Dominion Nuclear Connecticut, Inc.
Rope Ferry Rd., Waterford, CT 06385
Mailing Address: P.O. Box 128
Waterford, CT 06385
dom.com

Dominion®

JUL 24 2014

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555

| | |
|---|---|
| Serial No. | 14-349 |
| MPS Lic/GJC | R0 |
| Docket Nos. | 50-336 |
| | 50-423 |
| License Nos. | DPR-65 |
| | NPF-49 |

**DOMINION NUCLEAR CONNECTICUT, INC.**
**MILLSTONE POWER STATION UNITS 2 AND 3**
**LICENSEE EVENT REPORT 2014-006-00**
**MILLSTONE POWER STATION DUAL UNIT**
**REACTOR TRIP ON LOSS OF OFFSITE POWER**

This letter forwards Licensee Event Report (LER) 2014-006-00 documenting an event at Millstone Power Station Units 2 and 3 on May 25, 2014. This LER is being submitted pursuant to 10 CFR 50.73(a)(2)(iv)(A).

If you have any questions or require additional information, please contact Mr. William D. Bartron at (860) 444-4301.

Sincerely,

W. Matthew Adams
Plant Manager – Millstone

Attachments: 1

Commitments made in this letter: None

IE22
NRR

cc: U.S. Nuclear Regulatory Commission
Region I
2100 Renaissance Blvd, Suite 100
King of Prussia, PA 19406-2713

M. C. Thadani
NRC Senior Project Manager Millstone Units 2 and 3
U. S. Nuclear Regulatory Commission
One White Flint North
Mail Stop O8 B-1
11555 Rockville Pike
Rockville, MD 20852-2738

NRC Senior Resident Inspector
Millstone Power Station

Serial No. 14-349
Docket No. 50-336
50-423
Licensee Event Report 2014-006-00

**ATTACHMENT**

**LICENSEE EVENT REPORT 2014-006-00**
**MILLSTONE POWER STATION DUAL UNIT**
**REACTOR TRIP ON LOSS OF OFFSITE POWER**

**MILLSTONE POWER STATION UNITS 2 AND 3**
**DOMINION NUCLEAR CONNECTICUT, INC.**

NRC FORM 366 (02-2014) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB: NO. 3150-0104 EXPIRES: 01/31/2017

Estimated burden per response to comply with this mandatory collection request: 80 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the FOIA, Privacy and Information Collections Branch (T-5 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to Infocollects.Resource@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

# LICENSEE EVENT REPORT (LER)

(See Page 2 for required number of digits/characters for each block)

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| Millstone Power Station Unit 2 | 05000336 | 1 OF 7 |

**4. TITLE**

Millstone Power Station Dual Unit Reactor Trip on Loss of Offsite Power

| 5. EVENT DATE | | | 6. LER NUMBER | | | 7. REPORT DATE | | | 8. OTHER FACILITIES INVOLVED | |
|---|---|---|---|---|---|---|---|---|---|---|
| MONTH | DAY | YEAR | YEAR | SEQUENTIAL NUMBER | REV NO. | MONTH | DAY | YEAR | FACILITY NAME | DOCKET NUMBER |
| | | | | | | | | | Millstone Power Station Unit 3 | 05000423 |
| 05 | 25 | 2014 | 2014 | - 006 - | 00 | 07 | 24 | 2014 | FACILITY NAME | DOCKET NUMBER |
| | | | | | | | | | | 05000 |

| 9. OPERATING MODE | 11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: *(Check all that apply)* | | | |
|---|---|---|---|---|
| 1 | ☐ 20.2201(b) | ☐ 20.2203(a)(3)(i) | ☐ 50.73(a)(2)(i)(C) | ☐ 50.73(a)(2)(vii) |
| | ☐ 20.2201(d) | ☐ 20.2203(a)(3)(ii) | ☐ 50.73(a)(2)(ii)(A) | ☐ 50.73(a)(2)(viii)(A) |
| | ☐ 20.2203(a)(1) | ☐ 20.2203(a)(4) | ☐ 50.73(a)(2)(ii)(B) | ☐ 50.73(a)(2)(viii)(B) |
| | ☐ 20.2203(a)(2)(i) | ☐ 50.36(c)(1)(i)(A) | ☐ 50.73(a)(2)(iii) | ☐ 50.73(a)(2)(ix)(A) |
| **10. POWER LEVEL** | ☐ 20.2203(a)(2)(ii) | ☐ 50.36(c)(1)(ii)(A) | ☒ 50.73(a)(2)(iv)(A) | ☐ 50.73(a)(2)(x) |
| | ☐ 20.2203(a)(2)(iii) | ☐ 50.36(c)(2) | ☐ 50.73(a)(2)(v)(A) | ☐ 73.71(a)(4) |
| 100 | ☐ 20.2203(a)(2)(iv) | ☐ 50.46(a)(3)(ii) | ☐ 50.73(a)(2)(v)(B) | ☐ 73.71(a)(5) |
| | ☐ 20.2203(a)(2)(v) | ☐ 50.73(a)(2)(i)(A) | ☐ 50.73(a)(2)(v)(C) | ☐ OTHER |
| | ☐ 20.2203(a)(2)(vi) | ☐ 50.73(a)(2)(i)(B) | ☐ 50.73(a)(2)(v)(D) | Specify in Abstract below or in NRC Form 366A |

**12. LICENSEE CONTACT FOR THIS LER**

| LICENSEE CONTACT | TELEPHONE NUMBER *(Include Area Code)* |
|---|---|
| William D. Bartron, Supervisor Nuclear Station Licensing | (860) 444-4301 |

**13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT**

| CAUSE | SYSTEM | COMPONENT | MANU-FACTURER | REPORTABLE TO EPIX | CAUSE | SYSTEM | COMPONENT | MANU-FACTURER | REPORTABLE TO EPIX |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |

| 14. SUPPLEMENTAL REPORT EXPECTED | 15. EXPECTED SUBMISSION DATE | MONTH | DAY | YEAR |
|---|---|---|---|---|
| ☐ YES *(If yes, complete 15. EXPECTED SUBMISSION DATE)* ☒ NO | | | | |


ABSTRACT *(Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)*

On May 25, 2014, with Millstone Power Station (MPS) Unit 2 and 3 (MPS2 and MPS3) in operating MODE 1, operating at 100% reactor power, a total loss of offsite power occurred in the MPS switchyard. Both MPS2 and MPS3 experienced a turbine trip on power to load imbalance followed by an automatic reactor trip. Both units' safety related emergency diesel generators (EDGs) automatically started and supplied power to their respective safety busses. As designed, the motor driven auxiliary feedwater (AFW) pumps automatically started on MPS2 and all AFW pumps automatically started on MPS3.

MPS declared an Unusual Event (UE) following the reactor trips and the NRC was notified (EN50142 for MPS2 and EN 50141 for MPS3). Following stabilization of both MPS2 and MPS3, the UE was terminated.

With both MPS2 and MPS3 at full power and one of the Transmission Owner (TO) 345 kV lines out of service for scheduled work, a phase to ground fault occurred on one of the phases on a motor operated disconnect (MOD) on one of the three remaining TO 345 kV lines. The fault was caused by an insulator failure of a MOD switch at a TO substation (offsite). This fault was also sensed as an instantaneous ground in one of the two remaining TO 345 kV lines resulting in this line also tripping. With three of the four TO 345 kV lines out of service, the MPS total electrical output overloaded the single remaining TO 345 kV Line which then also tripped resulting in a total loss of offsite AC power to MPS.

The TO replaced the faulty components and is investigating additional corrective actions. Additional corrective actions are being taken in accordance with the station's corrective action program.

This event is being reported per 10 CFR 50.73(a)(2)(iv)(A) as an event that resulted in a manual or automatic actuation of systems listed in 10 CFR 50.73(a)(2)(iv)(B)(1), (6), and (8). Actuations of the reactor protection system, the AFW system, and the EDGs are reportable under this paragraph.

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## 1. EVENT DESCRIPTION:

At Approximately 0701 hours on May 25, 2014, with Millstone Power Station (MPS) Unit 2 (MPS2) in operating MODE 1, operating at 100% reactor power and MPS Unit 3 (MPS3) in operating MODE 1, operating at 100% reactor power, a total loss of offsite power occurred in the MPS switchyard. Both MPS2 and MPS3 experienced a turbine trip on power to load imbalance followed by an automatic reactor trip initiated by the reactor protection system on the loss of offsite AC power.

An investigation conducted by Connecticut Light & Power (the Transmission Owner) determined that with one of the Transmission Owner (TO) 345 kV lines out of service for planned upgrade project work, a phase to ground fault occurred on one of the phases on a motor operated disconnect (MOD) located in an offsite substation on one of the three remaining TO 345 kV lines. This fault was successfully cleared with relay operation by the TO. This fault was also sensed as an instantaneous ground in one of the two remaining TO 345 kV lines resulting in this line also tripping. The relays in this TO 345 kV line properly directionally sensed the ground fault and did not operate breakers in the MPS Substation. With three of the four TO 345 kV lines out of service, the MPS total electrical output overloaded the single remaining TO 345 kV Line which then also tripped resulting in a total loss of offsite AC power to MPS. At 0730 hours on May 25, 2014, MPS declared an Unusual Event (UE) following the trip of both MPS2 and MPS3 and NRC notification was made (EN 50141 for MPS3 and EN50142 for MPS2). Following stabilization of both MPS2 and MPS3, the UE was terminated at 1414 hours on May 25, 2014.

## BACKGROUND:

The offsite power system is designed to provide reliable sources of power to the on-site AC power distribution system adequate for the safe shutdown of MPS2.

The switchyard, which is configured in a breaker and a half arrangement, buses together four 345 kV transmission line circuits, two generator circuits and two station service circuits.

The four transmission line circuits terminated at the switchyard are:

a. TO Millstone to Beseck Line Number 348
b. TO Millstone to Card Line Number 383
c. TO Millstone to Montville Line Number 371
d. TO Millstone to Manchester Line Number 310

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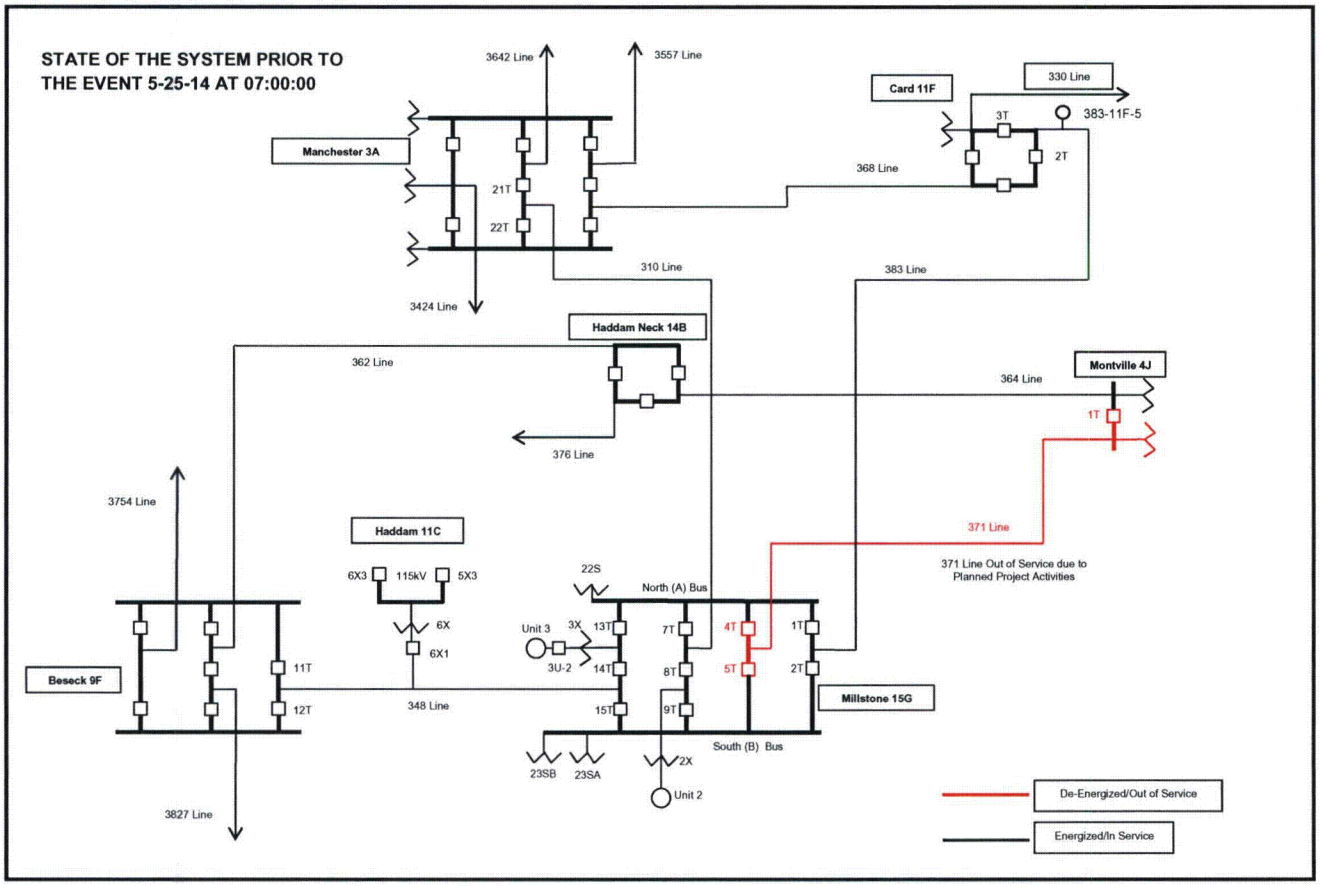
These circuits connect the station to the 345 kV system transmission grid and constitute the MPS offsite AC power source.




## MPS2 PLANT RESPONSE:

On the loss of all offsite AC power, the reactor protection system tripped the reactor in response to the turbine trip as designed. Both safety related emergency diesel generators (EDGs) started automatically based on the under voltage condition, as expected. Both motor driven auxiliary feedwater (AFW) pumps automatically started as expected. All systems responded as expected with the exception of an anomaly in generator voltage regulator performance during the trip. MPS2 remained within the generator capability curve throughout the transient. All safety systems functioned normally. Reactor coolant system (RCS) flow decreased gradually due to the gradual degradation of the electrical supply to the reactor coolant pumps (RCPs). There were no personnel injuries or offsite radiological consequences resulting from this event. A water hammer in the condensate polishing facility was observed during the event. This was entered into MPS corrective action program.

## MPS3 PLANT RESPONSE:

On the loss of all offsite AC power, the reactor protection system tripped the reactor in response to the turbine trip as designed. Both safety related EDGs started automatically based on the under voltage condition, as expected. All safety systems responded as expected. The motor driven AFW (MDAFW) pumps automatically started as expected on the reactor trip, and re-sequenced on to the EDG following

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the loss of power (LOP). The turbine driven auxiliary feedwater (TDAFW) pump started as expected on the reactor trip.

The MPS3 trip was affected by a loss of air when the 'B' instrument air compressor failed to start. The loss of instrument air affected head vent letdown alignment. After unsuccessful attempts to align the head vent to the volume control tank (VCT), letdown was returned to the pressurizer relief tank (PRT) and the PRT rupture disk burst approximately 20 minutes later.

Normal charging and letdown was subsequently restored which resulted in lifting a relief valve in the letdown line. This relief valve discharged to the primary drains transfer tank (PDTT). As a result, a PDTT high level alarm was received and normal charging and letdown was isolated nine minutes later.

Several areas inside the auxiliary building were contaminated as the result of overfilling the PDTT. As a result, tritium and noble gas were released into the auxiliary building and subsequently released through monitored ventilation pathways. A review of the auxiliary building and secondary leak collection and release system radiation monitors for the time period showed no increase. The contribution to the overall dose to the public was very small, less than 0.001 mrem.

The restoration of plant systems was affected by the loss of offsite AC power and instrument air resulting in delaying the transition from emergency operating procedure E-0, Reactor Trip or Safety Injection, to ES-0.1, Reactor Trip Response, to ES-0.2, Natural Circulation Cooldown. As a result the power operated relief valves (PORVs) operated automatically six times and there were five manual operations of a single PORV.

There were no personnel injuries.

This event is being reported per 10 CFR 50.73(a)(2)(iv)(A) as an event that resulted in a manual or automatic actuation of systems listed in 10 CFR 50.73(a)(2)(iv)(B)(1), (6), and (8). Actuations of the reactor protection system, the AFW system, and the EDGs are reportable under this paragraph.

## 2. CAUSE:

With both MPS2 and MPS3 on line at full power and the TO 371 line out of service for scheduled maintenance, a phase to ground fault on one of the phases on the TO 383 line occurred. The fault was caused by an insulator failure on one of the phases of the TO 383 line motor operated disconnect (MOD) switch at a TO substation offsite.

The TO incorrectly set the set-point for the TO 310 line ground instantaneous over-current (IOC) element. The 310 line relay ground IOC element settings were derived without full consideration given to the effects of mutual coupling with adjacent lines. This resulted in a setting that was prone to over-trip for a fault on the TO 383 line. The TO 348 line carried both MPS2 and MPS3 output for about a second then tripped as expected. This resulted in a loss of offsite AC power to both MPS2 and 3.

## 3. ASSESSMENT OF SAFETY CONSEQUENCES:

### CONCLUSION:

The response of both MPS2 and MPS3 to the May 25th loss of AC power event and dual unit reactor trip in terms of fuel and RCS integrity remain bounded by the events presented in the FSAR Chapter 14 and 15, respectively, accident analysis.

The less severe response of the plant was due to the action of non-safety grade reactor trips, which cannot be credited in the accident analysis, and due to the apparent gradual degradation of the electrical supply to the RCP rather than a sudden loss of motive force at the event onset.

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While the recovery phase of the MPS3 transient was complicated with a loss of instrument air and related control issues, none of the observed responses invalidated the bounding nature of the analyses presents in FSAR Chapter 15.

**EVALUATION OF MPS2 PLANT RESPONSE:**

The MPS2 FSAR does not contain an evaluation of a Loss of Non-emergency AC Power. The Loss of External Load event is presented in Section 14.2.1 of the MPS2 FSAR. The Loss of Forced Reactor Coolant Flow is presented in Section 14.3.1. The May 25, 2014 event combined features of both of these events.

The major difference between those FSAR Chapter 14 accident analysis events and the event of May 25, 2014 is that the accident analysis allows the event to proceed until the generation of the first safety grade reactor protection system trip occurs. In the case of the Section 14.2.1 event, a reactor trip signal is not credited until the generation of a high pressurizer pressure trip at 4.9 seconds with CEA insertion beginning at 6.3 seconds. In the case of the Section 14.3.1 event, a reactor trip is not credited until the generation of a low flow trip at 1.29 seconds with CEA motion beginning at 2.44 seconds. In the May 25, 2014 event, the non-safety grade reactor trip on turbine trip was first out.

The RCS flow exhibited an unusual behavior for a freewheeling coast-down of the RCPs. A typical flow coast-down usually begins with a very rapid rate for flow reduction, the rate of reduction gradually slowing as the pumps reach lower speed. The flow rate for MPS2 experienced a nearly linear rate of reduction for about a minute before taking on a more typical loss of flow behavior. This linear behavior made the transient approach to a DNBR safety limit much less severe than those analyzed in the Chapter 14 safety analysis for MPS2.

After the RCP coast-down, the plant established natural circulation as indicated by the approximately 25 degrees F hot to cold leg differential temperature.

The pressurizer pressure remained below its 'pre-event' value for the duration of the event. Therefore there was no need for the power operated relief valves or pressurizer safety valves to act in response to the event.

Pressurizer level reached a minimum of 27.6% with the initial RCS shrinkage upon reactor trip, before recovering due to both charging and the establishment of the differential temperatures for natural circulation.

The maximum steam generator pressure reached during the event was 931 psia. This pressure is well below the set-points for the lowest setting (1000 psia ±3 %) main steam safety valves (MSSVs). A review of plant process computer points confirmed that no MSSVs lifted during the event.

Steam generator reached a minimum of 17.2% narrow range before recovering with AFW delivered from 2 motor driven auxiliary feedwater pumps.

**EVALUATION OF MPS3 PLANT RESPONSE:**

The MPS3 FSAR contains an evaluation of a Loss of Nonemergency AC Power in Section 15.2.6 of the accident analysis, although it does defer to the Loss of Flow event, Section 15.3.2, for limiting departure from nucleate boiling ratio (DNBR) and to the Turbine Trip, Section 15.2.3 for limiting primary and secondary pressures. Note that the Chapter 15 accident analyses of these events are performed primarily to quantify the peak over-pressurization of the 15.2.3 event or the DNBR crisis of the 15.3.2 event. For these two events, this quantification is less than 30 seconds in length. Beyond this time, the plant is in recovery following emergency operating procedures (EOPs). While there may be malfunctions that complicate the recovery period, unless they result in additional events (i.e., PORVs

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which fail to reseat or releases of contaminated steam) they typically do not factor into a judgment as to whether a plant transient remains bounded by the Chapter 15 accident analysis.

The major difference between those Chapter 15 accident analysis events and the May 25, 2014 event is that the accident analysis allows the event to proceed until the generation of the first safety grade reactor protection system trip occurs. In FSAR Table 15.2-1, reactor trip is not credited until the generation of a high pressurizer pressure trip at 6.2 seconds with CEA insertion beginning at 8.2 seconds. In the case of the loss of flow event, Table 15.3-1 shows a reactor trip is not credited until the generation of a low flow trip at 0.9 seconds with CEA motion beginning at 1.5 seconds. In the May 25, 2014 event, the non-safety grade reactor trip on turbine trip was first out.

The RCS flow exhibited an unusual behavior for a freewheeling coast-down of the RCPs. A typical flow coast-down usually beings with a very rapid rate for flow reduction, the rate of reduction gradually slowing as the pumps reach lower speed. The flow rate for MPS3 experienced a nearly linear rate of reduction for about a minute before taking on a more typical loss of flow behavior. This linear behavior made the transient approach to a DNBR safety limit much less severe than those analyzed in the Chapter 15 safety analysis for MPS3.

As expected, after the RCP coast-down, natural circulation was established as indicated by the approximately 35 degrees F hot to cold leg differential temperature.

Both EDGs auto started as expected and energized 4160V busses 34C and 34D.

The pressurizer pressure remained below its 'pre-event' value for the period of the initial potential over-pressurization at the time of the Loss of AC. Therefore there was no need for the PORVs or the pressurizer safety valves (PSVs) to act in response to the initial over-pressurization event. Later, during event recovery without instrument air, pressurizer pressure did increase to the point of automatically cycling the PORVs six times.

The maximum steam generator pressure reached during the event was 1133 psig. This pressure is below the set-point for the lowest setting (1185 psig ±3 %) MSSVs.

Steam generator level reached a minimum of 44.2% wide range before recovering with AFW delivered from two MDAFW and the TDAFW pumps.

## 4. CORRECTIVE ACTION:

The faulted TO 383 line MOD switch at the TO Card Substation has been replaced by the TO. The ground IOC elements for all remote line terminals associated with MPS have been temporarily disabled by the TO through relay setting changes. Additional corrective actions are being taken in accordance with the station's corrective action program.

## 5. PREVIOUS OCCURRENCES:

None

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**6. Energy Industry Identification System (EIIS) codes**

- Emergency AC Power System — EK
- AC Power Distribution System — EA, EB, EC, ED, EF,
- Auxiliary Feedwater System — BA
- Reactor Coolant System — AC
- Main Steam System — SB
- Instrument Air Supply System — LD
- Plant (reactor) Protection System — JC
- Motor Operated Disconnect Switch — SWGR
- Turbine — TRB
- Pump — P
- Air Compressor — CMP
- Main Generator — TB
- Voltage Regulator — RG
- Relay — RLY
- Over-current Element — SWGR
- Safety Valve — RV
- Pressurizer — PZR