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Dresden Nuclear Power Station

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U. S. Nuclear Regulatory Commission
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**Dresden Nuclear Power Station, Units 2 and 3
Renewed Facility Operating License Nos. DPR-19 and DPR-25
NRC Docket Nos. 50-237 and 50-249**

Subject: Response to NRC Request for a Written Response to NRC Observations and Concerns Regarding Dresden Station Response Plan for External Flooding Events

Reference: Letter from Jamnes L. Cameron (NRC) to Michael J. Pacilio (Exelon Generation Company, LLC), "Request for a Written Response to NRC Observations and Concerns Regarding Dresden Station Response Plan for External Flooding Events," dated November 1, 2012

In the referenced letter, the NRC requested a written response to address NRC observations and concerns with the Dresden Nuclear Power Station (DNPS) response plan for external flooding events.

The purpose of this letter is to provide the requested information to the NRC, including a listing of actions and a schedule for those actions necessary to update or revise the current response plans and strategies. The attachment of this letter contains the Exelon Generation Company, LLC (EGC) response to the NRC's observations contained in enclosures 2 and 3 of the reference letter.

DNPS personnel along with an independent contractor performed flooding walkdowns at DNPS between August 8 and August 16, 2012. This initiative was taken in response to the Request for Information Pursuant to Title 10 of the Code of Federal Regulations 50.54(f) Regarding Recommendation 2.3 of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident. The associated report will be included in our response to the 50.54(f) request; however, the overall conclusion reached is that the critical path items of the flood emergency procedure can be implemented to ensure that both units are safely shutdown and reactor cooling is provided to remove decay heat.

A portion of NRC observations are associated with knowledge-based actions observed in the DNPS flood mitigation strategy. EGC has confidence in the ability of station personnel to execute knowledge-based actions due to the rigorous Systematic Approach to Training (SAT)-based training that they receive and their demonstration of their retention of this knowledge on

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an ongoing basis. Although the knowledge-based tasks are not complex, EGC recognizes that minimizing knowledge-based actions and clarifying procedure guidance serves to improve margins of success in overall execution of any strategy. The DNPS flood mitigation strategy has been enhanced based upon previous station reviews and the information received as a result of the referenced station walkdowns including a further reduction in knowledge-based tasks, with key aspects listed below.

- As an interim measure, the station has procured a temporary flood barrier that can encircle the DNPS primary plant structures including the reactor and turbine buildings. Action to initiate installation of this barrier has been incorporated into the flood mitigation strategy.
- The station has procured a floating platform for the staging and use of the temporary flood pump that eliminates the need to temporarily suspend the pump during the probable maximum flood (PMF). Use of this platform has been incorporated into the flood mitigation procedure.
- The availability and use of FLEX equipment has been incorporated into the flood mitigation procedure.
- Station walkdowns validated that the watercraft maintained on site is adequate to implement the required actions of the flood mitigation procedure. However, the station has determined it prudent to establish greater defense in depth and has ordered additional watercraft to be available for use as needed.
- Procedural enhancements have been incorporated that provide more detailed supporting information including a listing of below ground water storage tanks, a list of transformers and motor control centers on elevation 517 ft, and the use of a specific pipe flange elbow during the connection of the temporary flood pump to preclude any potential interference in the assembly.
- The flood mitigation procedure has incorporated enhancements that will improve flood prediction capability.
- Specific action points have been identified at which additional station support staffing will be implemented.
- The initiation of actions for removal of service water pump motors is now implemented at an earlier threshold to provide more available time to complete the actions.
- The Station Technical Support Guidelines have been enhanced to include a methodology that can be used to add inventory to the reactor pressure vessel (RPV) during abnormal conditions such as the PMF.

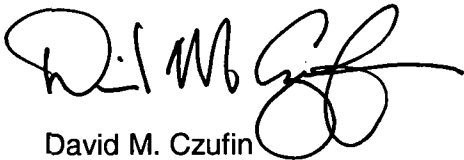
Additional improvements in progress that will strengthen the DNPS response to external flood events are as follows:

- A modification will be developed and installed to allow more timely installation of flood barriers at the isolation condenser make-up pump house. These flood barriers will provide protection for conditions other than the PMF. This is expected to complete on or before March 31, 2013.

- A study will be performed to identify an alternate source of water for decay heat removal utilizing permanently installed plant equipment. This study is expected to complete on or before March 31, 2013.
- A study will be performed to identify a strategy that will provide better flood protection of permanently installed safety related equipment. This study is expected to complete on or before March 31, 2013.
- A time verification will be performed of the installation of the temporary flood barrier. This is expected to complete on or before July 31, 2013.

Should you have any questions concerning this letter, please contact Mr. Hal Dodd, Regulatory Assurance Manager, at (815) 416-2800.

Respectfully,



David M. Czufin
Site Vice President
Dresden Nuclear Power Station

Attachment: "DNPS Responses to NRC Observations"

cc: Regional Administrator, NRC Region III
Project Manager, NRC NRR
Branch Chief, NRC Region III
NRC Senior Resident Inspector, Dresden Nuclear Power Station

DNPS Response to NRC Observations

Supplemental Information

Plausible flooding scenarios including the Probable Maximum Flood (PMF) for DNPS are primarily based on precipitation events of significant magnitude and will provide advance opportunity for station response prior to flood levels challenging safe plant operation. EGC has standard fleet procedural guidance in OP-AA-108-111-1001, "SEVERE WEATHER AND NATURAL DISASTER GUIDELINES," that directs activities designed to augment staff and make preparations in the event that a site is going to be impacted by high winds, tornados, hurricane, excessive rain, flooding, snow, or ice accumulation. These activities include augmenting staff, providing food, sleeping arrangements, consumables, and briefing of Emergency Response Organization (ERO) personnel.

Whenever notification is received that predicted rainfall will be greater than or equal to 2 inches in a 6 hour period in the area of DNPS or flooding is forecasted by the U.S. Weather Service for the Illinois, Des Plaines, or Kankakee Rivers in the area of DNPS, the station will enter OP-AA-108-111-1001 and Dresden Abnormal Operating procedure DOA 0010-04, "FLOODS."

Additionally, the Emergency Response Organization (ERO) will be staffed to support the operators during events that could challenge safe plant operations. In the case of a flood, an Unusual Event will be declared per EP-AA-1004, Radiological Emergency Plan Annex for Dresden Station, under Emergency Action Level (EAL) HU4 when water level exceeds an elevation of 509 ft and an Alert will be declared under EAL HA4 when water level exceeds an elevation of 513 ft. The Unusual Event declaration provides for optional staffing of the ERO and the Alert declaration requires mandatory staffing of the site and corporate ERO. This will result in approximately 70 additional support staff dedicated to maintaining the plants in a safe shutdown condition and the protection of public health and safety. The site and corporate ERO will be tasked with obtaining any additional resources as necessary from civilian, federal, state, and local agencies to support the maintenance and recovery of the facility.

These additional resources are not credited in the DNPS flood mitigation strategy; however, provide additional assurance that appropriate resources are available in a timely manner and dedicated to maintaining the highest levels of safety at DNPS.

Below are DNPS responses to NRC questions contained in Enclosures 2 and 3 of the referenced letter.

NRC Observations of procedural weakness of the external flooding plan are as follows:

- 1. The procedures were not sufficiently detailed with respect to the actions to be performed and relied heavily on an individual's knowledge of plant system. Please describe your basis for relying on knowledge-based actions and decisions and how that approach would be sufficient to ensure all required actions are accomplished.*

Response:

Procedural steps are written based on the knowledge and skill level of the intended user. In some cases procedural actions can be accomplished in multiple ways depending on plant conditions, resource availability, and time to execute. Some procedural steps were written in a manner to allow decision makers to determine the best course of action for success based on given conditions.

For example, the DNPS external flooding procedure DOA 0010-04, "FLOODS," has an action to denenergize all transformers and Motor Control Centers (MCCs) on the 517 ft elevation. This step could be performed locally in the plant, but the preferred simplest action is from the Main Control Room (MCR).

Operations personnel receive extensive initial and continuing training to ensure they acquire and maintain the requisite knowledge to successfully perform plant procedural actions. Training provided to the operators is through an INPO accredited program.

EGC, under observation of an independent contractor, performed reasonable simulations, walkdowns, and reviews of DOA 0010-04 as well as the supporting procedures. DNPS personnel performed 19 reasonable simulations requiring the execution of normal and abnormal procedures. It was concluded that the critical path items of the flood response procedure can be implemented to ensure that both units are safely shutdown and reactor cooling is provided to remove decay heat.

EGC has confidence in the ability of station personnel to execute knowledge-based actions due to the rigorous Systematic Approach to Training (SAT)-based training that they receive and their demonstration of their retention of this knowledge on an ongoing basis.

EGC recognizes that minimizing knowledge-based actions and clarifying procedure guidance serves to improve margins of success in overall execution of any strategy. Based on the observations of EGC and the independent contractor a number of procedural enhancements were identified and have been incorporated into the most recent procedural revisions. A list of key changes to the procedure has been included in this letter.

2. *Discuss how plant notification and/or measurement of flood water levels above elevation 510' (when the gage at the US Army Corps of Engineers (USACE) Navigation Lock and Dam is submerged) is performed. Explain how river level would be determined once flood waters exceed 510 feet, especially at critical flood levels where operator actions are specified in your procedure.*

Response:

DNPS Procedure DOA 0010-04 requires operator action at the following elevations above 510 ft: 513 ft, 516 ft, 517 ft, 518 ft, and 519 ft. These levels can be reasonably determined based upon the guidance contained in DOA 0010-04.

DNPS Technical Requirements Manual (TRM) section 3.7.f, "Flood Protection," contains a surveillance requirement (3.7.f.1) to determine water level at the Unit 2/3 crib house every two hours when river level is greater than or equal to 506.0 ft.

In accordance with DOA 0010-04, level may be determined by using plant process computer (PPC) Point E354, "Discharge Canal Water Level," or a portable measuring device in the crib house. PPC Point E354 uses Transmitter 2/3-4450-42 and has a maximum indication of approximately 516 ft. This level indication is currently nonfunctional and is in the corrective action program. Repairs are scheduled to complete in April 2013. Currently level is monitored locally at the 2/3 crib house daily.

Additionally, DOA 0010-04 directs the operators to reference Print B-320, "Crib House Elevations," when determining water level. Four of the elevations indicated in the print include:

- Concrete floor elevation of 509 ft 6 in; travelling screens elevation
- Finish Grade elevation of 517 ft
- Ground Floor elevation of 517 ft 6 in; 1st floor of the crib house
- Top of Sill elevation of 520 ft 4- 3/8 in; bottom of the windows on the south wall of the crib house

During the flood, the Unit 2/3 crib house is accessible to perform the required monitoring with flood levels up to 517 ft elevation. When the crib house becomes inaccessible, flood levels will be determined in the reactor building.

3. *The procedure makes general statements like "deenergize all transformers at EL XX" without providing a list of the equipment. This produced confusion and uncertainty during the walkdown simulation regarding which equipment was located at what elevation. Please describe your basis for relying on knowledge-based actions and decisions and how that approach would be sufficient to ensure all required actions are accomplished.*

Response:

Operators at DNPS attend an extensive initial and continuing training program to ensure they acquire and maintain the requisite knowledge to successfully perform plant operations and procedural actions. As part of the training program, operators are trained and are knowledgeable of station MCCs and transformers. Operators perform daily plant tours and rounds that include inspections and monitoring of in plant equipment including transformers and MCCs.

Procedural steps are written based on the knowledge and skill level of the intended user. In some cases procedural actions can be accomplished in multiple ways depending on plant conditions, resource availability, and time to execute. Some steps were written with the desired action, but allow some latitude in implementation.

DOA 0010-04 has an action to deenergize all transformers and MCCs on elevation 517 ft. This step could be performed locally in the plant, but the preferred simplest action is from the MCR. This action can be accomplished in as few as nine switch manipulations from the MCR. Based on the flood walkdown that was performed by an independent contractor and an interview with the operator performing the reasonable simulation, there was a discussion during the simulation that identified that this could be done in the MCR or locally. The evaluated procedural step was simulated successfully from the MCR per DOA 0010-04 and the Operations staff showed sufficient knowledge of the action needed to be performed.

EGC recognizes that minimizing knowledge-based actions and clarifying procedure guidance serves to improve margins of success in overall execution of any strategy. Based on the observations of EGC and the independent contractor a number of procedural enhancements were identified and have been incorporated into the most recent procedural revisions, which includes a list of MCCs and transformers on the 517 ft elevation. A list of other key changes to the procedure has been included in this letter.

- 4. The procedure appears to initiate actions when they should already have been completed to protect station staff. For example, the procedure states, "If the water reaches EL 517', deenergize down all transformers and motor control centers (MCCs) on El 517' (DOA-0010-04, D.14.a). Although there are small (~4 inch) sill barriers on the doors, this would likely be a situation where Aux Operators were performing activities in flooded areas of the plant with the potential for local energized equipment. NRC Staff noted that, at some locations in your facility, sill barriers were not completely intact. Please clarify what activities, following existing flood response procedures as written, could require operators to perform activities in the presence of environmental hazards. Explain how those activities can be performed safely.*

Response:

Safety of the personnel at DNPS is a key value. There is no desire for personnel to be exposed unnecessarily to environmental hazards. DOA 0010-04 provides a warning in the procedure to personnel of the potential electrical hazards.

DOA 0010-04 states to de-energize busses, MCCs and transformers on 517 ft. Actual floor elevation of the crib house, turbine building and reactor building is 517 ft 6 inches. The action to deenergize MCCs and transformers on elevation 517 ft 6 inches is performed from the MCR, which is on elevation 534 ft, but can be done locally. This provides margin between plant grade and the electrical equipment with no credit for sill barriers on doors. This action is not taken prior to this level as the intent is to maintain normal plant system availability for as long as possible.

Prior to flood levels reaching 517 ft elevation, personnel would use standard foul weather gear to provide protection from the probable rain that would be occurring on site. Once water level reaches elevation 517 ft there are limited actions that operators would be required to perform in the presence of environmental hazards. Those activities (performed after transformers and MCCs have been deenergized) include the opening of doors on elevation 517 ft, operation of the diesel-driven emergency make-up pump, the servicing of externally powered equipment, and plant patrols. These activities will be primarily performed within the confines of the building but some activities may require the use of a boat. Personnel will utilize life jackets while in boats as directed by plant procedures.

5. *The procedure makes statements like, "check level in below-ground storage tanks and fill," without stating which tanks. Please describe your basis for relying on knowledge based actions and decisions and how that approach would be sufficient to ensure all required actions are accomplished.*

Response:

Operators at DNPS attend an extensive initial and continuing training program to ensure they acquire and maintain the requisite knowledge to successfully perform plant procedural actions. Procedural steps are written based on the knowledge and skill level of the intended user. The below ground storage tanks at DNPS are routinely filled, transferred, and monitored by operators as part of the station's water management procedures.

The procedural direction in DOA 0010-04 to check level and fill below ground storage tanks is a desired action to protect the integrity of the below ground tanks, but is not critical for safe shutdown of the plant.

During the independent external contractor review discussed previously, EGC performed a simulation to raise water storage tank level and check/fill below ground water storage tanks. This action is performed through the radwaste control room where the below ground tanks are controlled and monitored. The independent external contractor and EGC found that all steps within the simulations were performed successfully. Procedural enhancements were identified for DOA 0010-04 and include the addition of a list of tanks below ground that will require level adjustments to support flood response efforts. These enhancements have been included in the latest revision of DOA 0010-04.

EGC has confidence in the ability of station personnel to execute knowledge-based actions due to the rigorous SAT-based training that they receive and their demonstration of their retention of this knowledge on an ongoing basis. EGC recognizes that minimizing knowledge-based actions and clarifying procedure guidance serves to improve margins of success in overall execution of any strategy.

6. *The procedure provides direction to "obtain boats," however, the details of such an activity are not included (e.g., from onsite storage, offsite entity with a durable agreement, etc). Explain the actual arrangements for obtaining needed boats (number, type, purpose, and source).*

Response:

The site has one boat with a motor and trailer used for periodic maintenance tasks that is immediately available for the operation of the diesel-driven emergency make-up pump. This is the only external flooding procedure task that would require a boat when water enters the power block.

Station walkdowns validated that the watercraft maintained on site is adequate to implement the required actions of the DNPS external flooding procedure. However, the station has determined it prudent to establish greater defense in depth and has ordered additional watercraft for use. In addition, two additional boats with outboard motors are available at a nearby EGC facility. The boats are the property of EGC. These boats would be obtained on an as-needed basis to support transport of personnel, materials, or plant patrols during the flood period. No specific written agreements are maintained as would be with an offsite entity.

During a flood, an Unusual Event will be declared per EP-AA-1004, "Radiological Emergency Plan Annex for Dresden Station," under Emergency Action Level (EAL) HU4 when water level exceeds elevation of 509 ft and an Alert will be declared under EAL HA4 when water level exceeds elevation of 513 ft. The Unusual Event declaration provides for optional staffing of the ERO and the Alert declaration requires mandatory staffing of the site and corporate ERO. The site and corporate ERO will be tasked with obtaining any additional resources as necessary from civilian, state, and federal agencies.

7. *The procedure directs activities from a starting condition of normal plant operations. No apparent consideration for starting these activities from an abnormal condition where the plant may be in a different configuration. Explain the strategy for entering the flooding procedure from a starting condition of other than normal operations. Clarify where and how that strategy has been provided to operating crews.*

Response:

During unit conditions other than Mode 1, the plant will already be in a partially cooled or depressurized state. DOA 0010-04 directs the operators to shutdown and cool down the units. If in Modes 2-5, DOA 0010-04 steps will still apply to both units regardless of the mode each unit is in. If one or both units is in Mode 5, the cavity is flooded and the unit is cooled down with adequate level inventory to satisfy DOA 0010-04. Additionally, DOA 0010-04 provides guidance for spent fuel pool makeup which will ensure adequate cooling for Mode 5 is maintained.

Operators at DNPS attend an extensive initial and continuing training program to ensure they acquire and maintain the requisite knowledge to successfully perform plant operations and procedural actions, which include casualty operations and training exercises that begin from varying Modes of operation. The procedural guidance in DOA 0010-04 and the requisite knowledge adequately provides the operators with the strategy for executing DOA 0010-04 from a starting condition of other than normal operations.

8. *The procedure does not appear to consider that the electrical bus for the emergency diesel generators (EDGs) is at the 517' elevation and the potential to create a personnel hazard if the bus were automatically energized. Explain provisions for addressing normal automatic plant responses, such as automatic start of diesel generators and energization of an electrical bus, in situations where personnel hazards could be created because of flooding. Explain where those provisions are provided to operating crews.*

Response:

During the flood walkdown, the procedural direction to secure MCCs and transformers on the 517 ft elevation included taking measures to prevent the EDGs from powering the associated buses. When isolating MCCs and transformers at 517 ft the EDGs would have to be isolated to prevent automatically starting and reenergizing the busses. Under these conditions the plant will be in a shutdown condition with a cooldown in progress.

Once water level reaches elevation 517 ft there are limited actions that operators would be required to perform during the duration of the flood. Those activities include the opening of doors on elevation 517 ft, operation of the diesel-driven emergency make-up pump, the servicing of externally powered equipment, and plant patrols. There are no automatic plant responses that would expose personnel to hazards.

EGC and an independent contractor performed reasonable simulations, walkdowns, and reviews of DNPS external flooding procedure, as well as the supporting procedures. The MCR actions to secure MCCs and transformers on 517 ft elevation are non-complex actions and were successfully demonstrated during the flood walk down with the independent external contractor.

Based on the observations of EGC and the independent contractor a number of procedural enhancements were identified and have been incorporated into the most recent procedural revisions, which includes a list of MCCs and transformers at 517 ft elevation and a step to prevent the EDGs from powering the associated buses.

NRC Observations of design weakness of the external flooding plan are as follows:

- 1. Visual observation of the connection points for the diesel-driven pump used to provide water to the isolation condensers showed that fire-water system piping could interfere with connection of the spool piece. It was initially unclear that the procedures accounted for physical impediments to connections to the fire header. It was unclear if the connection had ever been installed or tested while installed. After questioning the licensee identified that there were additional pipe fittings staged for dealing with pipe interface conflicts. This equipment, however, was not tagged for association with DOA-0010-04 and this was why it was not initially utilized. The licensee entered this issue into the Corrective Action Program (CAP). Provide how this issue was addressed and the current status of the resolution and the schedule for completing any open items.*

Response:

EGC under observation of an independent external contractor simulated installing hose connections to the fire protection system during the flooding walk down. These connections have not been physically installed and tested in the field due to the need to make equipment unavailable while making the connections.

During the simulation of the Unit 2 hose connection to the fire-water system valve, FIRE PROTECT PREACTION SV TO HPCI RM, 2-4199-135, the workers questioned potential interference between the fire protection piping and the discharge hose from the emergency make-up. This potential interference could not be validated during the walkdown with certainty under simulated conditions.

During the simulation, and within a short time period, the workers self-identified a flanged elbow fitting had been fabricated and was available in the storage area with the other connections and hoses, but was not labeled. The installation of a flanged elbow fitting ensures the discharge hose is connected from a different direction, which eliminates the possibility of interference.

Subsequently, the flanged elbow fitting has been labeled and the latest revision of DOA 0010-04 includes specific direction for use of the flanged elbow fitting. The procedural enhancement and labeling of the fitting was included in the overall actions taken in response to the results of the station walk downs and simulations and it was not entered separately into corrective action program. There are no additional open items pertaining to this issue.

- 2. The licensee's procedures called for local control of both the Isolation Condenser inlet valves and the hoist height of the diesel-driven pump. It was not clear that the licensee had accounted for the battery life of the communication pathway (walkie-talkie) to support this activity. Additionally, communication with both operators in the control room is critical since the Isolation Condenser controls for Unit 2 and Unit 3 are on opposite sides of the control room. Explain arrangements for ensuring that adequate communications would be available for the duration of a probable maximum flood event.*

Response:

The actions to operate the Isolation Condensers are conducted locally in the reactor building. During the initial start up of the Isolation Condenser some level of communication between the operators is necessary, but once the Isolation Condenser is in service the operators will be performing separate functions that do not require communications with other areas.

One operator will be controlling cool down rate through manual operation of a valve in the room adjacent to the instrument racks. The cool down rate is monitored locally using the gages installed at the instrument racks. A single operator is able to control cool down rate and does not require communications with other areas.

Another operator will be operating the diesel-driven emergency make-up pump, which is positioned and installed in accordance with DOA 0010-04. The purpose of this task is to maintain the pump in operation to keep the fire header pressurized and available for use as a make-up source. This operation is performed locally at the diesel-driven emergency make-up pump.

An additional operator is tasked with maintaining level of the shell side of the Isolation Condenser in the appropriate band. This is accomplished locally at the Isolation Condenser using a valve hand wheel near the Isolation Condenser shell side level sight glass. DOA 0010-04 also allows this task to be accomplished by an alternate method with the operator locally at the diesel-driven emergency make-up pump utilizing the pump throttle. If this method is utilized, radio communication will be sufficient to perform the task.

Utilizing normal methods described above, continuous communication is not required between the operator at the diesel-driven emergency make-up pump, the operator at the Isolation Condenser, and the operator controlling cool down rate as these are separate, distinct activities.

All communication within the control room will be face to face. Communication between the various areas in the plant will be accomplished by radio or face to face communications. There are stair wells on either side and in the middle of the reactor building that provides adequate access to these areas. There are no actions related to Isolation Condenser operation that require communication between the control room and the infield operators that are critical to its operation.

Additionally, there are numerous spare radio batteries available on site. Portable 120 volt gasoline/diesel generators are available on-site for radio battery charging. The operations Department also has satellite phones that will be available for communications if needed.

3. *The sand bagging effort associated with protection of the normal Isolation Condenser make-up pump building appears to be labor intensive without a commensurate benefit. The building is protected to 517' and the sand bagging stated purpose is to provide additional protection between 517' and 519.5'. Since the building contains multiple penetrations, including louvers to vent the exhaust, and since the current design basis probable maximum flood (PMF) is at 528', it appears that a significant amount of site resources may be devoted to an activity that may ultimately not protect the subject equipment. Provide current plans for sandbagging, the expected benefits, and explain any impacts this would have on resources needed for other flooding preparation activities.*

Response:

The purpose of sandbagging the Isolation Condenser make-up pump building is to extend availability of the permanently-installed Isolation Condenser make-up pumps. Without sandbagging the Isolation Condenser make-up pumps will remain available up to a flood level of approximately 518.5 ft. Constructing the berm extends the availability to 519.5 ft elevation. This ensures the preferred make-up source is available for all flood levels below 519.5 ft. Per DOA 0010-04, the diesel-driven emergency make-up pump is started at 518 ft; therefore, without construction of the berm the emergency pump will be started before the permanently installed Isolation Condenser make-up pumps become unavailable.

The resources to perform this task are not limited to site maintenance personnel. The directions provided in DOA 0010-04 are sufficient to allow this simple task to be performed by anyone available on site.

The site is pursuing alternatives to provide other flood protection features to the Isolation Condenser make-up pump house to eliminate the need for sandbagging. This action is being pursued to extend the availability of the Isolation Condenser make-up pump under flooding conditions other than PMF. An alternative is expected to be installed by March 31, 2013.

4. *The optional procedure to enter the Crib House (intake structure house) and remove two of the Service Water Pump Motors for later plant recovery appears to be labor intensive without a commensurate benefit. These motors weigh approximately 8000 pounds. The procedure states the motors should be removed from the Crib House and relocated to the turbine deck. Since the rotating trash-rack screens would allow water to enter the Crib House at approximately elevation 509', these pump motors would be wetted just before the site floods. It appears that a significant amount of site resources may be devoted to an activity that may ultimately not protect the station. Provide current plans for motor removal, the expected benefits, and explain impacts this would have on resources needed for other flooding preparation activities.*

Response:

The removal of the service water pump motors is to assist with recovery efforts after the flood waters recede without having to clean and dry out the motors. While it is desirable to remove these motors it is not required for flood mitigation. If resources are not available or insufficient time exists to perform the task, then this action does not need to be performed. At no time will it be expected that this action will be accomplished if there is any potential for personnel injury from the rising water level in the area. The labor demands, on the Electrical Maintenance Department, to mitigate the rising water levels are limited to removing the service water motors under DOA 0010-04. In the latest revision of DOA 0010-04 this is the only task that specifically requires Electrical Maintenance Department resources to perform and has no impact on other flooding preparation activities.

A procedural enhancement was made to DOA 0010-04 so that actions for removal of service water pump motors are now implemented at an earlier threshold to provide more available time to complete the actions.

5. *There is uncertainty regarding the ability of the licensee to monitor rapidly rising water levels above elevation 509' (eight feet below site grade and up). Although not all procedures were reviewed, the licensee and its contractors stated the primary source of water level information was the USACE via contact with the Lock Master at Dresden Lock and Dam. Staff visited the Lock and Dam, and toured the facility with USACE staff. NRC staff located the automatic, telemetered, water-level gage. Data from the water level gage is automatically sent to the Rock Island District office. In addition, a second staff gage located nearby can be visually read. However, both gages will be unusable at approximately elevation 510 ft (the visual staff gage ends at 508' and the electronic unit will flood). The Systematic Evaluation Program (SEP) Technical Evaluation Report (TER) TER-C5257-421 states that the top of the dam is elevation 506.5'. Therefore, it is unclear to NRC staff how the water level at the site will be estimated once the USACE Dam is submerged and the gages are not available. In addition, because the USACE Dam is downstream, water level estimates during a large storm would likely be lower than at the upstream Dresden site. Explain how river level would be determined or why measurements of site flood levels would not be required once existing gages become unavailable.*

Response:

Monitoring of accurate flood levels will be accomplished utilizing plant process computer (PPC) point (E354) and local observation at the plant. It is not solely reliant on the automatic, telemetered, water level gauge used by the USACE.

DNPS Technical Requirements Manual (TRM) section 3.7.f contains a surveillance requirement (3.7.f.1) to determine water level at the Unit 2/3 crib house every two hours when river level is greater than or equal to 506.0 ft.

In accordance with DOA 0010-04, level may be determined by using PPC Point E354, "Discharge Canal Water Level," or a portable measuring device in the crib house. PPC Point E354 uses Transmitter 2/3-4450-42 and has a maximum indication of approximately 516 ft. This level indication is currently nonfunctional and is in the corrective action program. Repairs are scheduled to complete in April 2013. Currently level is monitored locally at the 2/3 crib house daily.

Additionally, DOA 0010-04 directs the operators to reference Print B-320, "Crib House Elevations," when determining water level. Four of the elevations indicated in the print include:

- Concrete floor elevation of 509 ft 6 in; travelling screens elevation
- Finish Grade elevation of 517 ft
- Ground Floor elevation of 517 ft 6 in; 1st floor of the crib house
- Top of Sill elevation of 520 ft 4- 3/8 in; bottom of the windows on the south wall of the crib house

During the flood, the Unit 2/3 crib house is accessible to perform the required monitoring with flood levels up to 517 ft elevation. When the crib house becomes inaccessible, flood levels will be determined in the reactor building.

Additional NRC Staff Identified Issues with the External Flooding Design Plan:

- 1. The licensee's plan calls for using flood waters, pumped through the elevated diesel pump, as a cooling source for the Isolation Condenser. Explain how the clogging of pump intake hose(s) by flood debris will be prevented.*

Response:

The diesel-driven emergency make-up pump is a Godwin HL80M Dri-Prime Pump. There is a debris suction strainer attached to the end of its suction hose. In accordance with DOA 0010-04, the suction hose draws water off the ground floor of the reactor building and is not in the direct flow of the river where larger debris will be located. DOA 0010-04 directs operators to review DOS 1300-04, "Operation of the Isolation Condenser External Flood Emergency Make-up Pump," for prolonged use of the diesel-driven emergency make-up pump. DOS 1300-04 gives guidance to the operator for troubleshooting the diesel-driven emergency make-up pump, which includes clogging of the pump suction.

2. *The Updated Final Safety Analysis Report (UFSAR), Section 3.4, discusses using an "emergency flood pump" to pump water to both units' isolation condensers. Dresden's Dresden Operating Abnormal (DOA) procedure 0010-04 states: "Rig the reactor building crane or jib crane at elevation 545 foot with a 2 ton capacity chain fall to allow lifting the diesel-driven emergency make-up pump to a height of a least 15 feet above the floor." Please describe the logistics of operating a diesel pump while suspended from a chain fall and explain the reliability of this approach.*

Response:

DOA 0010-04 provides guidance to utilize the diesel-driven emergency make-up pump to provide make-up cooling for the Isolation Condensers once flood waters exceed elevation 518 ft. The diesel-driven emergency make-up pump draws water off the ground floor of the reactor building and is connected to plant's fire suppression system to provide make-up water to the Isolation Condensers. The pump is rigged to the reactor building crane (or the jib crane) with a chain fall to ensure that it can be manually moved up and down as the flood waters rise and recede to maintain it 1 to 2 ft above the water level. The weight of the suction and discharge hoses on the suspended pump ensures stable operation. Scaffolding is built up to approximately 15 ft height to allow for operation of pump controls and the chain fall. This task was simulated successfully as part of the demonstrations and simulations during the independent external contractor review of DNPS external flooding plan.

As an enhancement to the pump operation, the site has obtained a floating platform that has the necessary buoyancy to provide a stable platform for the diesel-driven emergency make-up pump and its supply of fuel. The use of the floating platform is the preferred option and has eliminated the need for suspending the diesel-driven emergency make-up pump from the reactor building crane. DOA 0010-04 has been revised to include this option for positioning and operation of the diesel-driven emergency make-up pump.

- 3. The use of flood waters as a cooling source for the Isolation Condenser will likely lead to silt and mud fouling of isolation condenser. Condenser fouling could lead to tube failure, and subsequently provide a direct pathway for release from the reactor. Please address the potential for Isolation Condenser fouling due to mud and silt, and explain how this will be prevented.*

Response:

The Isolation Condenser consists of two stainless steel tube bundles and a carbon steel shell. The silt that is drawn into the diesel-driven emergency make-up pump is not expected to affect the structural integrity of the Isolation Condenser shell or U-tubes during the time that the Isolation Condenser must function using floodwaters during and following a flood. This time period is expected to last from several days to a few weeks. The temperature and chemistry conditions will be similar to what is experienced in the main condenser following a seasonal storm.

There are greater than 9 inches of clearance between the Isolation Condenser shell and the bottom of the tube bundles. The Isolation Condensers are tested every five years to verify their heat removal capability. Six hours after reactor shutdown the Isolation Condenser has the capacity to remove greater than 275% of the reactor decay heat. At 19 hours the capacity is greater than 360% of decay heat and this continues to increase as time after shutdown increases and decay heat decreases. This capacity is expected to more than overcome losses that may occur as a result of fouling.

4. *The flood response plan does not call for removal of the reactor head. With the head intact, and all ECCS systems unavailable due to internal plant flooding, explain how cooling water inventory would be added to the reactor cooling system, if needed, during a flooding event.*

Response:

Prior to the de-energization of electrical busses which will result in the unavailability of the ECCS pumps, the DOA 0010-04 directs the operators to fill the vessel to an increased level. Adequate level indication is provided at this level both in the control room and locally at instrument racks in the reactor building.

The use of the Isolation Condenser does not result in an inventory loss in the reactor vessel. Inventory losses are expected to be bounded by the unidentified leakage rates calculated per Technical Specification 3.4.4, "RCS Operational Leakage," prior to shutdown. This leakage would be expected to drop as the reactor is cooled down and it is not anticipated that makeup would be required during flood conditions. An enhancement that has been implemented in DOA 0010-04 is the isolation of the reactor recirculation pumps, which will eliminate a potential source of RPV inventory loss if a failure of a pump seal were to occur. This isolation is performed from the MCR and will occur prior to the station de-energizing the electrical busses.

Using a conservative assumption that primary system leakage is at the Technical Specification's limit of 5 gpm unidentified leakage, vessel makeup to maintain above the top of active fuel will be required in approximately 130 hours after flood waters reach plant grade. Within the 130 hours, flood waters will recede and DNPS will transition control of critical functions to other abnormal and emergency operating procedures.

Additionally, plant Technical Support Guidelines have been enhanced to provide guidance for a makeup source, from fire protection system via Standby Liquid Control System (SBLC) piping, to the RPV that will be implemented under plant flood conditions if required.

5. *The flood response plan calls for use of flood waters as a cooling source for the Isolation Condenser. When flood waters recede below the plant grade of 517 feet, please identify what water source will be used to continue cooling of the Isolation Condenser.*

Response:

As the event continues, reactor decay heat will decrease requiring less make-up to the Isolation Condenser shell side. DOA 0010-04 provides direction for when flood waters recede below elevation 518 ft. The suction hose for the diesel-driven emergency make-up pump will be relocated to draw water from areas below grade. This includes the torus areas for both units, which are below grade in the reactor building, and which will contain substantial quantities of water due to their size.

When the flood waters recede, DNPS will transition the control of critical functions to other abnormal and emergency operating procedures. This will eliminate the need for a water source to the diesel-driven emergency make-up pump.

If additional water is required at the suction of the diesel-driven emergency make-up pump during the transition, guidance has been added to DOA 0010-04 to provide the water using FLEX equipment. FLEX equipment is portable equipment available for protection against the most unlikely events that go beyond the plant's design basis.

- 6. In the event of a flood at the level up to the probable maximum flood (528 feet), explain how relief crews will gain access to the site, considering the nearest dry land will likely be several miles away. Furthermore, explain how they will gain entry to, and existing crews will evacuate from, site buildings, since all normal entry/egress points will be under water. For those crews on site during such a flooding event, please describe the environmental conditions they may have to contend with in order to implement your flood response plan and strategy.*

Response:

EGC recognizes that personnel may be required to remain on-site for extended periods of time during severe weather. The EGC procedure OP-AA-108-111-1001, "SEVERE WEATHER AND NATURAL DISASTER GUIDELINES," prompts actions to be taken in the event the site is going to be impacted by severe weather, which includes a flooding event. This procedure directs the site to establish food plans for the site, review consumables lists and ensure supplies are adequate, over-staffing for reliefs, and sleeping arrangements. OP-AA-108-111-1001 provides guidance that personnel may need to remain on-site for extended periods of time during severe weather conditions, which would include when river level rises to the point of blocking access.

Additionally, OP-AA-108-111-1001 provides guidance for briefing ERO duty teams and organizations to ensure awareness of their potential roles. During a flood, an Unusual Event will be declared under EAL HU4 when water level exceeds elevation of 509 ft, and an Alert will be declared under EAL HA4 when water level exceeds elevation of 513 ft. The Unusual Event declaration provides for optional staffing of the ERO and the Alert declaration requires mandatory staffing of the site and corporate ERO. The site and corporate ERO will be tasked with obtaining any additional resources as necessary from civilian, state, and federal agencies.

The site has an immediate supply of food, water, sleeping bags, cots, toiletry and personnel hygiene supplies to support personnel while additional arrangements are being made for resupply. As a part of the FLEX equipment obtained, there are also portable generators with cords, lights and fans that will be utilized during the event. The Operations Department has satellite phones that will be available for communications.

Access within the site will be accomplished via the following methods: Access to the turbine building from the administrative buildings will be via the normal access doors in the MCR or the U-2 4kV bus area on elevation 534 ft. Access to the reactor building will be via the interlock door accessed from the turbine building 561 ft elevation which accesses the reactor building on elevation 570 ft.

As needed, access to site buildings from personnel offsite will be accomplished via boat through the open reactor building interlock and to stairs leading to higher elevations and then into the turbine building from elevation 570 ft.

Prior to flood levels reaching 517 ft elevation, personnel would use standard foul weather gear to provide protection from the probable rain that would be occurring on site. Once water level reaches elevation 517 ft there are limited actions that operators would be required to perform in the presence of environmental hazards. Those activities include the opening of doors on

elevation 517 ft, operation of the diesel-driven emergency make-up pump, the servicing of externally powered equipment, and plant patrols. These activities will be primarily performed within the confines of the building but some activities may require the use of a boat. Personnel will utilize life jackets while in boats as directed by site procedures.

7. *In the event of a flood at the level up to the probable maximum flood (528 feet), please describe the potential impact of flood waters on radiological conditions on site (for example, flooded contaminated areas and rooms containing tanks of radioactive materials/waste). Please discuss the radiological conditions that operators onsite would have to contend with while performing required actions.*

Response:

The radiological hazards associated with the DNPS flooding event are expected to be minimal. Operators will be able to perform the actions in the DNPS external flooding procedure without additional assistance from Radiation Protection (RP) personnel and without exposure to undue radiological hazards.

There will be no flood related radiological concerns until flood levels exceed 517 ft. After flood levels exceed 517 ft, radiologically controlled areas (RCAs) will begin to be flooded. Based on contamination and radiation levels below the 528 ft flood level in both the reactor and turbine buildings, there will be no appreciable change in radiation levels in these areas due to the flood, and operators will be able to perform their actions without impact.

Radioactive materials located in vaults and rooms located below 517 ft elevation in the Radwaste building and other RCAs are projected to be a minimal radiological hazard during the flooding event. As flood waters rise, the levels below 517 ft will be filled by flood waters. Once the areas are flooded, there will be no significant water flow through the areas and significant amounts of radioactive materials will not migrate to areas above 517 ft. When flood waters recede, areas below 517 ft will remain flooded until recovery efforts are begun, and there will be no migration of radioactive materials from these areas.

Radioactive materials in other satellite RCAs are expected to have no impact on operators performing the required actions during the flooding event.

The RP Shepherd Calibrator would be the highest source from a radiological aspect. This source, along with other sources, is located in an area where it could be exposed to flood water, but it is located in an area of the plant where there are barriers in place that would keep it from exiting the building. The Shepherd Calibrator is also chained in place to help secure movement. Therefore, it would remain in place and would not adversely impact any operator actions.

RP personnel can easily relocate radioactive materials, such as instruments, radioactive sources, and respiratory equipment, to areas that would not be impacted by the flood waters. These actions are not critical for the flood response and will be coordinated by the ERO as needed.

8. *Considering the extreme hardship potentially posed to crews tasked with implementing your flood response plan, please address human reliability of executing all aspects of the flooding plan procedure.*

Response:

The Human Reliability Review was performed by a multi-disciplined team with experience in risk management, engineering and operations. The review concluded that the critical manual actions during flood response are feasible and reliable. Adequate time margins exist to account for the uncertainty associated with human performance under the severe conditions expected in the design basis flood.

Human reliability of executing DOA 0010-04 was reviewed considering the Performance Shaping Factors (PSF) applicable to actions performed under flood response conditions. These PSFs were identified using the applicable portions of guidance found in NUREG 1852 *Demonstrating the Feasibility and Reliability of Operator Manual Actions in Response to Fires*. The PSFs considered during the review were the following:

- Time Available to Justify Feasibility
- Time Available to Ensure High Confidence
- Environmental Factors (Onsite and offsite)
- Equipment Functionality and Accessibility
- Available Cues/Indications of Functional Success
- Communications
- Portable Equipment (Availability & Transport)
- Personnel Protection Equipment
- Procedures and Training
- Staffing
- Demonstration of Actions

The demonstrated times during simulation and actual performance of critical actions, and the time available during a flood using the most time limiting hydrograph (i.e., PMF Hydrograph) were assumed in this analysis. After applying these factors, it was concluded that the critical manual actions are feasible, reliable and will be completed as required. The review determined that there may be insufficient time available to complete the DOA 0010-04 actions of service water pump motor removal and sandbag berm construction. However, as discussed in the response to previous questions, completion of these activities is not required for successful flood mitigation.

9. *The 500-year flood level for Dresden is estimated to be between 511.5 feet and 514.9 feet based on analyses performed in various reports (e.g., U.S. Army Corps of Engineers, Franklin Research Center, Independent Spent Fuel Storage Installation Operability Evaluation, etc.). Please provide a best estimate of the frequency and uncertainty of a flooding event reaching the plant grade of 517 feet. Also, please explain what assumptions were used in making this estimation and justify why these assumptions are appropriate.*

Response:

This question asks EGC to determine the best estimate of the frequency of a flooding event reaching the plant grade of 517 feet. The subject of estimating the frequency (return period) of extreme flooding events has been a topic of debate for many years.

The typical method for predicting river flows (and subsequent flooding levels) is the United States Geological Survey (USGS) Guidelines for Determining Flood Flow Frequency Bulletin #17B of the Hydrology Subcommittee, published in March of 1982. However, the USGS Bulletin and several NRC documents recognize that there is no endorsed methodology to develop a probabilistic framework for estimating extreme flood frequencies well beyond the range of observed history.

Solely to answer the question as posed, an estimate of the frequency and uncertainty of a flooding event reaching the plant grade of 517 feet was performed. The scope was based on stream flow gauge data from 1940 to 2011, the Log Pearson Type III (LP3) methodology, and utilizing hydraulic models developed for the DNPS in association with recent efforts for a deterministic probable maximum flood (PMF) evaluation. The plausible estimate that was obtained for the return period for flooding reaching the plant grade elevation of 517 ft. is well in excess of one million years.

With the limited data, unknown uncertainties, and lack of industry guidance for predicting flooding events far into the future, EGC does not endorse the frequency of greater than 1 million years.

Recently, the US Bureau of Reclamation published a research report DSO-04-08, which establishes their procedure for generating probabilistic hydrologic hazard curves. This report outlines credible limits on extrapolating hazard curves beyond the record length. It states that an optimal amount of records is required to estimate to the 1,000-yr return period when using regional stream flow data. In order to estimate further, additional and supplemental sources of data are required (i.e. paleoflood, regional precipitation data, etc.).

EGC performed an alternate evaluation using the DSO-04-08 methodology to extrapolate flood levels from the Army Corps of Engineers August 2003 report titled Upper Mississippi River System Flow Frequency Study. The evaluation predicted the flooding impact from a 1,000 year flooding event at DNPS. The extrapolation performed shows an estimated stage elevation of less than 513 ft for the 1,000 year flood. This demonstrated that there is greater than 4 feet of elevation difference between the DNPS site elevation of 517 ft and the estimated 1,000 year flood. EGC has a high degree of confidence that any flood that could approach the elevation of the plant site would have a recurrence interval of much longer than 1,000 years.