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10 CFR 50.4

W3F1-2022-0020

April 11, 2022

ATTN: Document Control Desk
U. S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Subject: Waterford Steam Electric Station
Review of Preliminary Accident Sequence Precursor Report

Waterford Steam Electric Station, Unit 3
NRC Docket No. 50-382
Renewed Facility Operating License No. NPF-38

Reference: NRC Letter, "Transmittal of Preliminary Waterford Steam Electric Station, Unit 3, Accident Sequence Precursor Report (Licensee Event Report 382-2021-001-00)" (ADAMS Accession No. ML22026A378), dated January 31, 2022

In the referenced document, the NRC submitted for Entergy Operations, Inc.'s (Entergy's) review and comment, the Preliminary Accident Sequence Precursor (ASP) Program analysis of Licensee Event Report 382-2021-001-00. Based on this review and discussions with the NRC research staff, additional information is provided in the Enclosure to aid in determining the best estimate of risk. The NRC's preliminary risk assessment was based on very conservative assumptions. Entergy requests that these key points be considered in the Final ASP analysis:

- Testing and Maintenance should not be a contributor in the ASP
- Credit should be given for long term Turbine Driven Emergency Feedwater Pump operation
- Credit should be given for FLEX N+1 Diesel Generator availability

A revised risk assessment with updated data for these scenarios will result in a lower risk significance below the Significant Accident Sequence Precursor threshold.

While Entergy understands the purpose and process used to conduct the ASP analysis, it is important to note that Entergy took extensive action to minimize the risk to the public from Waterford Unit 3 prior to, and during, Hurricane Ida. Prior to the hurricane, as required by plant procedures, actions were taken including enhanced onsite staffing with the ability to respond to any equipment damage that could have occurred and validation that safety equipment needed to respond to a possible Loss of Offsite Power (LOOP) was fully functional. As the hurricane approached, also as required by procedures, Entergy completed a safe reactor shutdown and

began a plant cooldown to cold shutdown conditions prior to the LOOP. Following the LOOP, both of the emergency diesel generators successfully started and ran loaded, supplying power to the plant's safety systems, for the fifty-three (53) hours until offsite power could be restored to the unit. During that time period, the station cooldown and depressurization continued, and the shutdown cooling systems functioned properly. In the very unlikely chance that both emergency diesel generators had failed, the equipment installed and stored, as required by procedures, to address Beyond Design Basic Events (FLEX equipment) was fully functional and available for use to ensure plant safety.

This letter contains no new regulatory commitments.

Should you have any questions concerning this issue, please contact John D. Lewis, Manager, Regulatory Assurance, at 504-739-6028.

Respectfully,

John Ferrick

JF/jkb

Enclosure: Entergy Comments on the Preliminary ASP Analysis of the Waterford Steam Electric Station, Unit 3 Loss of Offsite Power Due to Hurricane Ida

cc: NRC Region IV Regional Administrator
NRC Senior Resident Inspector – Waterford Steam Electric Station, Unit 3
NRC Project Manager – Waterford Steam Electric Station, Unit 3
Louisiana Department of Environmental Quality

Enclosure to

W3F1-2022-0020

Entergy Comments on the Preliminary ASP Analysis of the Waterford Steam Electric Station, Unit 3 Loss of Offsite Power Due to Hurricane Ida

Entergy Comments on the Preliminary ASP Analysis of the Waterford Steam Electric Station, Unit 3 Loss of Offsite Power Due to Hurricane Ida

The initial risk assessment that was performed by the NRC as part of the Accident Sequence Precursor (ASP) program identified that the Hurricane Ida event at Waterford meets the criteria to be considered a Significant Accident Sequence Precursor. The NRC's preliminary risk assessment was based on very conservative assumptions. The following are the key points that should be considered in this risk evaluation:

- Testing and Maintenance should not be a contributor in the ASP
- Credit should be given for long term Turbine Driven Emergency Feedwater Pump operation
- Credit should be given for FLEX N+1 Diesel Generator availability

A revised risk assessment with updated data for these scenarios will result in a lower risk significance below the Significant Accident Sequence Precursor threshold.

Modeling of Testing and Maintenance Activity

Entergy monitored the projected track of Hurricane Ida as it approached the Louisiana coast. The site took several actions preparing for the storm in accordance with Entergy fleet procedure EN-FAP-EP-010, Severe Weather Response*. The procedure contains a Waterford specific attachment with steps that prepares the station for various environmental events. The procedure directs the selection and briefing of on-site sequestered response teams using Table 3.1, Severe Weather Staffing. The staffing plan augments the normal shift complement with additional proficient Operators, Engineers, Electrical Technicians, Instrumentation Technicians, Mechanical Technicians and Construction personnel. Additional guidance outlines activation of the Corporate Emergency Center in Jackson, Mississippi for Category 2 hurricanes.

As Hurricane Ida tracked further north, Waterford entered Off-Normal Procedure OP-901-521, Severe Weather and Flooding*. Key pre-storm actions directed by this procedure include maximizing on-site condensate inventory, minimizing potential debris and missile hazards by removing or securing loose objects and verifying the availability of safety related equipment. Following the procedure, Operations personnel started both Emergency Diesel Generators (EDG) A and B to verify functionality and then secured. Following the Loss of Offsite Power (LOOP), all equipment, including both EDGs, started and operated properly for the fifty-three (53) hours before offsite power was restored. Additionally, Subsection E4 of this procedure directs operators to review Operations Procedure OP-100-010, Equipment Out of Service* and expedite the restoration of vital plant systems and components to service. Implicit to this requirement is that no vital plant system or component would be taken out of service. During Hurricane Ida, no scheduled or emergent maintenance activities or test procedures were in progress prior to the LOOP, and none occurred during the event. Waterford also uses the Protected Train concept outlined in EN-WM-101, On-Line Work Management Process*. This concept installs placards and barriers to restrict access to key safety related areas and components. The Protected Train includes all necessary attendant instrumentation, controls, normal and emergency power sources, cooling and seal water, lubrication and auxiliary equipment required for the train to perform its specified functions. Due to the site's prior knowledge of Hurricane Ida and extensive preparation efforts, there were no Test and Maintenance activities prior to or during the LOOP. Testing and Maintenance in general, and EDG related components specifically, should not be a contributor in the Final Accident Sequence Precursor.

Turbine Driven Emergency Feedwater Pump Operation

At Waterford, the Turbine Driven Emergency Feedwater (TDEFW) Pump can deliver 100% of the required Emergency Feedwater (EFW) flow. If direct current (DC) power from the AB DC bus is not available, Waterford's Emergency Operating Procedure OP-902-005, Station Blackout Recovery* contains steps for operating the TDEFW pump manually, using Appendix 36 of Standard Appendices, OP-902-009*. Diverse and Flexible Coping Strategies (FLEX) implementation guidance contains an attachment for these actions in FIG-001, Extended Loss of AC Power*. To aid in maintaining proper pump control, Operators use a strobe scope to observe pump speed while adjusting trip throttle valve position. The strobe scope is maintained calibrated, and fully charged in a staged location. The scope is verified weekly on rounds by an Auxiliary Operator during performance of OI-004-000, Operations Shift Logs*. Operators are trained on the procedure to control the pump manually with the throttle valve using indications provided by the strobe scope.

Downstream, EFW flow control valves are cross powered from A and B trains, respectively. FLEX Implementing Guideline, FIG-001, directs gagging closed the flow control valves not powered from the train selected for deep load shed. As seen on Figure 5 of the Emergency Feedwater System Description*, the dual flow path arrangement leaves one flow leg powered from the deep load shed train maintaining the Control Room Operators ability to control EFW flow to both Steam Generators. Attachment 2 of FIG-001 also lists instrumentation that will be available after deep load shed is complete. If a credited SG instrument fails, the procedure directs the staff to an attachment in FSG-007, Loss of Vital Instrumentation or Control Power*, that instrumentation and controls (I&C) technicians use to measure SG parameters from field terminals. The primary location for these field terminal readings is the Main Control Room and Switchgear Room, with redundant terminals available in the penetration areas. The measurements are done using alternative instrumentation (Fluke meters) that are available and maintained in FLEX specific storage boxes and verified operational on a periodic basis. Due to the specific procedural guidance for operating the TDEFW pump manually, the ability for Control Room Operators to control EFW Flow Control Valve position, the availability of alternate SG instrumentation after loss of DC, and Operator training on controlling the TDEFW Pump without DC power, the Final Accident Sequence Precursor should include credit for long term TDEFW Pump operation.

N+1 Diesel Availability

In accordance with the Waterford Technical Requirements Manual, the FLEX N+1 Diesel Generator, the N+1 FLEX Diesel Fuel Transfer Pump and N+1 FLEX Core Cooling Pump were available during Hurricane Ida. As demonstrated to the Waterford NRC Resident Inspectors the week of March 14, 2022, there was sufficient ability to allow for the connection and use of the N+1 FLEX equipment within the necessary twelve (12) hours from the LOOP. During the time of the event, there was sufficient staffing onsite to accomplish these tasks. During Hurricane Ida, the N+1 FLEX equipment was located on-site in the fully protected N+1 Building. When facing a projected Flooding Event, the N+1 Diesel is moved into the Nuclear Island. For rapid deployment of the N+1 Diesel Generator and the N+1 FLEX Diesel Fuel Transfer Pump, alternate placement locations are available on the east and west sides of the Reactor Auxiliary Building because it is not necessary to locate them on the Q-deck. Attachment 14 of FLEX Support Guideline FSG-005, Initial Assessment and FLEX Equipment Staging* provides an overhead view of Waterford's physical layout including preferred cable routing for either N or N+1 Diesel Generator deployment. Hurricane Ida was not projected to be a Flooding Event and at no time did Hurricane Ida develop into a Flooding Event. Due to the increased staffing, including

operators, engineers and maintenance technicians sequestered on site prior to Hurricane Ida and the availability of alternate N+1 Diesel Generator deployment locations, the Final Accident Sequence Precursor should include credit for N+1 Diesel Generator availability.

NRC SPAR Model considerations

The Waterford FLEX strategy relies on local manual control of the TDEFW pump speed when the Train AB DC voltage reaches 110V DC, likely to be between four (4) and six (6) hours after the LOOP. The deep load shed is performed on the either the A or B DC bus, specifically the train to which the FLEX N DG or the FLEX N+1 DG will be connected. Once the FLEX DG is operating supplying power to the selected 480V safety bus, one battery charger is restored to recharge both the Train A and B station batteries - one charger for the A battery and one charger for the B battery. The AB DC bus does not get reenergized and the TDEFW Pump is maintained in operation with manual speed control until it becomes more advantageous to utilize the FLEX Core Cooling Pump to feed the Steam Generators. However, if manual control is not possible after AB battery depletion, the FLEX Core Cooling Pump is aligned. Station Blackout Recovery and FLEX implementation procedures can be implemented, concurrently. Additionally, at Waterford, the FLEX N DG and the FLEX Core Cooling Pump are pre-staged at their deployed locations and can be available more than six (6) hours earlier than the typical twelve (12) hour FLEX assumption.

The FLEX N DG (or the FLEX N+1 DG) power the 480V Train A and AB or Train B and AB electrical buses. The selected buses then power the associated installed charging pumps. The FLEX Core Cooling Pump can also be powered from the selected buses via supply from charging pump A and AB or charging pump B and AB. The FLEX Core Cooling Pump can be aligned for either Steam Generator make up or Reactor Coolant System make up. It appears that the model has separate FLEX diesel driven pumps supplying SG and reactor coolant system makeup. To ensure greater accuracy, the model should reflect this equipment alignment.

Qualitative Insights

In addition to the redundant equipment operation and availability information, the boundary conditions of the event lend to additional qualitative insights. The LOOP occurred approximately eight (8) hours after the reactor was manually tripped in preparation for arrival of hurricane conditions onsite. During this time, the Auxiliary Feedwater Pump (powered by offsite power) was being used to remove decay heat using inventory from an alternate source not typically aligned for EFW during transient conditions. Eight (8) hours after reactor trip, the decay heat profile is much lower and more stable. By this time, the time required to restore feedwater flow to prevent core from being uncovered is over four (4) hours compared to just over one (1) hour for a LOOP coincident with the reactor trip. This allows for additional time to complete actions and utilize redundant equipment. Additionally, at this point, the decay heat profile made control of EFW flow and SG level more predictable and less subject to changes on shorter time frames.

Additional Supporting Documents

The additional documents listed below have been provided to the NRC to support earlier discussions on Entergy's perspective:

- Emergency Operating Procedure OP-902-000, Standard Post Trip Actions
- Waterford 3 FLEX Validation dated March 10, 2016
- FLEX Support Guideline FSG-002, Alternate EFW Suction Source
- FLEX Support Guideline FSG-003, Alternate Low-Pressure Feedwater

- FLEX Support Guideline FSG-004, ELAP DC Bus Load Shed and Management*
- FLEX Support Guideline FSG-009, Low Decay Heat Temperature Control*
- Station Blackout to Manual TDEFW Pump Operation Outline*
- FLEX N+1 Diesel Generator Maps*
- FLEX N+1 Diesel Generator Timeline (used in discussion with NRC Resident Inspectors)*

Conclusion

Based on the information provided above and Entergy's PRA model of Waterford, Entergy has determined internally that the Final Accident Sequence Precursor value will be less than 1×10^{-3}. Entergy appreciates the opportunity to review the referenced document and concurs with the NRC's desire that the Final Accident Sequence Precursor accurately portray the impact of Hurricane IDA on Waterford Steam Electric Station, Unit 3.

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* These documents have been provided to the NRC as separate files using the NRC Box.