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**Michael R. Chisum**  
Site Vice President  
Waterford 3

10 CFR 21.21

W3F1-2014-0026

April 11, 2014

U.S. Nuclear Regulatory Commission  
Attn: Document Control Desk  
11555 Rockville Pike  
Rockville, MD 20852

Subject: Part 21 Report of Time-Delay Relays Spurious Actuation  
Waterford Steam Electric Station, Unit 3 (Waterford 3)  
Docket No. 50-382  
License No. NPF-38

Dear Sir or Madam:

Pursuant to 10 CFR 21.21(d)(3)(ii), Entergy is providing the Waterford Steam Electric Station, Unit 3 (Waterford 3) required written notification of the identification of a defect associated with spurious actuation of time-delay relays. This information was initially reported to the NRC Operations Center on March 13, 2014.

The attachment to this letter provides the information required by 10 CFR 21.21, including details associated with spurious actuation of certain time-delay relays at Waterford 3.

This report contains no new commitments. Please contact John P. Jarrell, Regulatory Assurance Manager, at (504) 739-6685 if you have questions regarding this information.

Sincerely,

A handwritten signature in black ink, appearing to read "MR Chisum".

MRC/JDW

Attachment: Waterford 3 Part 21 Report of Allen Bradley 700RTC Relays

cc: Mr. Marc L. Dapas, Regional Administrator  
U.S. NRC, Region IV  
RidsRgn4MailCenter@nrc.gov

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**Attachment to**

**W3F1-2014-0026**

**Waterford 3 Part 21 Report of Allen Bradley 700RTC Relays**

### Waterford 3 Part 21 Report of Allen Bradley 700RTC Relays

This written notification information follows the format of and addresses the considerations contained in 10CFR21.21(d)(4)(i)-(ix).

I. Name and Address

Michael R. Chisum  
17265 River Road  
Killona, LA 70057

II. Facility, Activity or Component

The basic component is an electrical relay. Allen Bradley 700RTC relays installed at Waterford Steam Electric Station, Unit 3 (Waterford 3) susceptible to the deviation are used in monitoring undervoltage conditions for the 3A3, 3B3, 3A31, and 3B31 safety related electrical buses, as well as other applications, such as time delay relays for starting Engineered Safety Features Actuation Signal (ESFAS) equipment.

III. Constructor or Supplier

The basic component containing a defect was provided by QualTech NP as the qualifying vendor of the Allen Bradley manufactured 700RTC relays. QualTech NP has been notified of the 10CFR Part 21 notification and provided failure analysis documentation.

IV. Defect and Safety Hazard

Nature of the defect:

Waterford 3 has experienced spurious actuations of Engineered Safety Features Actuation Signal (ESFAS) equipment. The direct cause of the reported spurious actuations of ESFAS equipment that have occurred at the site was determine to be the Allen Bradley 700RTC relays associated with each ESFAS circuit spuriously de-energizing. The spurious de-energization of the associated relays caused the ESFAS equipment to perform its required safety function.

Independent failure analysis performed by Southwest Research Institute (SwRI) and National Technical Services (NTS) have found Allen Bradley model 700RTC00110U1 relays that have failed in service at Waterford 3 contain inadequate solder joints and degraded C25 capacitors. The C25 capacitors when tested did not meet the manufacturer's specifications for capacitance and effective series resistance. SwRI reported that installation of the C25 capacitor at the factory may have contributed to failure of the capacitor, specifically the way in which the capacitor leads had been bent to fit the much wider spacing of the holes in the coil-control circuit board on which the capacitor is installed. SwRI and NTS were not able to repeat the failure mode experienced at Waterford 3 of Allen Bradley relays de-energizing intermittently while control power is maintained on the relay coil through laboratory testing. Inadequate solder joints and the failed C25 capacitors were found during destructive failure analysis

after initial relay testing had been performed. Disassembly of an Allen Bradley 700RTC00020U1 that had failed in service by Waterford 3 personnel indicated inadequate solder joints and a failed C25 capacitor subsequent to SwRI and NTS failure analysis being received.

Safety hazard which could have been created:

Four Allen Bradley 700RTC relays susceptible to the deviation are used in monitoring undervoltage conditions for the 3A3, 3B3, 3A31, and 3B31 safety related electrical buses. If an undervoltage condition occurs concurrent with a Loss of Offsite Power or concurrent with a Safety Injection Actuation Signal while the Emergency Diesel Generator Load Sequencer is between the S3 and S8 load blocks (192 seconds), then these relays will initiate a sequencer lock out and the white "Lock Out" light for the sequencer will be lit. Under this scenario, the Emergency Diesel Generator will automatically start and come up to rated voltage within 10 seconds. Once the sequencer detects the bus is at full rated voltage after a Loss of Offsite Power, it will begin to sequence on loads. During the loading sequence, if the observed failure mode occurs between the S3 and S8 load block, then the lockout feature will be active. All loads previously sequenced on, prior to the lockout, will remain running. At the point of the spurious actuation of the relay, no further automatic loading will occur until the sequencer is reset manually. The most limiting failure of an Allen Bradley relay at Waterford 3 occurred at three years of service, the under voltage relays listed above have been installed for under three years (currently 2.9 years). These relays installed in the 3A3, 3B3, 3A31, and 3B31 safety related electrical buses could be susceptible to this condition had they been installed for greater than three years. In this instance, the relays could prevent safety functions from being accomplished due to Engineering Safety Features equipment not receiving power in the time sequence assumed by the safety analysis.

V. Date

On 3/12/2014, Engineering evaluation determined the Deviation could create a Substantial Safety Hazard, as defined in 10CFR21, and provided the Site Vice President (responsible officer) information of the Defect the same day. NRC Headquarters Operations Center was notified by telephone on 3/13/2014 (Ref. EN#49911).

VI. Location and Number of Defective Components

Thirty three (33) Allen Bradley 700RTC relays are installed at Waterford 3. These applications are used in monitoring undervoltage conditions for the 3A3, 3B3, 3A31, and 3B31 safety related electrical buses, as well as other applications, such as time delay relays for starting Engineered Safety Features Actuation Signal (ESFAS) equipment.

Waterford 3 has determined that the other Entergy nuclear operated facilities utilizing these Allen Bradley relay types, possibly in a safety related application, is at James A. Fitzpatrick and Cooper Nuclear Station, at which this condition has been made known and entered into their Corrective Action Program.

VII. Corrective Action

Nine of the Allen Bradley 700RTC relays have been replaced by Entergy's Electrical Maintenance organization at Waterford 3 as of 4/9/2014.

The four Allen Bradley 700RTC relays used in monitoring undervoltage conditions for the 3A3, 3B3, 3A31, and 3B31 safety related electrical buses are to be replaced by Entergy's Electrical Maintenance organization at Waterford 3, due prior to ascending to Mode 4 (Hot Shutdown) at the conclusion of Refueling Outage 19. Refueling Outage 19 is scheduled to start April 13, 2014.

Reduce the relay replacement preventative maintenance tasks frequency from eighteen years to three years for the twenty nine Allen Bradley 700RTC relays. The remaining four perform alarm only functions and will not have replacement frequency revised. This action is to be performed by Entergy's Engineering organization at Waterford 3 and is due by 4/26/2014.

Perform an Engineering Study to determine possible solution to resolve Allen Bradley 700RTC relay failures that have occurred at Waterford 3. Issue additional actions to implement the results of the engineering study to resolve Allen Bradley 700RTC relay failures at Waterford 3. This action is to be performed by Entergy's Engineering organization at Waterford 3 and is due by 8/29/2014

VIII. Advice

Failure analysis indicated internal heat degradation of the relays' sub-components. Operating the relays at 12% overvoltage and 120°F ambient temperature is causing the Allen Bradley 700RTC relays installed in Auxiliary Relay Cabinets to degrade faster than expected. The effect of both higher operating voltage and temperature together should be evaluated in aggregate.

IX. Early Site Permit

This is not an early site permit concern.