

July 31, 2012

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

Subject: Duke Energy Carolinas, LLC (Duke Energy)  
Catawba Nuclear Station, Units 1 and 2  
Docket Nos. 50-413 and 50-414  
Special Report 413/2012-S01-0

Pursuant to 10 CFR 50.73(d), attached is the subject Special Report entitled, "Special Report - Small Amount of Special Nuclear Material (SNM) in Nuclear Instrumentation Detectors Unaccounted For".

This report is being submitted in accordance with 10 CFR 20.2201(b)(2)(i).

There are no regulatory commitments contained in this letter or its attachment.

This event is considered to be of no significance with respect to the health and safety of the public.

If there are any questions on this report, please contact L.J. Rudy at (803) 701-3084.

Sincerely,



Kelvin Henderson  
Site Vice President

LJR/s

Attachment

JE22  
NRK

Document Control Desk  
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xc (with attachment):

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U.S. Nuclear Regulatory Commission - Region II  
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## LICENSEE EVENT REPORT (LER)

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

APPROVED BY OMB: NO. 3150-0104

EXPIRES: 10/31/2013

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 Records and FOIA/Privacy Service Branch (T-5 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to [infocollects.resource@nrc.gov](mailto: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.

## 1. FACILITY NAME

Catawba Nuclear Station, Unit 1

## 2. DOCKET NUMBER

05000413

## 3. PAGE

1 OF 6

## 4. TITLE

Special Report - Small Amount of Special Nuclear Material (SNM) in Nuclear Instrumentation Detectors Unaccounted For

## 5. EVENT DATE

MONTH	DAY	YEAR
06	21	2012

## 6. LER NUMBER

YEAR	SEQUENTIAL NUMBER	REV NO
2012	S01	0

## 7. REPORT DATE

MONTH	DAY	YEAR
07	31	2012

## 8. OTHER FACILITIES INVOLVED

## FACILITY NAME

Catawba Unit 2

## DOCKET NUMBER

05000414

## FACILITY NAME

## DOCKET NUMBER

## 9. OPERATING MODE

1

## 11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check all that apply)

- |  |   |   |  |
|--|---|---|--|
| <input checked="" type="checkbox"/> 20.2201(b) | <input type="checkbox"/> 20.2203(a)(3)(i)   | <input type="checkbox"/> 50.73(a)(2)(i)(C)  | <input type="checkbox"/> 50.73(a)(2)(vii)        |
| <input type="checkbox"/> 20.2201(d)            | <input type="checkbox"/> 20.2203(a)(3)(ii)  | <input type="checkbox"/> 50.73(a)(2)(ii)(A) | <input type="checkbox"/> 50.73(a)(2)(viii)(A)    |
| <input type="checkbox"/> 20.2203(a)(1)         | <input type="checkbox"/> 20.2203(a)(4)      | <input type="checkbox"/> 50.73(a)(2)(ii)(B) | <input type="checkbox"/> 50.73(a)(2)(viii)(B)    |
| <input type="checkbox"/> 20.2203(a)(2)(i)      | <input type="checkbox"/> 50.36(c)(1)(i)(A)  | <input type="checkbox"/> 50.73(a)(2)(iii)   | <input type="checkbox"/> 50.73(a)(2)(ix)(A)      |
| <input type="checkbox"/> 20.2203(a)(2)(ii)     | <input type="checkbox"/> 50.36(c)(1)(ii)(A) | <input type="checkbox"/> 50.73(a)(2)(iv)(A) | <input type="checkbox"/> 50.73(a)(2)(x)          |
| <input type="checkbox"/> 20.2203(a)(2)(iii)    | <input type="checkbox"/> 50.36(c)(2)        | <input type="checkbox"/> 50.73(a)(2)(v)(A)  | <input type="checkbox"/> 73.71(a)(4)             |
| <input type="checkbox"/> 20.2203(a)(2)(iv)     | <input type="checkbox"/> 50.46(a)(3)(ii)    | <input type="checkbox"/> 50.73(a)(2)(v)(B)  | <input type="checkbox"/> 73.71(a)(5)             |
| <input type="checkbox"/> 20.2203(a)(2)(v)      | <input type="checkbox"/> 50.73(a)(2)(i)(A)  | <input type="checkbox"/> 50.73(a)(2)(v)(C)  | <input type="checkbox"/> OTHER                   |
| <input type="checkbox"/> 20.2203(a)(2)(vi)     | <input type="checkbox"/> 50.73(a)(2)(i)(B)  | <input type="checkbox"/> 50.73(a)(2)(v)(D)  | Specify in Abstract below<br>or in NRC Form 366A |

## 10. POWER LEVEL

100%

## 12. LICENSEE CONTACT FOR THIS LER

## FACILITY NAME

L.J. Rudy, Regulatory Compliance

## TELEPHONE NUMBER (Include Area Code)

(803) 701-3084

## 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

☐ YES (If yes, complete EXPECTED SUBMISSION DATE) ☒ NO

## 15. EXPECTED SUBMISSION DATE

MONTH	DAY	YEAR

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

On 06/21/2012, it was determined that two nuclear instrumentation incore detectors could not be accounted for at Catawba. Detectors of this type are used to measure incore neutron flux (intensity of neutron radiation) inside the reactor vessel. This determination was made following the completion of a physical inventory of nuclear instrumentation incore detectors in storage. According to Catawba documentation, there should be 54 such detectors in storage. Only 52 detectors could be physically located onsite. There is no evidence of theft or diversion of these detectors. According to site documentation, one of the detectors may have been shipped to Barnwell in 1986 via a low level radioactive waste shipment. Detectors of this type contain very small amounts of Uranium-235 (0.0041 grams per detector), which qualifies them as SNM. The quantity of SNM contained in the two detectors is 0.0178 microCurie, which is greater than ten times the quantity specified for Uranium-235 in Appendix C to 10 CFR 20 (0.001 microCurie). The most likely location for the detectors is either in one of the bunkers located onsite within the radiologically controlled area or at Barnwell. The search for these detectors was suspended based on a determination that the additional dose to plant workers involved in the search was not justified by an equivalent offsetting safety benefit resulting from locating the detectors. It is extremely unlikely that the detectors could have left the site other than in a radioactive waste shipment, as the radiation monitoring equipment in place would likely have identified the presence of the detectors. If a detector was shipped to Barnwell, it would not have posed a radiological hazard to the public or to workers. This event had no effect upon plant operations or the health and safety of the public.

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## NARRATIVE

## BACKGROUND

This event is being reported under the following criterion:

10 CFR 20.2201(b)(1), Reports of theft or loss of licensed material, Written reports.

Catawba Nuclear Station Units 1 and 2 are Westinghouse four-loop Pressurized Water Reactors (PWRs) [EIS: RCT].

The Incore Instrumentation System [EIS: IG] provides information regarding the neutron flux distribution and the fuel assembly outlet temperatures at selected core locations. The system provides a means to acquire the data only, and does not perform any operational plant control. The incore instrumentation provides information which is used to calculate the coolant enthalpy and the fuel burnup distribution, which is used to estimate the coolant flow distribution and is used to calibrate the Excore Instrumentation System [EIS: IG] for axial offset. The Incore Instrumentation System consists of chromel-alumel thermocouples [EIS: THC] at fixed core outlet positions and movable miniature fission chamber neutron detectors [EIS: DET] which can be positioned at the center of selected fuel assemblies anywhere along the length of the fuel assembly vertical axis.

The movable incore detectors which are used to measure the neutron flux inside the reactor core are 2.1 inches in length and 0.188 inches in diameter. When installed, the detectors are attached to over 100 feet of cable. Each detector of this type contains 0.0041 grams of Uranium-235 prior to irradiation; therefore, the detectors are classified as SNM. Six detectors are installed in a nuclear unit at one time. Individual detectors do not have serial numbers or unique identifiers stamped on them; therefore, once installed, they are indistinguishable from one another by visual means alone.

Occasionally, detectors fail and need to be replaced. To date at Catawba, 54 such detectors have failed.

When the SNM was declared lost on 06/21/2012, Unit 1 and Unit 2 were in Mode 1 at 100% power. No structures, systems, or components were out of service that had any effect on the event.

## EVENT DESCRIPTION

Date/Time	Event
01/07/1985	Unit 1 achieved initial criticality.
05/1986	Six detectors were installed on the Unit 2 Incore Instrumentation System prior to initial criticality. The installation work package indicated that four of the six detectors failed prior to irradiation. Reactor Engineering SNM incore detector data and summary sheets from this time period indicated that one of the original six detectors was to be shipped to the Barnwell low level radioactive waste disposal facility in South Carolina. The detector was determined to be failed prior to irradiation. However, no confirmation documentation of an actual shipment could be located.

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## NARRATIVE

05/08/1986 Unit 2 achieved initial criticality.

04/19/2012 through 06/14/2012 Catawba personnel conducted a physical inventory of detectors in storage. Of the 54 known detectors, only 52 could be physically located. A description of the locations searched and the results of the search are as follows:

- Detector drum shield in Auxiliary Building Room 405 - Inventoried 46 detectors.
- Detector cable drum shield in Auxiliary Building Room 405 - Inventoried an additional 6 detectors. These 6 detectors were placed into the detector drum shield.
- Unit 1 and Unit 2 containment vaults - The vaults are the tubing in which the detectors are located when they are in storage. These vaults were inspected with remote video equipment. No detectors were located in either the Unit 1 or the Unit 2 vaults.
- Unit 1 and Unit 2 detector workboxes in lower containment - These workboxes contain the lead shields that are used for transporting incore cables and detectors. All detector workboxes were empty of detectors.
- Auxiliary Building Rooms 237 and 247 - These rooms were considered the Hot Equipment Shop in the 1986 timeframe, where the four failed detectors on Unit 2 were transported prior to initial criticality. No detectors were found in these rooms.
- Bunkers in Auxiliary Building Room 405 - Bunkers A, B, and D in Room 405 were inspected with remote video equipment. Bunker C was excluded from the inspection due to high dose rates from the contents of the bunker, and the low likelihood of finding any detectors in that bunker. No detectors were observed based on the visual inspection. There were containers in the bunkers (e.g., bags, buckets) whose entire contents could not be determined during the visual inspection.

06/21/2012 Due to personnel dose concerns and the lack of an offsetting safety benefit, site management determined that no additional searches would be conducted for the two detectors and that the detectors would be considered lost.

07/05/2012/1406 Operations notified the NRC Operations Center of the lost detectors via the Emergency Notification System (event notification number 48070).

## CAUSAL FACTORS

This event resulted from inadequate accounting practices related to small quantities of SNM. The inadequate accounting practices occurred from 1985 through 2012. This event is attributed to a lack of procedural guidance for SNM control.

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## NARRATIVE

Catawba had not performed a physical inventory of failed incore detectors until 2012. Incore detectors contain a small quantity of SNM (much less than one gram of SNM). Duke Energy incorrectly assumed that small quantities of SNM were excluded from physical inventory requirements. The receipt of incore detectors does not require DOE/NRC Form 741 to be utilized. This form is required for items containing greater than one gram of SNM. Therefore, the detectors are not subject to the level of tracking associated with DOE/NRC Form 741. The small quantities of SNM have not been incorporated into the Inventory of Record. In addition, for inventory purposes, the failed detectors were considered to be inaccessible. The detectors are located inside a locked drum shield (a locked high radiation area) and the irradiated detectors have high dose rates associated with them. Catawba considered the detectors inside the drum shield to be inaccessible and assumed that they were excluded from physical inventory requirements. Duke Energy incorrectly assumed that inaccessible SNM was excluded from physical inventory requirements. Over the past several years, clarification has been made that locations that various utilities considered to be inaccessible were not considered as such by the NRC, and that the presence of high dose rates does not render a location inaccessible.

## CORRECTIVE ACTIONS

Immediate:

Not applicable.

Subsequent:

1. The physical inventory was completed. Site management determined that due to personnel dose concerns and the lack of an offsetting safety benefit, additional search efforts were not justified.
2. This event was reported to the NRC Operations Center on 07/05/2012.

Planned:

Refer to the section entitled "INFORMATION REQUIRED BY 10 CFR 20.2201(b)(1)".

There are no NRC commitments contained in this report.

## SAFETY ANALYSIS

This event had no consequence on the safe operation of the Catawba units. The detectors contain an extremely small amount of SNM and pose no significant safety concern. It is believed that the detectors are either located onsite within the radiologically controlled area or were disposed of as radioactive waste at Barnwell. Therefore, no inadvertent radiation exposures are believed to have occurred as a result of this event.

This event did not affect the health and safety of the public.

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## ADDITIONAL INFORMATION

Within the previous three years, there have been no other similar events involving SNM. Therefore, this event is considered to be non-recurring.

Energy Industry Identification System (EIIIS) codes are identified in the text as [EIIIS: XX]. This event is not considered reportable to the Equipment Performance and Information Exchange (EPIX) program.

This event is not considered to constitute a Safety System Functional Failure. There was no release of radioactive material, radiation overexposure, or personnel injury associated with the event described in this report.

## INFORMATION REQUIRED BY 10 CFR 20.2201(b)(1)

(i) A description of the licensed material involved, including kind, quantity, and chemical and physical form:

Two incore detectors manufactured by Imaging and Sensing Technology (IST) are considered lost. Movable incore detectors are used to measure the neutron flux inside the reactor core. Incore detectors are 2.1 inches in length and 0.188 inches in diameter. When installed, the detector is attached to over 100 feet of cable. Each detector of this type contains 0.0041 grams of Uranium-235 prior to irradiation; therefore, they are classified as SNM. The SNM is encapsulated in stainless steel. The aggregate quantity of Uranium-235 contained in these two detectors is 0.0082 grams, representing an activity of 0.0178 microCurie, which is greater than ten times the quantity specified for Uranium-235 in Appendix C to 10 CFR 20 (0.001 microCurie).

(ii) A description of the circumstances under which the loss or theft occurred:

At least one of the two detectors may have been disposed of as radioactive waste in 1986. However, detailed records related to the disposition of the missing detectors could not be located. The two detectors are classified as lost due to the lack of disposal documentation.

Due to the sensitivity of plant radiation monitoring equipment, it is extremely unlikely that the detectors were removed from Catawba other than through a Barnwell shipment, as the installed plant radiation monitoring equipment would have alerted personnel to such an occurrence. Catawba has concluded that theft or diversion of the missing detectors is highly unlikely.

(iii) A statement of disposition, or probable disposition, of the licensed material involved:

Although two detectors could not be physically located, there is a high likelihood that the detectors are either onsite within the radiologically controlled area or were previously disposed of as radioactive waste via shipment to Barnwell.

(iv) Exposures of individuals to radiation, circumstances under which the exposures occurred, and the possible total effective dose equivalent to persons in unrestricted areas:

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## NARRATIVE

There is no known exposure to individuals. It is believed that the detectors are either located onsite within the radiologically controlled area or were disposed of as radioactive waste; therefore, no inadvertent radiation exposures are believed to have occurred as a result of this event.

(v) Actions that have been taken, or will be taken, to recover the material:

The locations that were searched for the two missing detectors are described previously in this report. No additional searches are planned.

(vi) Procedures or measures that have been, or will be, adopted to ensure against a recurrence of the loss or theft of licensed material:

The Catawba inventory procedure for non-fuel SNM had relied previously on documentation records in lieu of physical inventory for inaccessible material. The Catawba inventory procedure for non-fuel SNM has been revised to require a physical inventory of all non-fuel SNM.

The remaining failed incore detectors have been consolidated into a single location. The procedure for replacement of an incore detector is being revised to specify this location as the location to place any additional failed detectors. Tamper indicating devices will be utilized to facilitate future inventories of the detectors.

A new administrative procedure was developed to provide guidance for non-fuel SNM receipt, transfer, and shipment offsite.

Actions are planned to incorporate small quantities of SNM into the Inventory of Record.