

Comanche Peak Units 3 and 4

**Special Nuclear Material (SNM) Control and Accounting
(MC&A) Program Description**

Revision 1

March 9, 2012

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1. Scope

The MC&A Program establishes guidelines concerning control of and accounting for SNM at Comanche Peak Units 3 and 4 in accordance with Subpart B of 10 CFR Part 74.

The criteria prescribed in the MC&A Program are applicable to SNM and various material mixtures containing SNM. Generally, the SNM involved is plutonium, U-233, or uranium enriched in the isotope U-235. SNM is typically in the form of pellets encapsulated in fuel rods. Criteria are established for the SNM control and accounting system, including criteria for the receipt, internal control, physical inventory, and shipment of SNM.

In addition to the information provided in this program description, the following Comanche Peak Units 3 and 4 licensing basis documents provide the regulatory basis that describes how the applicable requirements for material control and accounting defined in 10 CFR 74 will be met:

- Information related to amounts of SNM as reactor fuel required for reactor operation is provided in FSAR Section 4.1.
- Information related to storage of SNM as reactor fuel is provided in FSAR Section 9.1.
- Information related to the organizational structure for Comanche Peak Units 3 and 4, including those responsible for SNM material control and accounting, is provided in FSAR Section 13.1.
- Information related to training of personnel, including those responsible for SNM material control and accounting, is provided in FSAR Section 13.2.
- Information related to implementation of this Special Nuclear MC&A Program is provided in FSAR Table 13.4-201
- Information related to plant procedures, including those used to control SNM, is provided in FSAR Section 13.5.
- Information on the Physical Protection and Control of SNM is contained in "SNM Physical Protection Program Description," Rev. 0, December 2011 (this control is in place prior to fuel receipt and prior to full implementation of the Physical Security Program per 10 CFR 73.55).

2. Definitions

In this program description, the following definitions shall apply:

2.1. Book inventory (inventory of record). A master database or listing of all SNM currently possessed, reflecting the input of all material control records.

2.2. Fuel assembly. The grouping of fuel components combined as an integral unit for use in a nuclear reactor.

2.3. Fuel component. The smallest structurally discrete part of a fuel assembly that contains SNM. This is normally a fuel rod for intact components, but includes rod fragments, or pellets (or significant fraction thereof) if the rod structural integrity is not maintained.

2.4. Fuel component container. A container that provides protection to fuel components comparable to that afforded by an intact fuel assembly and that is held to the same accounting standards as a fuel assembly, in that the container has the following attributes:

- The container is specifically designed to contain rods/rod fragments;
- The container is stored in the fuel storage racks; and
- The use of specialized handling tools and equipment is required to access the SNM stored in the container.

2.5. Item. Fuel assembly, fuel component container, non-fuel SNM container, sealed container, reassembled reactor vessel, or a discrete piece of SNM (fuel or non-fuel) that is not stored in a container.

2.6. Item control area (ICA)/ Controlled Access Area (CAA). A defined area within the access controlled area for which the SNM (fuel assemblies, fuel components, or non-fuel SNM) is maintained in such a way that, at any time, an item count and related SNM quantities can be obtained from the records for the SNM located within the area. ICAs/CAA have defined physical boundaries; these generally comprise fresh and irradiated fuel storage areas, including reactor vessels, spent fuel pools, and non-fuel SNM storage areas.

2.7. Item count (piece count). Visual verification that an item is in the location documented in the material control records. Verification of an item's identification number is not necessary for a piece count.

2.8. Material control records. Records of SNM receipt, internal transfer, reconstitution, acquisition, inventory, and shipment (including disposal).

2.9. Non-fuel SNM. Items containing SNM that are not intended for use as fuel, e.g., fission detectors.

2.10. Non-fuel SNM container. A container used to store non-fuel SNM items, which has the following attributes:

- The container is specifically designed or evaluated for storage of SNM;
- The container is stored in an area with controlled access; and
- The use of specialized handling tools and equipment is required to access the SNM stored in the container.

2.11. Physical inventory. Determined on a measured basis of the quantity of SNM on hand at a given time; a complete check of all material on hand. The methods of physical inventory and associated measurements will vary depending on the material to be inventoried and the process involved. The typical physical inventory at a power reactor plant consists of an item count (piece count) of SNM in each ICA.

2.12. Sealed container. Container storing SNM that has been sealed with a tamper-safing device or other mechanical means; e.g., welding.

2.13 Special nuclear material (SNM). Plutonium, U₂₃₃, uranium enriched in the isotope U-233 or in the isotope U-235, and any other material which the Nuclear Regulatory Commission (NRC), pursuant to the provisions of Section 51 of the Atomic Energy Act of 1954, as amended, determines to be SNM.

2.14 Tamper-safing. The use of a device on a container in a manner and at a time that ensures a clear indication of any violation of the integrity of the contents of the container.

3. Organizational Requirements

3.1. Delegation of Responsibilities and Authority

3.1.1 Reactor engineering (sometimes called core performance engineering) is part of system engineering, and has responsibility for custody and inventory control of all SNM on site. The reactor engineering manager assigns the SNM Custodian and reports through system engineering to the Director of Site Engineering.

3.1.2 Material control functional and organizational relationships are set forth in writing in organizational directives, instructions, procedures, manuals, and other documents. Documentation includes position qualification requirements and definitions of authority, responsibilities, and duties. Activities involving handling, accounting, or control of SNM are verified by a second person. Specific assignments of responsibilities are prescribed for all facets of the SNM control system. Delegation of material control responsibilities and authority are in writing.

3.2 SNM Custodian

The SNM custodian is a reactor engineer (systems engineer) responsible for the performance of the functions that relate to the custody, inventory control and accounting of SNM. The SNM Custodian resides in reactor engineering under the Director of Site Engineering. All records generated will be provided to the records management group in accordance with 10 CFR 74.19 (d).

3.3 Experience or Training

Personnel responsible for SNM control and accounting have experience or training applicable to their functions.

3.4 Accounting and Inventory Control Group

The SNM Custodian maintains procedures for accounting and inventory control of SNM in the plant's possession as required in 10 CFR 74.19(b). The site records management group maintains long term records storage as required by 10 CFR 74.19 (d).

3.5 Vendor/Contractor Oversight

A program is established to provide adequate oversight of vendors/contractors conducting activities involving handling, accounting, and control of SNM.

4. Material Control and Accounting Program

4.1. Procedures

Written procedures are prepared and maintained covering the SNM control and accounting system, as required in 10 CFR 74.19(b). These procedures shall address, as a minimum, the following topics:

- (1) Organization and personnel responsibilities and authorities;
- (2) Designation and description of ICAs;
- (3) Material control records and reporting;
- (4) Notification for events concerning SNM;
- (5) Receiving and shipping SNM;
- (6) Internal transfer of SNM;
- (7) Physical inventory of SNM;
- (8) SNM element and isotopic calculation method; and
- (9) Characterization and identification of items as SNM or non-SNM to preclude loss of control of SNM items.

4.2. Configuration Control

Provisions are made for written approval of revisions to the contents of the SNM material control and accounting procedures by the appropriate plant personnel.

4.3. Corrective Action Program

Discrepancies or program deficiencies are documented, investigated, reported, as required in 10 CFR 74.11 and 10 CFR 20.2201, and resolved using the plant corrective action program.

5. Input Control

5.1. Review of Fuel Supplier's Values

The fuel supplier reviews the adequacy of its material control and accounting system used in establishing the quantities and assays of SNM. In the event of a significant discrepancy between the fuel supplier's values for SNM quantities and assays and those determined by Comanche Peak, the cause of such discrepancies are investigated with the fuel supplier and the differences are resolved and reconciled expeditiously.

5.2. Receipt of SNM

For SNM received at the plant site, Comanche Peak:

- (1) Contacts the shipping vendor in the event the SNM does not arrive as scheduled; initiates an investigation and resolves, as required in 10 CFR 73.67 and 10 CFR 74.11;
- (2) Verifies the integrity of the shipping container and tamper-safing devices and resolves any problems identified, as required in 10 CFR 73.67 and 10 CFR 74.11;
- (3) Verifies that the quantity (item count) and unique identification numbers are in agreement with those indicated on the shipper's documents;
- (4) Takes appropriate steps to resolve and reconcile any differences in quantities or identification numbers, as required in 10 CFR 73.67 and 10 CFR 74.11; and
- (5) Notifies the regulatory body, as required in 10 CFR 73.67 and 10 CFR 74.11.

5.3. Documentation

The SNM custodian reports the receipt of each item containing SNM, by serial number or other unique identifier, to the accounting group. The receipt of SNM is documented in the material control records and the book inventory updated for

the applicable ICA, as required in 10 CFR 74.19(a). A Nuclear Material Transaction Report is completed, as required in 10 CFR 74.15.

6. Internal Control

6.1. Unit of Control

Units of SNM that require control are the items defined in paragraph 2.5. Each of these units is identified in the material control records by its serial number or other unique identifier (e.g., a physical description of the item) and location, as required in 10 CFR 74.19(a).

6.2. Item Control Areas

ICAs are established for physical and administrative control of SNM. The number of ICAs is sufficient to establish control.

6.3. Internal Transfers

Transfers of SNM into, out of, or within an ICA are accomplished only upon written authorization of the SNM custodian or other individual(s) at the plant site responsible for the SNM program.

Written authorization is obtained prior to the movement. All transfers of SNM are documented using a material control record by the responsible person involved in each operation, and the book inventory is updated for the applicable ICA.

6.4. Non-SNM items

Non-SNM items stored with items containing SNM are clearly identified as such to preclude SNM items from being mistaken for non-SNM items. In accordance with the regulatory requirements of 10 CFR 70.22 (a) (4), each application for a 10 CFR Part 70 Special Nuclear Material (SNM) License shall include the name, amount, and specifications (including the chemical and physical form and, where applicable, isotopic content) of the special nuclear material the applicant proposes to use or produce. The radioactive material identified in Appendix A represents nominal values of known non-fuel SNM specifically required for use in each CPNPP US-APWR unit.

FSAR Section 12.2 includes the requirements for written procedures that address leak-testing of radioactive sources (byproduct material, source material, and devices that contain SNM, as appropriate). The leak-test will be consistent with 10 CFR 20.1501 survey and monitoring requirements for evaluating the quantities of radioactive material and the potential radiological hazard of the radioactive source.

6.5. Sealed containers

A container with a tamper-safing device can be treated as a single item for inventory purposes; however, before the container is closed and the tamper-safing device is installed, the contents are physically inventoried. If the contents of a sealed container are accessed, the contents will be physically re-inventoried or administrative procedures will be in place to establish the integrity of the contents before it can be treated as a single item for inventory purposes.

6.6. Damaged Cladding

Severe damage to cladding, where rod structural integrity has not been maintained, has the potential to result in inadvertent physical separation and dispersal of fuel components from the fuel rod. Upon visual identification of inadvertent physical separation, an estimate of the SNM quantity and an engineering judgment concerning the origin of the SNM will be made and documented. The amount of irretrievable or inadvertent loss will be reported, if the quantity is reportable, as required in 10 CFR 74.13. Methods used to estimate SNM quantities include, for example, engineering calculation, engineering judgment, physical measurement of length, destructive or non-destructive measurement, and count of the number of pellets retrieved or missing.

7. Physical Inventory

7.1. Conduct

Physical inventory is taken at intervals not to exceed 12 months, as required in 10 CFR 74.19(c). Physical inventory is conducted according to written inventory procedures, as required in 10 CFR 74.19(b).

7.2. Coverage

Physical inventory includes all SNM possessed under license and is conducted in all ICAs, including:

- (1) New fuel storage areas;
- (2) Irradiated fuel storage areas;
- (3) Reactors;
- (4) Areas containing non-fuel SNM.

7.3. Inventory Method

An item count is conducted of all SNM, as required in 10 CFR 74.19(c).

7.3.1. Assemblies and Fuel Component Containers

For fuel assemblies and fuel component containers, an item count is sufficient. If the contents of an assembly or a fuel component container are accessed, the contents are physically reinventoried before the assembly or container can be treated as a single item for inventory purposes.

7.3.2. Fuel Components

For fuel components that are not part of an intact assembly, physically captured in an assembly, stored in a sealed container, or stored in a fuel component container, each component is inventoried.

7.3.3. Sealed Containers

For sealed containers, verification of the integrity of the tamper-safing device is sufficient.

7.3.4. Reactor

Whenever fuel assemblies are loaded into a reactor, the unique identifier and location of each item is visually verified. When the reactor vessel is reassembled, the reactor is considered one item for inventory purposes.

7.3.5. Non-fuel SNM

For non-fuel SNM, the method of physical inventory depends on the method of storage and use:

- For installed components, verification is performed at the time of installation, and administrative procedures and controls are established so that records concerning the location and unique identity are accurate.
- For non-installed components stored in primary containment, administrative procedures and controls are established so that records concerning the location and unique identity are accurate when the reactor is at power, and verification is performed during refueling outages.
- For non-fuel SNM containers, item count of the containers is sufficient. If the contents of the container are accessed, the contents are physically re-inventoried or administrative procedures are in place to ensure the integrity of the contents before the container can be treated as a single item for inventory purposes.

7.4. Reconciliation and Resolution

The physical inventory is reconciled to the book inventory. Discrepancies between the physical inventory and the book inventory are investigated and addressed expeditiously. The book inventory shall be adjusted to agree with the result of the physical inventory.

7.5. Documentation

The results of the physical inventory of SNM are documented in the material control records of the applicable ICA and utilized as input to the isotopic calculations. A Material Balance Report and Physical Inventory Listing Report are completed, as required in 10 CFR 74.13.

8. SNM Calculations

8.1. Element and Isotopic Computations

Methods of computation are established and utilized for determining the total element and isotopic composition of SNM in irradiated nuclear fuel assemblies and fuel components. The computed values are the basis for shipment documents, as required in 10 CFR 74.15, and material status reports, as required in 10 CFR 74.13.

9. Output Control

9.1. Shipment

Procedures are established, as required by 10 CFR 74.19(b), to provide for:

- (1) Verification and recording of the serial number or unique identifier of each item containing SNM;
- (2) Recording of the quantities of SNM contained in each item;
- (3) Reporting the quantity of SNM shipped, if the quantity is reportable, as required in 10 CFR 74.15;
- (4) Verification of compliance with regulations, including licensing, transportation, and security requirements for shipment; and
- (5) Reporting the completion of each shipment to the accounting group

9.2. Documentation

The shipment of fuel assemblies, fuel components, or non-fuel SNM is documented in the material control records and the book inventory updated for the applicable ICA. Nuclear Material Transaction Reports are completed, as required in 10 CFR 74.15.

10. Records and Reports

Records are created and retained, as required in 10 CFR 74.19(a). The accounting records are the basis for the MC&A program. Quantitative data generated by calculations of changes in quantities and isotopic composition due to irradiation and decay are recorded and reported in accordance with Comanche Peak's recording and reporting procedures. The records and reports system include:

- (1) An accounting system for maintaining the book inventory;
- (2) Material control records maintained for each ICA;
- (3) Reconciliation of the results of physical inventories to the book inventory;
- (4) Recording the transfer of SNM into or out of each ICA;
- (5) Recording movement of SNM between locations within an ICA, for ICAs where locations have been established;
- (6) Recording the creation of items containing SNM, such as creation of a rod fragment;
- (7) Recording the estimated quantity and origin of SNM which has been inadvertently separated from fuel upon the discovery of the separation;
- (8) Reporting to the accounting group the transfer of SNM into, within, or out of an ICA, if applicable;
- (9) Perpetual inventory records of each ICA, including the serial number or other unique identifier and location of each item in the ICA that contains SNM;
- (10) Historical data of SNM in each nuclear fuel assembly, fuel component, or non-fuel SNM item while in Comanche Peak's possession; and
- (11) Retention as required in 10 CFR Part 74.

11. System Review and Assessment

Reviews of the SNM MC&A program are conducted periodically. The results of the reviews are documented and reported in accordance with the requirements of the quality assurance or self-assessment program.

12. Physical Security

Protection of SNM is in accordance with the requirements of 10 CFR 73.67 and the Comanche Peak Physical Security Plan. Information on the Physical Protection and Control of SNM is contained in "SNM Physical Protection Program Description," Rev.0, December 2011. (This control is in place prior to fuel receipt and prior to full implementation of the Physical Security Program per 10 CFR 73.55.)

Appendix A

Non-Fuel Special Nuclear Material for Use in Each CPNPP US-APWR Unit

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In accordance with the regulatory requirements of 10 CFR 70.22 (a) (4), each application for a 10 CFR 70 Special Nuclear Material (SNM) License shall include the name, amount, and specifications (including the chemical and physical form and, where applicable, isotopic content) of the special nuclear material the applicant proposes to use or produce. The radioactive material identified below represents nominal values of known non-fuel SNM specifically required for use in each CPNPP US-APWR unit:

(a) Element and Mass Number	(b) Chemical or Physical Form	(c) Maximum Amount
Uranium 235 (approx. 93%) 234, 236 & 238 (approx. 7%)	Uranium Oxide in Incore Neutron Detector – Fission Chambers (8 detectors, including 4 spare)	4.4 mg of Uranium per fission chamber Eight fission chambers – total of approx. 35 mg
Uranium 235 (approx. 93%) 234, 236 & 238 (approx. 7%)	Uranium Oxide in Wide Range Neutron Detector – Fission Chambers (4 detectors, including 2 spare)	3 g of Uranium per fission chamber Four fission chambers – total of approx. 12 g