughout the site. The towers support 161 kV and 345 kV power transmission cabling between the Turbine Building and Switchyard and into the electrical distribution grid. These are shown in Figure 2-18, Sheets 1 through 3. The towers are constructed on pile foundations shown in Drawing E-4600.

Owner Controlled Property Boundary

Omaha Public Power District

Transmission Towers
Fort Calhoun Station

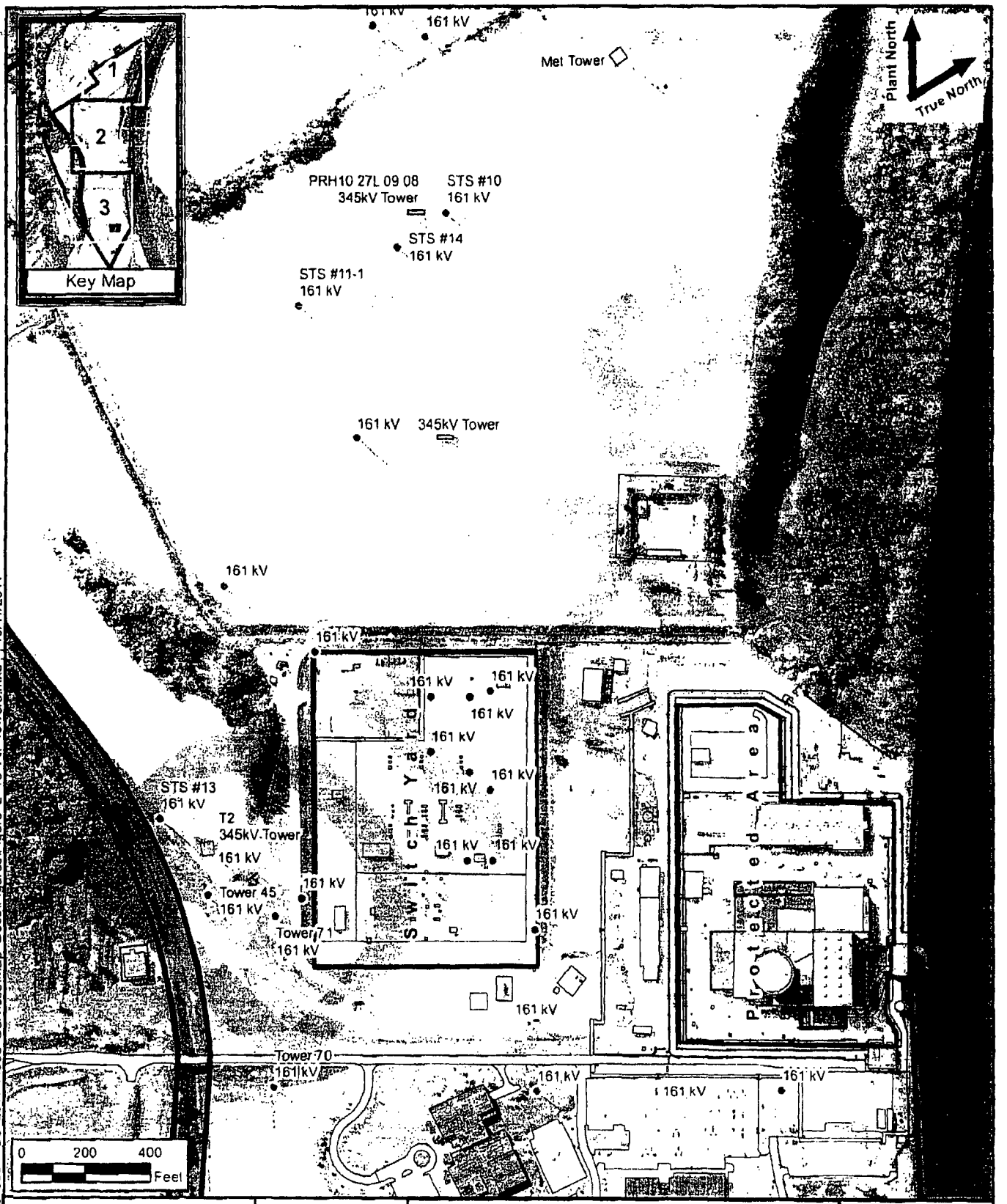
Plant and Facility Geotechnical and Structural Assessment

HDR

DATE
Sep 2011

FIGURE
2-18

Z:\Projects\OPPD\164565 FCS 2011 Flood Services\Map Docs\Figures\Figure 2 18 All Towers.mxd 10/11/2011



Owner Controlled Property Boundary

Omaha Public Power District

Transmission Towers
Fort Calhoun Station

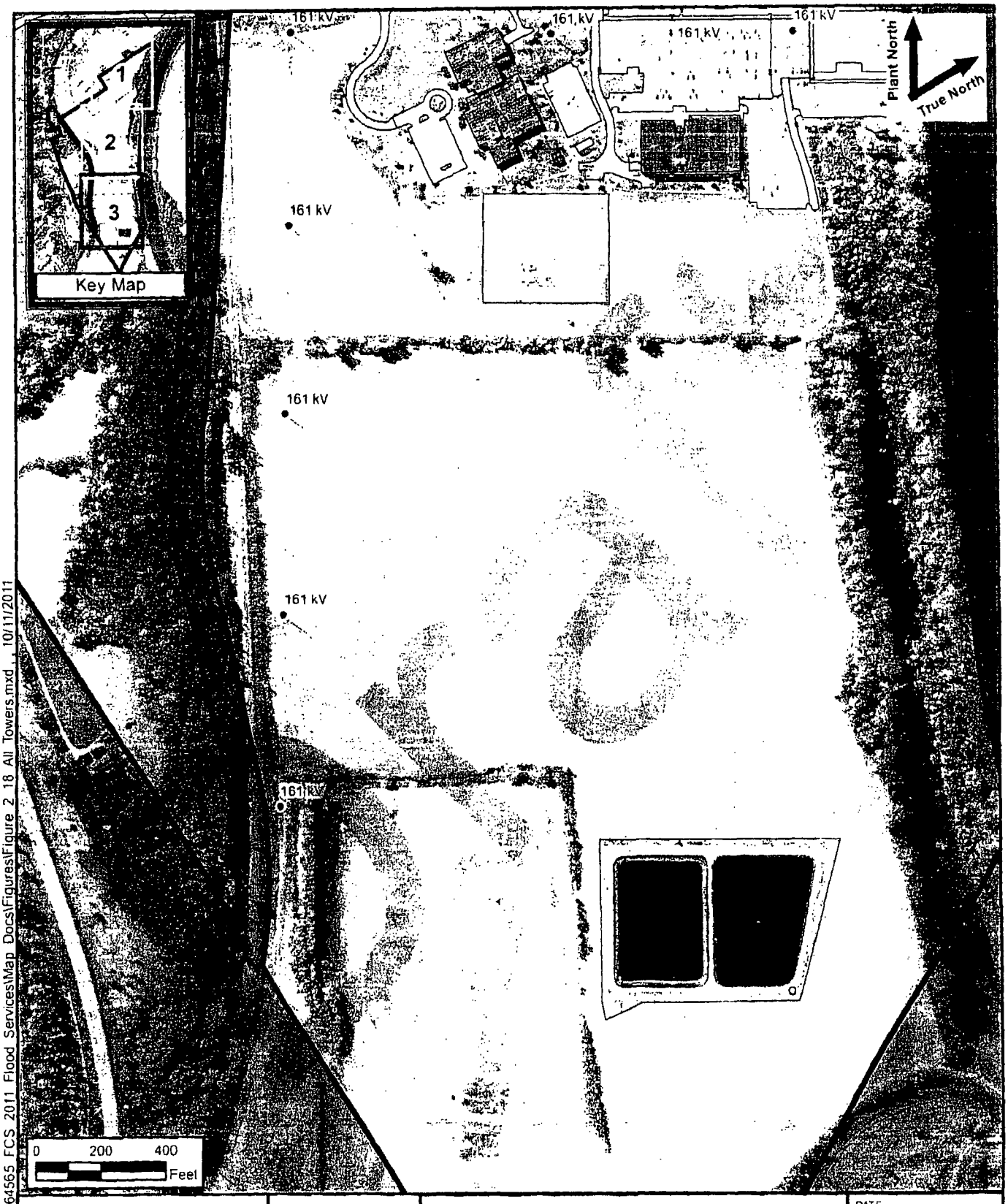
Plant and Facility Geotechnical and Structural Assessment

HDR

DATE
Sep 2011

FIGURE
2-18

Z:\Projects\OPPD\164565 FCS 2011 Flood Services\Map Docs\Figures\Figure 2-18 All Towers.mxd 10/11/2011



Owner Controlled Property Boundary

Omaha Public Power District

Transmission Towers
Fort Calhoun Station

Plant and Facility Geotechnical and Structural Assessment

HDR

DATE
Sep 2011

FIGURE
2-18

Z:\Projects\OPPD\164565 FCS 2011 Flood Services\Map Docs\Figures\Figure 2 18 All Towers.mxd 10/11/2011

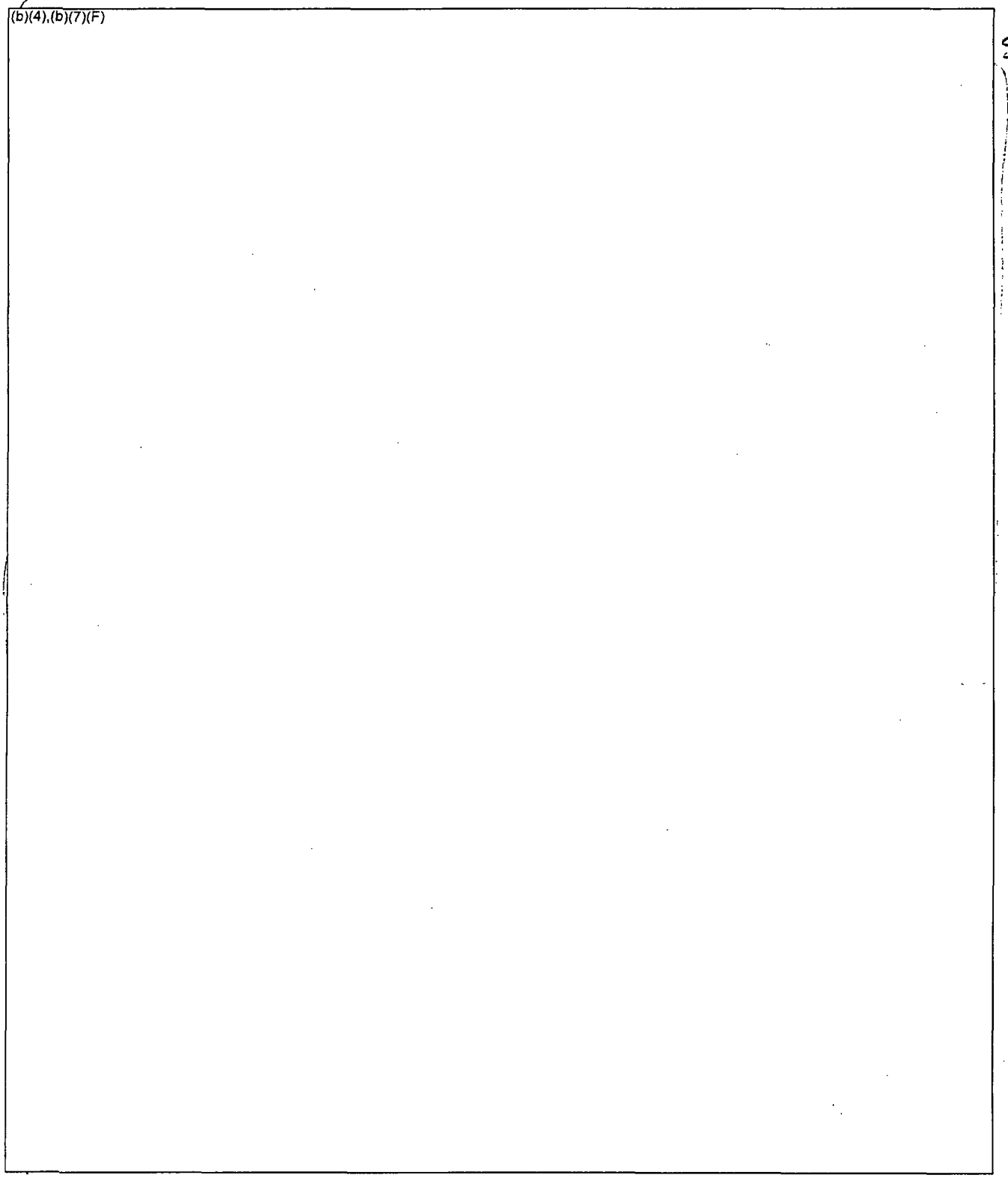
Section 5.7

Security Building

(b)(4),(b)(7)(F)

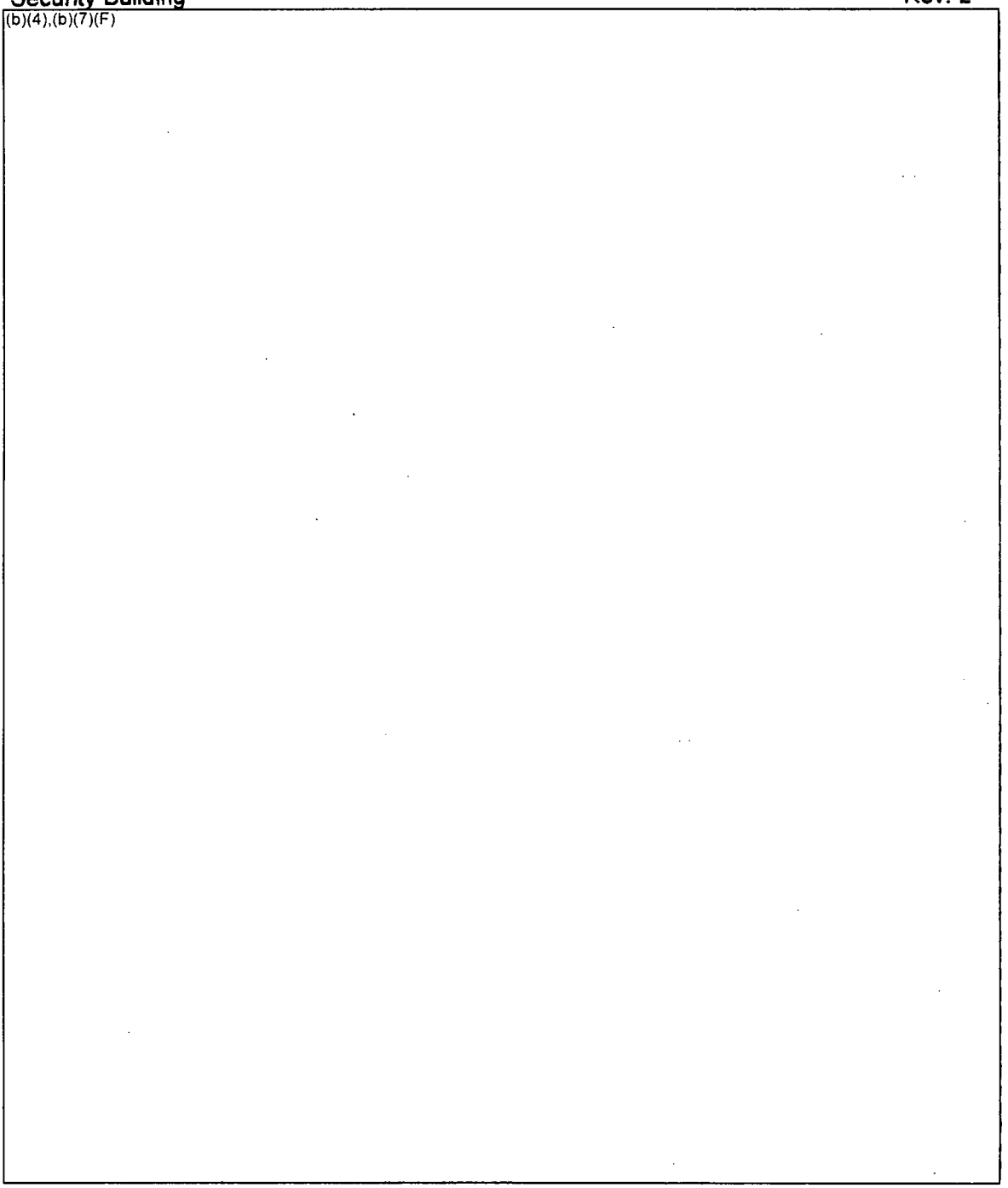
EX 4

(b)(4),(b)(7)(F)



EX 4

(b)(4),(b)(7)(F)



5.7.4.1 Potential Failure Modes Ruled Out Prior to the Completion of the Detailed Assessment

The ruled-out CPFMs reside in the Not Significant/High Confidence category and for clarity will not be shown in the Potential for Failure/Confidence matrix.

Triggering Mechanism 2 – Surface Erosion
CPFM 2a – Undermining shallow foundation/slab/surfaces

Reason for ruling out:

- It was evident from HDR's site inspection that no surface erosion occurred in the vicinity of the Security Building.

Triggering Mechanism 5 – Hydrodynamic Loading
CPFM 5a – Overturning
CPFM 5b – Sliding
CPFM 5c – Wall failure in flexure
CPFM 5d – Wall failure in shear
CPFM 5e – Damage by debris
CPFM 5f – Excess deflection

Reason for ruling out:

- The Security Building was protected from [illegible] the use of [illegible]O barriers. No floodwater flowed over the site in the vicinity of the b[illegible]

Triggering Mechanism 6 – Buoyancy, U[illegible] Forces [illegible] Stru[illegible]
CPFM 6b – Cracked slab, loss of struct[illegible] supp[illegible]
CPFM 6c – Displaced struct[illegible] broken connec[illegible]s

Reasons for ruling out:

- Altho[illegible] uplift force f[illegible] floodwaters might have occurred on the Security B[illegible] cracking or lo[illegible] structural support of the slabs was not observed at the [illegible] of the inspect[illegible]
  According to the Syst[illegible] Design Basis Document, the building is designed for a hydrostatic uplift of 1007 ft, which [illegible] proximately [illegible] maximum flood level (SDBD-STRUC-504 Rev 6).
  HDR's inspection of the S[illegible]ty Building was completed shortly after the floodwaters had begun to recede below the[illegible] ximum elevation. Therefore, distress related to buoyancy or uplift forces was at its hi[illegible] potential prior to the inspection, and signs of distress would be apparent.
- The co[illegible]ation of the building footings does not allow a net uplift pressure due to buoyancy [illegible] conditions in conjunction with maximum gross uplift forces from flooding du[illegible] maximum flood elevation did not cause observable distress.

Triggering Mechanism 7 – Soil Collapse (first time wetting)

CPFM 7a – Cracked slab, differential settlement of shallow foundation, loss of structural support

CPFM 7b – Displaced structure/broken connections

CPFM 7c – General site settlement

Reasons for ruling out:

- Due to the elevation of the Security Building slab (1004 ft) and the close proximity of the building to the river, this was not the first time wetting of soils beneath the building.
- The peak flood elevation prior to 2011 was documented in 1993 at 1003.3 ft, which would indicate that soils below and surrounding the building were saturated at that time.

Triggering Mechanism 10 – Machine/Vibration-Induced Liquefaction

CPFM 10a – Cracked slab, differential settlement of shallow foundation, loss of structural support

CPFM 10b – Displaced structure/broken connections

Reason for ruling out:

- The Security Building has not been subjected to machinery vibrations that could induce liquefaction of soils. Therefore, machine or vibration induced liquefaction failures are not possible.

Triggering Mechanism 11 – Loss of Soil Strength due to Static Liquefaction or Upward Seepage

CPFM 11a – Cracked slab, differential settlement of shallow foundation, loss of structural support

CPFM 11b – Displaced structure/broken connections

Reason for ruling out:

- Visual observations and survey measurements indicate no structure movement. Therefore, degradation that can be attributed to this CPFM did not occur.

Triggering Mechanism 13 – Submergence

CPFM 13b – Corrosion of structural elements

Reason for ruling out:

- The Security Building has not been subjected to corrosive circumstances that would be considered beyond the normal conditions. The building was kept dry by the use of HESCO barriers. Therefore, structural elements being wetted by the 2011 flood was considered in the original design of the facility.

Triggering Mechanism 14 – Frost Effects
CPFM 14a – Heaving, crushing, or displacement

Reasons for ruling out:

- The Security Building's foundation system is below frost level, and the interior of the building is a heated structure. The building will not be subjected to freeze/thaw cycles. Therefore, frost effects have been discredited.
- Flooding did not change the frost and foundation conditions. The structure has always been subjected to freezing temperatures with moist to saturated soils.

5.7.4.2 Detailed Assessment of Credible Potential Failure Modes

The following CPFMs are the only CPFMs carried forward for detailed assessment for the Security Building as a result of the 2011 flood. This detailed assessment is provided below.

Triggering Mechanism 3 – Subsurface Erosion/Piping
CPFM 3a – Undermining and settlement of shallow foundation/slab surfaces (due to pumping)

During the flood, continual pumping was required in the Trenwa system around and in the Security Building because a large amount of water infiltrated its trench.

The Triggering Mechanism and CPFM could then occur as follows: soil deposits could have been carried with the water flow causing subsurface erosion. Although soil was removed from these areas, it is possible that portions of the building's foundation and slabs could be undermined.

The following table describes observed distress indicators and other data that would increase or decrease the potential for degradation associated with this CPFM for the Security Building.

Adverse (Degradation/Direct Floodwater Impact More Likely)	Favorable (Degradation/Direct Floodwater Impact Less Likely)
Pumping from the Trenwa system occurred in multiple locations for an extended period.	Soils for the Trenwa system in the interior of the Security Building are noted to have granular fill directly below the slab, which is less likely to be subjected to erosion.
Probing near the Security Building discovered soft spots and voids below the nearby pavement, which could be attributed to subsurface erosion.	No current signs of settlement or structure distress.
Data Gaps: • The extent of subsurface erosion and potential adverse impacts on the Security Building are not known due to a lack of geophysical and geotechnical data. • During the infiltration of the Trenwa system, observations of the water flow into the system to determine if soil was being deposited was not completed because it occurred before HDR's site inspection.	

Conclusion

Significance

Potential for Degradation/Direct Floodwater Impact

Subsurface erosion is expected to have occurred at the site due to groundwater pumping in Trenwas and manholes in or adjacent to the Security Building. If subsurface erosion is significant, it could materially and negatively impact the integrity or intended function of the structure. It is believed that if subsurface erosion were occurring beneath structures, signs would be visible during the inspections. Because no signs of distress have been observed at this time, it is believed that the potential for degradation is low.

Implication

The occurrence of this CPFM on a large scale could negatively impact the capacity of the footings supporting the building. This could lead to excessive foundation movement. However, settlements are expected to occur at a slow rate and not result in sudden potential building collapse. Should foundation movement be detected, appropriate measures could be implemented to keep the building functional. The settlements should not negatively impact the integrity or intended function of the Security Building. Therefore, the implications of the potential degradation for this CPFM is low.

Confidence

The extent of subsurface erosion and its potential impact on the building is not known due to the lack of data gathered on subsurface conditions. There is not enough information on the subsurface conditions at this time and the pumping on site could have caused undermining or settlement. The confidence for this CPFM is low.

Summary

For CPFM 3a, as discussed above, the potential for degradation is low because signs of distress were not observed. It is unlikely that degradation would have caused enough erosion to impact the integrity or intended function of the structure. The combined consideration of the potential for degradation and the implications of that degradation to a structure of this type puts it in the "not significant" category. The data currently collected are not sufficient to rule out this CPFM. Therefore, the confidence in the above assessment is low, which means more data or continued monitoring and inspections might be necessary to draw a conclusion.

Triggering Mechanism 3 – Subsurface Erosion/Piping

CPFM 3d – Undermining and settlement of shallow foundation/slab (due to river drawdown)

Floodwater elevations, at the time of HDR's inspection, were above finished floor elevations, and river levels were being lowered at a relatively slow pace. River elevations were still well above normal levels.

The Triggering Mechanism and CPFM could then occur as follows: the drop in elevation of the river is expected to occur at a higher rate than the drop in elevation of the groundwater. This will result in an increased groundwater gradient. This increase could allow for subsurface erosion to occur.

The following table describes observed distress indicators and other data that would increase or decrease the potential for degradation associated with this CPFM for the Security Building.

Adverse (Degradation/Direct Floodwater Impact More Likely)	Favorable (Degradation/Direct Floodwater Impact Less Likely)
The Security Building is in close proximity to the river.	No distress was observed at the time of HDR's site inspection.
Elevated saturated soils and elevated flood levels provide a water source. A potential path for water and soil migration can extend under the structure to the river, causing erosion.	Survey data do not identify movement of the building.
Data Gaps: Effects of rapid drawdown may still initiate due to high flood levels. The subsurface conditions and how they may affect this CPFM are not well known due to lack of geophysical and geotechnical data in the vicinity of the Security Building at this time.	

Conclusion

Significance

Potential for Degradation/Direct Floodwater Impact

River stage levels has receded and stabilized at a level corresponding to the nominal normal river levels as of October 4, 2011. The potential for degradation from drawdown is low because it has not been observed since October 4, 2011. Rapid drawdown has been controlled, and continued rapid drawdown is not expected to occur at a rate that would cause undermining. Therefore, the potential degradation for this CPFM is low.

Implication

The occurrence of this CPFM on a large scale could negatively impact the capacity of the footings supporting the building. This could lead to gradual foundation movement. However, settlements are expected to occur at a slow rate and not result in sudden, total building collapse. Should foundation movement be detected, appropriate repairs could be implemented to keep the building functional. The settlements should not negatively impact the integrity or intended function of the Security Building. Therefore, the implication of the potential degradation for this CPFM is low.

Confidence

The extent of current subsurface erosion and its potential impact on the building is not known due to the lack of data on subsurface conditions. Unknown river drawdown rates in the future could also add to current subsurface erosion. River levels are such that this CPFM might not have occurred yet. Therefore, the confidence for this CPFM is low.

Summary

For CPFM 3d, as discussed above, the potential for degradation is low because river drawdown is controlled and is not expected to occur at a rate to initiate this CPFM. It is unlikely this degradation would have caused enough erosion to impact the integrity or intended function of the structure. The combined consideration of the potential for degradation and the implications of that degradation to a structure of this type puts it in the "not significant" category. It is unknown whether this CPFM has occurred or whether it will occur in the future because the data at hand are not sufficient to rule out this CPFM. Therefore, the confidence in the above assessment is low, which means more data or continued monitoring of inspections might be necessary to draw a conclusion.

Triggering Mechanism 12 – Rapid Drawdown

CPFM 12a – River bank slope failure and undermining surrounding structures
CPFM 12b – Lateral spreading

The Triggering Mechanism and CPFMs could occur in two ways: the river level drops faster than pore water pressure in the soil can dissipate. The saturated soil is elevated above the dropping river level. The sloped bank of the river provides lateral pressure support for the saturated soil. At some point there is insufficient support on the riverside to support the saturated soils. At that point, the soils experience slope movement and even failure. Generally, slope failures associated with rapid drawdown are relatively localized and shallow in nature; however, deeper failures can occur.

Floodwater elevations, at the time of HDR's inspection, were above finished floor elevations, and river levels were being lowered at a relatively slow pace. River elevations were still well above normal levels. The drop in elevation of the river is expected to occur at a higher rate than the drop in elevation of the groundwater. This will result in an increased groundwater gradient. This increase could cause localized riverbank slope failure and/or lateral spreading.

At the time of Revision 0, the river level had dropped to a nominal normal level (roughly 94 ft). Field observation of the river bank area has not been performed since the river levels have dropped.

The following table describes observed distress indicators and other data that would increase or decrease the potential for degradation associated with these CPFMs for the Security Building.

Adverse (Degradation/Direct Floodwater Impact More Likely)	Favorable (Degradation/Direct Floodwater Impact Less Likely)
The Security Building is in close proximity to the river.	No distress was observed at the time of HDR's site inspection.
Elevated saturated soils and elevated flood levels provide a water source. A potential path for water and soil migration can extend under the structure to the river, causing adverse effects attributed to river drawdown.	Survey data to date do not identify movement of the building.
Data Gaps: • Observations of the riverbank following drawdown to [illegible] river elevation • Geophysical investigation data to address observed cond[illegible] • Inclinometer readings that will provide an indication of slo[illegible]ement	

Conclusion

Significance

Potential for Degradation/Direct Floodwater [illegible]act

River stage level has receded and stabilized [illegible] a level co[illegible]sponding to the nominal normal river level at 40,000 cfs as of October 4, 2[illegible]. The po[illegible]tial for [illegible]dation from drawdown is low because it has not been obser[illegible]as of [illegible]ctober [illegible]011. Ra[illegible]wdown has been controlled, and continued river d[illegible]own is not e[illegible]ted to occ[illegible]at a rate that would initiate these CPFMs. Since it is belie[illegible]that a potentia[illegible] degradati[illegible] of the structure exists but is not likely, these CPFMs are [illegible]red low.

Implic[illegible]

The occurrence of these [illegible]Ms on a la[illegible]ale could negatively impact the capacity of the footings supporting the bu[illegible]. This co[illegible]d to gradual foundation movement but should not negatively impact the in[illegible]y or intended function of the Security Building. Therefore, the implication of the potentia[illegible]gradation for these CPFMs is high.

Confidence

At the time of the field repo[illegible] Revision 0, conditions required to trigger CPFMs 12a and 12b had not ye[illegible]rred. Fi[illegible]bservations and other investigation data required to evaluate this CPFM have [illegible]not be[illegible]made, and an evaluation cannot be made. Therefore, confidence for these CPFMs is [illegible].

The data at hand are not sufficient to rule out these CPFMs or to lead to a conclusion that physical modification to ensure that river bank slope failure and lateral spreading will not occur. Therefore, the confidence in the above assessment is low, which means more data are necessary to draw a conclusion.

Summary

For CPFMs 12a and 12b, as discussed above, the potential for degradation is low because river drawdown is controlled and is not expected to occur at a rate necessary to initiate these CPFMs.

If the degradation were to occur, the implications to the structure would likely be low. The combined consideration of the potential for degradation and the implications of that degradation to a structure of this type puts it in the "not significant" category. It is unknown whether these CPFMs have occurred or if they will occur in the future because the data at hand are not sufficient to rule out these CPFMs. Therefore, the confidence in the above assessment is low, which means more data or continued monitoring and inspections might be necessary to draw a conclusion.

5.7.5 Results and Conclusions

The CPFMs evaluated for the Security Building are presented in the following matrix, which shows the rating for the estimated significance and the level of confidence in the evaluations.

	Low Confidence (Insufficient Data)	High Confidence (Sufficient Data)
Potential for Failure Significant		
Potential for Failure Not Significant	CPFM 3c CPFM 3d CPFM 12a CPFM 12b	

5.7.6 Recommended Actions

Continued monitoring is recommended to include a continuation of the elevation surveys of the previously identified targets on this structure and surrounding site. The purpose is to monitor for signs of structure distress and movement or changes in soil conditions around the structure. The results of this monitoring will be used to increase the confidence in the assessment results. Elevation surveys should be performed weekly for 4 weeks and biweekly until December 31, 2011. At the time of the writing of this version of the Assessment Report, groundwater levels had not yet stabilized to nominal normal levels. Therefore, it is possible that new distress indicators could still develop. If new distress indicators are observed before December 31, 2011, appropriate HDR personnel should be notified immediately to determine if an immediate inspection or assessment should be conducted. Observation of new distress indicators might result in a modification of the recommendations for this structure.

5.7.7 Updates Since Revision 0

Revision 0 of this Assessment Report was submitted to OPPD on October 14, 2011. Revision 0 presented the results of preliminary assessments for each Priority 1 Structure. These assessments were incomplete in Revision 0 because the forensic investigation and/or monitoring for most of the Priority 1 Structures was not completed by the submittal date. This revision of this Assessment Report includes the results of additional forensic investigation and monitoring to date for this structure as described below.

5.7.7.1 Additional Data Available

The following additional data were available for the Security Building for Revisions 1 and 2 of this Assessment Report:

- Additional groundwater monitoring well and river stage [illegible] data from OPPD.
- Field observations of the river bank (see Section 5.25).
- Results of geophysical investigation by Geotechnology, Inc. (see Attachment 6).
- Results of geotechnical investigation by Thiele Geotech, Inc. (see Attachment 6).
- Data obtained from inclinometers by Thiele Geotech, Inc. (see Attachment 6).
- Results of continued survey by Lamp Rosenquist and Associates (see Attachment 6).

5.7.7.2 Additional Analysis

The following analysis of additional data was conducted for the Security Building:

- Groundwater monitoring well and river stage [illegible] data from OPPD.

  Data indicate the river and groundwater have returned to nominal normal levels.

- Field observations of river bank

  No significance distress from the 2011 flood was observed.

- Results of geophysical investigation by Geotechnology, Inc.

  Seismic Refraction and Seismic ReMi tests performed around the outside perimeter of the power block identified deep anomalies that could be gravel, soft clay, loose sand, or possible voids.

- Results of geotechnical investigation by Thiele Geotech, Inc.

  Six test borings were drilled, with continuous sampling of the soil encountered, to ground truth the Geotechnology, Inc. seismic investigation results as part of the KDI #2 forensic investigation. Test bore holes were located to penetrate the deep anomalies identified in the seismic investigation. The test boring data did not show any piping voids or very soft/very loose conditions that might be indicative of subsurface erosion/piping or related material loss or movement.

  All of the SPT and CPT test results conducted for this Assessment Report were compared to similar data from numerous other geotechnical investigations that have been conducted

on the FCS site in previous years. This comparison did not identify substantial changes to the soil strength and stiffness over that time period. SPT and CPT test results were not performed in the top 10 feet to protect existing utilities.

Data from inclinometers to date, compared to the original baseline measurements, have not exceeded the accuracy range of the inclinometers. Therefore, deformation at the monitored locations since the installation of the instrumentation has not occurred.

- Results of continued survey by Lamp Rynearson and Associates

Survey data to date compared to the original baseline surveys have not exceeded the accuracy range of the surveying equipment. Therefore, deformation at the monitored locations, since the survey baseline was shot, has not occurred.

Several CPFMs were identified in Revision 0. Since Revision 0, additional data has become available that have clarified the significance and confidence for the CPFMs. The following presents each of the previously identified CPFMs and the new interpretation of their significance and confidence based on the new data.

Triggering Mechanism 3 – Subsurface Erosion/Piping

CPFM 3a – Undermining and settlement of shallow foundations/slab/surfaces (due to pumping)

During the flood, continual pumping was required in the Trenwas system around and in the Security Building because a large amount of water infiltrated its joints. Soil deposits could have been carried with the water flow, causing subsurface erosion. If enough soil was removed from these areas, it was possible that portions of the shallow foundation and slabs would be undermined.

Significance

Potential for Degradation/Loss of Floodwater Impact

Subsurface erosion could have occurred at the site due to groundwater pumping in Trenwas and manholes in or adjacent to the Security Building. If subsurface erosion was significant, it could have materially and negatively impacted the integrity or intended function of the structure. It is believed that if subsurface erosion had occurred below the structures, signs would have been visible during the inspection or would be apparent from survey data. Because no signs of distress have been observed at this time, it is believed that the potential for degradation is low.

Implication

The occurrence of this CPFM on a large scale could negatively impact the capacity of the footings supporting the building. This could lead to excessive foundation movement. However, settlements are expected to occur at a slow rate and not result in sudden, total building collapse. Should foundation movement be detected, appropriate repairs could be implemented to keep the building functional. The settlements should not negatively impact the integrity or intended function of the Security Building. Therefore, the implication of the potential degradation for this CPFM is low.

Confidence

The extent of subsurface erosion and its potential impact on the building was not known at the time of Revision 0 due to the lack of data gathered on subsurface conditions. Subsequent field inspections and a review of surveyed data indicate no structure movement. Since the structure has been monitored and no signs of movement have been detected, the confidence in the assessment of degradation for this CPFM has increased. If further structure monitoring reveals no further issues, the confidence of the assessment for this CPFM becomes high.

Summary

For CPFM 3a, as discussed above, the potential for degradation is low because signs of distress were not observed. It is unlikely this degradation would occur enough erosion to impact the integrity or intended function of the structure. The consideration of the potential for degradation and the implications of that degradation to a structure of this type place it in the "not significant" category. The data collected since Revision 0 are sufficient to rule out this CPFM assuming the previously recommended monitoring schedule is continued. Therefore, the confidence in the above assessment is high, with this means no additional data and inspections are necessary to draw a conclusion. The data previously thought to be required to rule out this CPFM, which includes the geophysical, geochemical, and piezometer data, is no longer required.

Triggering Mechanism 3 – Subsurface Erosion/Piping

CPFM 3d – Undermining and displacement of shallow foundation slab (due to river drawdown)

At the time of Revision 1 of the Assessment Report, the river level had dropped to a nominal normal level (nominal level 994 ft). Detailed observations of the river bank area were performed while the river level returned to normal levels. The drop in elevation of the river to its current level occurred gradually, resulting in a minimal increase in the groundwater gradient. This increase did not allow for subsurface erosion to be observed on site.

Significance

Potential for Degradation/Direct Floodwater Impact

River stage level has receded and stabilized at a level corresponding to the nominal normal river level of 90,000 cfs as of October 4, 2011. The potential for degradation from drawdown is low because cracks were not observed as of October 4, 2011. Rapid drawdown has been controlled, and uncontrolled river drawdown is not expected to occur at a rate that would cause undermining. Therefore, the potential for degradation is low.

Implication

The occurrence of this CPFM on a large scale could negatively impact the capacity of the footings supporting the building. This could lead to gradual foundation movement. However, settlements are expected to occur at a slow rate and not result in sudden, total building collapse. Should foundation movement be detected, appropriate repairs could be implemented to keep the building functional. The settlements should not negatively impact the integrity or intended

function of the Security Building. Therefore, the implication of the potential degradation for this CPFM is low.

Confidence

The extent of subsurface erosion and its potential impact on the building was not known at the time of Revision 0, due to the lack of data gathered on subsurface conditions. Subsequent field inspections and a review of surveyed data indicate no structure movement. The groundwater elevation measured in the monitoring wells closely followed the river levels as the flood water receded. The data indicate that groundwater elevation was about 2 feet above the river level near the beginning of October 2011 and receded to the river level by about October 14, 2011. Therefore, the differential head created by the river drawdown was insufficient to facilitate subsurface erosion. Since the structure has been monitored with no signs of movement and the monitoring well data did not indicate sufficient differential head which could initiate subsurface erosion, the confidence in the assessment of degradation for this CPFM is increasing. If further structure monitoring reveals no further issues, the confidence of the assessment for this CPFM is high.

Summary

For CPFM 3d, as discussed above, the potential for degradation is low because river drawdown has been controlled thus far and is not expected to occur at a rate to initiate this CPFM in the future. It is unlikely this degradation would have caused enough movement to impact the integrity or intended function of the structure. The combined consideration of the potential for degradation and the implications of that degradation to a structure of this type put it in the "not significant" category. It is believed that this CPFM has not occurred due to a review of survey data, monitoring well data, field observations, and current river levels. The current river elevation and groundwater elevations indicate this CPFM will not occur in the future. Therefore, the confidence in the above assessment is high, which means no additional data, other than the previously recommended monitoring, are necessary to draw a conclusion. The data previously thought to be required to resolve this CPFM, which includes the geophysical, geotechnical, and inclinometer data, are no longer required.

Triggering Mechanism 12 – Rapid Drawdown
CPFM 12a – River bank slope failure and undermining surrounding structures
CPFM 12b – Lateral spreading

At the time of Revision 1 Feature Assessment Report, the river level had dropped to a nominal normal level (nominally at 594 ft). Field observation of the river bank area was performed since the river level has dropped. The drop in elevation of the river to its current level occurred gradually resulting in a minimal increase in the groundwater gradient. This increase did not allow for subsurface erosion to occur.

Significance

Potential for Degradation/Direct Floodwater Impact

River stage level has receded and stabilized at a level corresponding to the nominal normal river level at 40,000 cfs as of October 4, 2011. The potential for degradation from drawdown is low because it has not been observed as of October 4, 2011. Rapid drawdown has been

controlled, and continued river drawdown is not expected to occur at a rate that would initiate these CPFMs. Since it is believed that a potential for degradation of the structure exists but is not likely, these CPFMs are considered low.

Implication

The occurrence of this CPFM on a large scale could negatively impact the capacity of the footings supporting the building. This could lead to gradual foundation movement but should not negatively impact the integrity or intended function of the Security Building. Therefore, the implication of the potential degradation for this CPFM is low.

Confidence

The groundwater monitoring well data and river level data indicate that excess pore pressures due to river drawdown had generally dissipated by about October 4, 2011. Field observations of the river bank on October 20, 2011, did not identify deformations in the River Bank that could be attributed to slope failure or lateral spreading. Therefore, neither slope failure nor lateral spreading occurred due to the 2011 flood. Since the structure has been monitored and no signs of movement have been detected, the confidence for this CPFM is high.

Summary

For CPFMs 12a and 12b, as discussed above, the potential for degradation is low because river drawdown has been controlled this year and is not expected to occur at a rate to initiate this CPFM in the future. It is unlikely this degradation would have caused adverse effects that would impact the integrity or intended function of the structure. The combined consideration of the potential for degradation and the implications of this degradation to a structure of this type puts it in the "not significant" category. It is believed that this CPFM has not occurred due to a review of survey data, field observations, and current river levels. The current river elevations and groundwater elevations indicate that CPFM will not occur in the future. Therefore, the confidence in the above assessment is high, which means no additional data, other than the previously recommended monitoring, are necessary to draw a conclusion. The data previously thought to be required to rule out this CPFM, which includes the geophysical, geotechnical, and inclinometer data, are no longer required.

5.7.7.1 Revised Results

The CPFMs evaluated for the Security Building are presented in the following matrix, which shows the rating for the estimated significance and the level of confidence in the evaluation. CPFMs 3a, 3d, 12a, and 12b for the Security Building are not associated with any Key Distress Indicators. Results of survey data, ground well monitoring data, riverbank assessments, and field observations do not indicate signs of structure movement or other adverse effects that could be attributed to these CPFMs. The data currently collected are sufficient to rule out these CPFMs due to the 2011 flood. Therefore, assuming that no further [illegible] are identified through the monitoring program for the Security Building discussed in Section 5.7.6 and continuing until December 31, 2011), these CPFMs are moved to the [illegible] of the matrix representing "No Further Action Recommended Related to the 2011 Flood."

	Low Confidence (Insufficient Data)	High Confidence (Sufficient Data)
Potential for Failure **Significant**		
Potential for Failure **Not Significant**		CPFM 3a CPFM 3d CPFM 12a CPFM 12b

5.7.7.2 Conclusions

In the assessment of the FCS Structures, the first step was to develop a list of all Triggering Mechanisms and PFMs that could have occurred due to the prolonged inundation of the FCS site during the 2011 Missouri River flood and could have negatively impacted these structures. The next step was to use data from various investigations, including systematic observation of the structures over time, either to eliminate the Triggering Mechanisms and PFMs from the list or to recommend further investigation and/or physical modifications to remove them from the list for any particular structure. Because all CPFMs for the Security Building other than CPFMs 3a, 3d, 12a, and 12b had been ruled out prior to Revision 1, and because CPFMs 3a, 3d, 12a, and 12b have been ruled out as a result of the Revision 1 findings, no Triggering Mechanisms and their associated PFMs remain credible for the Security Building. Therefore,

HDR has concluded that the 2011 Missouri River flood did not impact the geotechnical and structural integrity of the Security Building because the potential for failure of this structure due to the flood is not significant.