

Tennessee Valley Authority, Post Office Box 2000, Spring City, Tennessee 37381

August 19, 2016

10 CFR 50.73

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

> Watts Bar Nuclear Plant, Unit 2 Facility Operating License No. NPF-96 NRC Docket No. 50-391

Subject: Licensee Event Report 391/2016-005-00, Main Feedwater Pump Trip on Loss of Condenser Vacuum Leads to Turbine Trip and Reactor Trip

This submittal provides Licensee Event Report (LER) 391/2016-005-00. This LER provides details concerning a recent event where the operating main feedwater pump turbine lost condenser vacuum, resulting in a turbine trip and subsequent reactor trip. This report is being submitted in accordance with 10 CFR 50.73(a)(2)(iv)(A).

Please direct any questions concerning this matter to Gordon Arent, WBN Licensing Director, at (423) 365-2004.

Respectfully,

Paul Simmons Site Vice President Watts Bar Nuclear Plant

Enclosure cc: See Page 2 U.S. Nuclear Regulatory Commission Page 2 August 19, 2016

cc (Enclosure):

NRC Regional Administrator - Region II NRC Senior Resident Inspector - Watts Bar Nuclear Plant

| NRC F(| ORM 36 | 6 | U.S. NUC | LEAR REG | ULATO | DRY CON | MISSIO | N APPR | ovi | ED BY OMB: NO. | 3150-0104 | | l | EXPIRES | : 10/31/20 |)18 |
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| (11-2013) | A LOCKER REGUL | LICE | ENSEE EV | ENT RE | EPOI | RT (LE | ER) | Estimate Reporte Send c Branch internet Regulate DC 205 OMB co respond | ed b omm (T-5 e-m ory / 03. 1 ontro 1 to, 1 | burden per response ssons learned are inc nents regarding burde 5 F53), U.S. Nuclear nail to Infocollects. Reso Affairs, NEOB-10202, If a means used to im ol number, the NRC n the information collection | to comply with orporated into an estimate to Regulatory Cc urce@nrc.gov, (3150-0104), C pose an inform hay not condu- on. | h this ma the licens the FOIA ommission and to the Office of N nation colle ct or spor | andatory co sing process A, Privacy a A, Washingto e Desk Offici Management ection does nsor, and a | lection red and fed and Inform on, DC 20 er, Office o and Budg not display person is | uest: 80 ho pack to indu: ation Collect 555-0001, or f Information let, Washing a currently v not required | urs. stry. ions by and iton, valid d to |
| 1. FAC | LITY N | AME | | | | | | 2. DC | DCI | KET NUMBER | | 3. PAG | GE | | | |
| Wat | Watts Bar Nuclear Plant, Unit 2 | | | | | | | 050 | 05000391 1 OF 6 | | | | | | | |
| 4. TITL Mair | e n Feed | water Pi | ımp Trip on | Loss of C | onde | nser Va | icuum L | _eads to | ъΤ | urbine Trip a | nd Reac | tor Tri | ip | | | |
| 5 6 | | | 6 FF | NUMBER | | 75 | REPORT | | | | | | | | | |
| MONTH | DAY | YEAR | YEAR SI | | REV | молтн | DAY | YEAR | | FACILITY NAME | N/A | | | | KET NUMBE | R |
| 06 | 20 | 2016 | 2016 - 0 | 05 - | 00 | 08 | 19 | 2016 | ; | FACILITY NAME | N/A | | | DOC N/A | KET NUMBE | R |
| 9. OPF | RATING | | 11. THIS | REPORT | SUB | | <u> </u> PURŜUA | | -1E | REQUIREMEN' | TS OF 10 0 | CFR &: | (Check | all that | apply) | |
| | | | | (h) | T | | 203(a)(3 | ara | | 50 73(a) |)(2)(ii)(A) | 1 | 50 | 73(a)(2 | | |
| | | | 20.2201(d) | | | 203(a)(3 |)(ii) | | | | | | 73(a)(| | | |
| | 1 | | 20.220 | 2203(a)(1) 20.2203 | | | 2203(a)(4 | -) -) | 50.73(a)(2)(ii) | | | + | 50.73(a)(2)(ix)(A) | | | |
| | | | 20.2203 | 20.2203(a)(2)(i) | | | 50.36(c)(1)(i)(A) | | | 50,73(a)(2)(iv)(A) | | | 50,73(a)(2)(x) | | | |
| 10. PO | WER LE | EVEL | 20.2203 | (a)(2)(ii) | 50.36(c)(1)(ii)(/ | | |)(A) | | 50.73(a)(2)(v)(A) | | | 73.71(a)(4) | | | |
| | | | 20.2203(a)(2)(iii) | | | 50.36(c)(2) | | · · · · · | 50.73(a)(2)(v)(B) | | | 73.71(a)(5) | | | | |
| | | | 20.2203(a)(2)(iv) | | | 50.46(a)(3)(ii) | | i) | 50.73(a)(2)(v)(C) | | | | 73.77(a)(1) | | | |
| | 32 | | 20.2203(a)(2)(v) | | | 50.73(a)(2)(i)(A) | |)(A) | | 🔲 50.73(a |)(2)(v)(D) | | 73 | .77(a)(2 | ?)(i) | |
| | | | 20.2203 | (a)(2)(vi) | 50.73(a)(2)(i) | | |)(B) | 50.73(a)(2)(vii) | | | | 73 | .77(a)(2 | ?)(ii) | |
| | | | | | | 50.7 | 73(a)(2)(i) |)(C) | | | Specify i | n Abstrac | t below or i | NRC Fo | m 366A | |
| | CONTAC | г | | | 12. L | ICENSEE | CONTA | CT FOR | TH | IIS LER | TTE | LEPHON | | (Include | Area Code) | |
| Dea | n Bake | er, Licen: | sing Engine | ər | | | | | | | | | 423-4 | 52-45 | 39 | |
| | | | 13. COMPLE | E ONE LIN | E FOR | EACH C | OMPON | ENT FAII | JUF | | IN THIS F | REPOR | RT | | | |
| CAUS | E | SYSTEM | COMPONEN | FACTU | J- RER | REPORTA TO EPI | BLE X | CAUSE | | SYSTEM | COMPONE | INT | MANU- FACTURE | R | TO EPIX | _E |
| | | | | | | | | | | | | | | | | |
| 14. SUP | | | PORT EXPEC | | | | | | | 15. EXF SUB | PECTED MISSION | | MONTH | DAY | YEAI | २ |
| | | es, comple | | | 531010 | DATE) | | | | | DATE | | | | | |
| On J resul withi Gene relat | lune 20 Iting in n the c erator ively c | nt to 1400 sµ D, 2016, a loss o capacity Water Le old AFW | the 2B Mair f normal fee of Auxiliary evel (SGWL following th | Feedwat d, and the eedwate Lo Lo in e trip. | er Pu e subs r (AF) Stear | mp (MF sequent W), the n Gene | ritten lines P) tripp trip of reactor rator N | bed on a the mai tripped o.4. SG | a lo n t l at i w | oss of vacuur turbine. While t 1540 Easter ater level low | n in the 2 operato n Daylig vered rap | 2B MF ors we ht Tin oidly d | ⁻ P turbi ere redu ne (ED lue to s | ine co icing p T) on 1 hrink 1 | ndense ower to Steam rom the | r,)) |
| All co unco | ontrol a omplica | and shut ated. | down rods f | ully insert | ed. Al | I safety | system | ns respo | ono | ded as desigr | ned. The | trip re | espons | e was | | |
| The resu | trip wa Ited in | is cause a loss of | d by a huma f vacuum or | n perform the 2B M | nance IFP tu | error di rbine. | uring th | e drain | dc | own of the 2A | MFP tu | rbine | conder | iser w | nich | |
| | | | | | | | | | | | | | | | | |

| NRC FORM 366A | U.S. NUCLEAR REGULA | TORY COMMISSION | APPROVED BY OMB: NO. 315 | 0-0104 | EXPIRE | S: 10/31/2018 |
|---|--|---|---|---|--|---|
| | ISEE EVENT RE CONTINUATION | PORT (LER) SHEET | Estimated burden per response to complessons learned are incorporated into comments regarding burden estimate the F53), U.S. Nuclear Regulatory Commis Infocollects Resource@nrc.gov, and to NEOB-10202, (3150-0104), Office of Ma used to impose an information collection NRC may not conduct or sponsor, are collection. | bly with this min the licensinn the FOIA, P ssion, Washin, the Desk Offici anagement and n does not dis d a person i | andatory collection request: 6 g process and fed back to rivacy and Information Colle- gton, DC 20555-0001, or by er, Office of Information and d Budget, Washington, DC 2 play a currently valid OMB of s not required to respond to | 30 hours. Reported to industry. Send ctions Branch (T-5 r internet e-mail to Regulatory Affairs, 20503. If a means control number, the to, the information |
| 1. FACILITY NAME | | 2. DOC | | | 3. LER NUMBER | 2 |
| Watte Bar Nuclear Pla | nt Unit 2 | 05000391 | | YEAR | SEQUENTIAL NUMBER | REV NO. |
| Walls bai Nuclear Fla | | 00000001 | | | - 005 | - 00 |
| NARRATIVE | | • | · · · · · · · · · · · · · · · · · · · | | | |
| I. PLANT OP | ERATING CONDITIC | ONS BEFORE THE | EVENT | | | |
| Watts Bar N | luclear Plant (WBN) | Unit 2 was in Mode | e 1 at 32 percent Rated | Therma | I Power (RTP) . | |
| II. DESCRIPT | ION OF EVENT | | | | | |
| A. Eve | ent | | | | | i |
| On the trip Fee Ge due All res B. Ino No C. Dat | June 20, 2016, the 2 2B MFP turbine con of the main turbine. edwater (AFW) {EIIS: nerator Water Level (to shrink from the re- control and shutdown ponse was uncompli- perable Structures, C inoperable systems tes and Approximate Time (EDT) | B Main Feedwater denser, resulting ir While operators we BA}, the reactor to (SGWL) Lo Lo in S elatively cold AFW n rods fully inserted cated. Components, or Sy contributed to the e Times of Occurrer | Pump (MFP) {EIIS:P} to a loss of normal feed { ere reducing power to w ripped at 1540 Eastern I team Generator No.4. S following the trip. d. All safety systems res stems that Contributed t event. | ripped o EIIS:SJ} ithin the Daylight G water ponded | n a loss of vacuu , and the subsec capacity of Auxi Time (EDT) on S level lowered ra as designed. Th vent | um in quent liary Steam apidly e trip |
| Date 6/20/1 | <u> </u> | vent uxiliary Unit Opera | itors (ALIOs) dispatched | to drain | the 2A MFP | |
| 6/20/1 | 6 1510 A a | urbine condenser UOs begin drainin acuum Lo. AUOs larm. Based on th | (MFPTC) in preparation g the 2A MFPTC. Alarn directed to stop draining e expectation to receive | for start n receive the cor the alar | up. ed for MFPTC ndenser due to m, permission to |) |
| 6/20/1 | c 6 1520 A Ir Ir V V V V V | ontinue draining wa UOs begin drainin Instrumentation and Integrated Compute Iain Control Room acuum to swap to acuum. AUOs dire eplacement comple ecorder was restor | as authorized. g 2A MFPTC for second l Control (I&C) personne r System (ICS) Data Lin (MCR) board recorder u its post-accident parametected by MCR to stop dr eted. Once the card rep ed to its normal parameted | I time. C el comm ik Card. used to t eter and aining 2. lacemer ter moni | Concurrently, enced work on a This resulted in rend MFPTC off of the MFPTC A MFPTC until c nt was complete, toring state. | n the C ard the |
| 6/20/1 | 6 1537 B | ased on MCR dire | ction, AUOs attempt to a drain valve. 2B MFP to | drain 2A Irbine tri | MFPTC for third | 1 |
| 6/20/1 | 6 1540 B th s fl S th | ased on the lower he fact that the Trip tarted, operators to ow to the No. 1 ar GWLs were still lo he SGs. SGWLs st | flows in Steam Generat Time Delays (TTDs) fo ook manual control of AF od 4 SGs so that all 4 flo wering slowly based on opped dropping and sta | ors (SG r those s W flow ws were the shrift rted to the | s) No.2 and 3 ar same S/Gs were and reduced the balanced. All hk of the water ir urn. Around this | nd |

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| | | | | | Pag | je 3 of 6 | | | | |
|----------------------------|--|---|---|--|--|---------------------------------------|--|--|--|--|
| NRC FORM 366A (11-2015) | U.S. NUCLEAR REGULATORY COMMISSION APPROVED BY OMB: NO. 3150-0104 EXPIRES: 1 Estimated burden per response to comply with this mandatory collection request: 80 hou lessons learned are incorporated into the licensing process and fed back to indi- comments regarding burden estimate to the FOIA, Privacy and Information Collections F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by inter Infocollects.Resource@ncc.gov, and to the Desk Officer, Office of Information and Regu NEOB-10202, (3150-0104), Office of Management and Budget, Washington, DC 2050- NRC may not conduct or sponsor, and a person is not required to respond to, the collection. | | | | | | | | | |
| 1. FACILITY NAME | | 2. DOC | KET NUMBER | | 3. LER NUMBER | २ | | | | |
| Watts Bar Nucl | ear Plant, Unit 2 | 05000391 | | year 2016 | SEQUENTIAL NUMBER - 005 | REV NO. - 00 | | | | |
| NARRATIVE | | | | | | | | | | |
| | Date Time (EDT) Eve tim cap The | ent le, rods had been pabilities of the A e reactor tripped | i inserted enough that po FW system. automatically on No. 4 S | ower wa | s nearing the I Lo-Lo. | | | | | |
| | D. Manufacturer and Model I | Number of Comp | onents that Failed | | | | | | | |
| | i nere were no equipment | t failures associat | ied with this event . | | | | | | | |
| | E. Other Systems or Second | ary Functions Af | fected | | | | | | | |
| | No other safety systems v | No other safety systems were affected by this event. | | | | | | | | |
| | There were no failed com | There were no failed components, systems or procedural errors associated with this event | | | | | | | | |
| | Failure Mode and Effect of Each Failed Component | | | | | | | | | |
| | No component failures we | re associated with this event | | | | | | | | |
| | H. Operator Actions | | | | | | | | | |
| | Following the loss of the 2 levels could be maintaine unsuccessful, and a react uncomplicated. | 2B MFP, operation d within acceptation tor trip occurred. | ons personnel attempted ble levels using the AFW The subsequent recove | to reduce system ery and r | ce power such th They were esponse to the t | nat SG rip were | | | | |
| | I. Automatically and Manua | lly Initiated Safet | y System Responses | | | | | | | |
| | All safety systems operate | ed as expected. | | | | | | | | |
| III. CAL | ISE OF THE EVENT | | | | | | | | | |
| | A. The cause of each compo | onent or system f | ailure or personnel error | , if know | /n. | | | | | |
| | This event was not the rea | sult of a compone | ent or system failure. | | | | | | | |
| | B. The cause(s) and circums | stances for each | human performance rela | ated root | t cause. | | | | | |
| | Operations staff did not re that lowering the 2A MFP 2B MFPT condenser. Ad TTDs for steam generator tripped the reactor prior to | ecognize that, bas T condenser belo ditionally, when t r level were alrea o reaching an aut | sed on the system align ow a certain point would aking manual control of dy actuated, and operat omatic trip. | ment pre cause a steam g ors shou | esent shown in F I loss of vacuum enerator water lo Ild have manual | igure 1, on the evel, the ly | | | | |

| | | | | | | Pa | ge 4 of 6 | | | |
|---------------------------------|---|---|---|--|---|---|--|--|--|--|
| NRC FOR | M 366A | U.S. NUCLEAR REGULAT | ORY COMMISSION | APPROVED BY OMB: NO. 31 | 50-0104 | EXPIRE | ES: 10/31/2018 | | | |
| (11-2015) | | CENSEE EVENT REP CONTINUATION S | ORT (LER) HEET | Estimated burden per response to com lessons learned are incorporated intr comments regarding burden estimate the F53), U.S. Nuclear Regulatory Commin Infocollects.Resource@nrc.gov, and to NEOB-10202, (3150-0104), Office of M used to impose an information collection NRC may not conduct or sponsor, a collection. | ply with this m o the licensin o the FOIA, F ssion, Washin the Desk Offic anagement an on does not dia nd a person | andatory collection request: g process and fed back to rivacy and Information Colle gton, DC 20555-0001, or b zer, Office of Information and d Budget, Washington, DC splay a currently valid OMB is not required to respond | 80 hours. Reported to industry. Send ections Branch (T-5 y internet e-mail to d Regulatory Affairs, 20503. If a means control number, the to, the information | | | |
| 1. FACILIT | YNAME | | 2. DOC | | | 3. LER NUMBE | R | | | |
| Watts Bar Nuclear Plant, Unit 2 | | | 05000391 | | YEAR 2016 | SEQUENTIAL NUMBER | REV NO. - 00 | | | |
| NARRATIV | /E | | | | | I | | | | |
| IV. | ANALY | YSIS OF THE EVENT | | | | | | | | |
| | The MFPT Condensers for the 2A and 2B MFPs share a common MFPT Condenser Drain Tank. When AUOs drained the 2A MFPT Condenser completely, an air in leakage path was created from the turbine steam seals on the 2A MFPT (steam seals were out of service) through the 2A MFPT Condenser to the MFPT Condenser Drain Tank to the 2B MFPT condenser (see Figure 1). This resulted in a loss of vacuum on the 2B MFPT Condenser and a trip of the 2B MFPT. | | | | | | | | | |
| | Loss o system | f the 2B MFP led to a main n could maintain SG level, b | turbine trip. Ope out were unsucce | erations attempted to rec essful. | duce pov | wer such that the | e AFW | | | |
| V. | ASSE | ASSESSMENT OF SAFETY CONSEQUENCES | | | | | | | | |
| | The los SG. A expect | The loss of the 2B MFP led to a turbine trip, and subsequent reactor trip on Lo-Lo SG level in the No. 4 SG. At the time of the reactor trip, SG levels were already recovering. All safety systems operated as expected during this event. | | | | | | | | |
| | Α. | Availability of systems or components and systems | components that that failed during | could have performed t g the event | he same | e function as the | | | | |
| | | No safety systems failed | during this event. | | | | | | | |
| | Β. | For events that occurred when the reactor was shut down, availability of systems or components needed to shutdown the reactor and maintain safe shutdown conditions, remove residual heat, control the release of radioactive material, or mitigate the consequences of an accident | | | | | | | | |
| | | Not applicable. | | | | | | | | |
| | C . | For failure that rendered a from the discovery of the | a train of a safety failure until the tr | system inoperable, an ain was returned to serv | estimate vice | e of the elapsed t | time | | | |
| | | Not applicable. | | | | | | | | |
| VI. | CORR | CORRECTIVE ACTIONS | | | | | | | | |
| | This ev tracked | vent was entered into the T d under condition reports (C | ennessee Valley CRs) 1183877 an | Authority (TVA) Correct d 1186630. | tive Actio | on Program and | is being | | | |
| | Α. | Immediate Corrective Act | ions | | | | | | | |
| | | The trip was reviewed and coaching provided. | d the human perf | ormance issues that led | l to this e | event were ident | tified and | | | |

B. Corrective Actions to Prevent Recurrence

The event is considered a performance issue for operations to precisely control the plant. Additional training in response to this event will be performed.

| | | | | | | Pag | je 5 of 6 |
|---|--------|------------------------------------|---------------------|---|---|---|--|
| NRC FORM (11-2015) | 366A | U.S. NUCLEAR REGULAT | ORY COMMISSION | APPROVED BY OMB: NO. 31 | 50-0104 | EXPIRE | S: 10/31/2018 |
| A CONTRACT OF A | LIC | CENSEE EVENT REP CONTINUATION S | ORT (LER) HEET | Estimated burden per response to complessons learned are incorporated into comments regarding burden estimate to F53), U.S. Nuclear Regulatory Commis Infocollects. Resource@nrc.gov, and to NEOB-10202, (3150-0104), Office of Maused to impose an information collection NRC may not conduct or sponsor, ar collection. | bly with this m the licensin the FOIA, P ssion, Washin the Desk Offic anagement and n does not dis nd a person i | andatory collection request: 1 g process and fed back t rivacy and Information Colle gton, DC 20555-0001, or by cer, Office of Information and d Budget, Washington, DC 2 splay a currently valid OMB of s not required to respond | 30 hours. Reported b industry. Send ctions Branch (T-5 r internet e-mail to Regulatory Affairs, 20503. If a means control number, the to, the information |
| 1. FACILITY | NAME | | 2. DOC | | | 3. LER NUMBER | ł |
| Watts Bar | Nuclea | r Plant, Unit 2 | 05000391 | | YEAR | SEQUENTIAL NUMBER | REV NO. |
| | | | | | 2016 | - 005 | - 00 |
| VII. | ADDITI | ONAL INFORMATION | | | | | |
| | Α. | Previous similar events at | the same plant | | | | |
| | | No similar events have be | en identified at th | ne Watts Bar plant . | | | |
| | В. | Additional Information | | | | | |
| | | None. | | | | | |
| | С. | Safety System Functional | Failure Consider | ration | | | |
| | | This condition did not resu | ult in a safety sys | tem functional failure. | | | |
| | D. | Scrams with Complication | s Consideration | | | | |
| | | This reactor trip was deter | rmined to be unco | omplicated. | | | |
| VIII. | COMM | ITMENTS | | | | | |
| | None. | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
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