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**DOE/ORO RADIOACTIVE SOURCE CONTROL
POLICY 04/09/90**

04/09/90

DOE-FMPC/WMCO

1415

POLICY

DOE/ORO RADIOACTIVE SOURCE CONTROL POLICY
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1.0 Purpose

- 1.1 This policy is intended to ensure that sealed and unsealed radioactive sources (that is, source material, special nuclear material, or by-product material) received, possessed, used or transferred under routine operations at Oak Ridge Operations (ORO) sites are accounted for, controlled, and used properly such that exposures to such materials are kept as low as reasonably achievable (ALARA). This policy provides a common standard for radioactive source accountability and control.

2.0 Scope

- 2.1 The provisions of this policy are applicable to the ORO Office, all ORO contractors, all subcontractors, as well as SPRO, CEBAF, and WSSRAP operations. For purposes of this policy, radioactive sources are sources that contain activities in quantities greater than or equal to the quantities shown in Table 1.
- 2.2 The following are examples of sources that are exempt from this policy.
- 2.2.1 Fission chambers (i.e., equipment containing radioactive materials which is inaccessible to personnel).
 - 2.2.2 Process inventory (e.g., process flows, samples, products, etc.).
 - 2.2.3 Consumer products such as luminescent exit signs, smoke detectors, and static eliminators.

3.0 References

- 3.1 The following are documents used in developing this policy.
- 3.1.1 Doe Order 5480.11
 - 3.1.2 Doe Order 5484.1
 - 3.1.3 10 CFR 20
 - 3.1.4 10 CFR 30
 - 3.1.5 49 CFR 173

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4.0 Definitions

- 4.1 **Control (of a source)** - The situation in which the radioactive source is used, stored, transported, and disposed of under conditions which are approved by Health Physics and which conform to DOE Orders, DOE Policy, and industry practice such that there are no unwarranted exposures of the public or workers.
- 4.2 **Controlled Documents** - Procedures, manuals, or training lectures which are: labeled with the document's name, number, effective date, and page numbers. Such documents are assigned to an individual(s) who has responsibility for the document(s) (e.g., location, updating, etc.). Controlled documents are administered by a document control group.
- 4.3 **Leak Test** - A test designed to determine escape of radioactive source activity.
- 4.4 **Master File** - A file at a single location for each DOE/ORO site (e.g., all ORNL records are at one ORNL location, all ORAU records are at one ORAU location, etc.) where all records for the radioactive source control program (e.g. NIST traceability certificates, training records, dosimetry, leak tests, etc.) are kept.
- 4.5 **Master Inventory** - Records of the physical inventory. Such records are kept in a single DOE/ORO site (e.g., all ORNL inventory records are at one ORNL location, all ORAU inventory records are at one ORAU location, etc.).
- 4.6 **NIST** - National Institute of Standards and Technology (formerly the National Bureau of Standards - NBS).
- 4.7 **Physical Inventory** - A visual sighting of the radioactive source or another physical evidence (e.g., dose rate) of its presence.
- 4.8 **Radioactive Source** - Radioactive materials in solid or liquid form with activities greater than or equal to activities shown in Table 1.
- 4.9 **Sealed Source** - A radioactive source sealed in a capsule or having a bonded cover in which the capsule

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or cover is strong enough to prevent contact with, or dispersion of, the radioactive material under normal conditions of use, including a one-meter drop on an unyielding surface.

- 4.10 Unsealed Source - A source containing radioactive material affixed to a surface by electroplating or chemical means, embedded in a matrix of non-radioactive material, or used with foil, mylar, or other coverings which allows penetration of alpha or beta-gamma radiations. Also included are sources prepared by evaporation of liquid on a backing material and which have no covering as part of the source, or any source not fully meeting the definition of a sealed source.

5.0 Requirements

5.1 Responsibilities

- 5.1.1 ORO contractors and subcontractors are responsible for ensuring the requirements of this policy are met.
- 5.1.2 Personnel shall be clearly identified (e.g., title, phone number, etc.) in procedures who have the responsibility to ensure the requirements of this policy are fulfilled.
- 5.1.3 One individual, (i.e., the Source Custodian), shall be assigned functional responsibility for each source. More than one source may be assigned to that individual.
- 5.1.4 Health Physics shall be made aware of who the Source Custodian is for each source.
- 5.1.5 The Source Custodian and Health Physics shall be aware of use of radioactive sources prior to their use (i.e., through signoff approval of procedures or signoff approval of work permits).
- 5.1.6 The Source Custodian shall be responsible for physical inventory control, and physical accountability of radioactive source(s) assigned to him/her.

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- 5.1.7 The Source Custodian is responsible for immediately notifying Contractor Management and Health Physics of lost or leaking radioactive sources.
- 5.1.8 Health Physics shall be assigned oversight responsibility for the following items: leak tests of radioactive sources; inventory audits; procedures/work permits; training and training records; prompt notification to DOE/ORO of lost, damaged, or leaking sources or theft of sources; acquisition/disposal/use of radioactive sources; promoting safe handling of radioactive sources; maintaining a master file of all radioactive source control records; and records maintenance for radioactive sources.
- 5.1.9 The Source Custodian shall have responsibility for procedures for the radioactive sources assigned to him/her.
- 5.2 Minimum Levels
- 5.2.1 Radioactive sources with activity levels greater than or equal to quantities shown in Table 1 shall be labeled per section 5.3 and controlled and accounted for per section 5.4.
- 5.3 Labeling
- 5.3.1 All radioactive sources with activity levels greater than or equal to quantities shown in Table 1 shall be permanently marked to permit individual source identification as follows: The label shall bear the radiation caution symbol and the words "CAUTION, RADIOACTIVE MATERIAL" or "DANGER, RADIOACTIVE MATERIAL." The label should also provide sufficient information to permit individuals handling or using the containers, or working in the vicinity thereof, to take precautions to avoid or minimize exposures. Such information

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should, as practicable, consist of: an identification number, isotopic identification, radiation type, dose rate at contact, activity, date of activity determination, and half-life. Sources permanently sealed within an outer container may have the source identification inscribed on the outer container. Unique circumstances which preclude labeling and/or permanent inscription shall be addressed on a case-by-case basis by the Source Custodian and Health Physics. Documentation of these situations shall be maintained.

5.4 Accountability And Control

- 5.4.1 A master inventory (see section 4.5) of all radioactive sources with activities greater than or equal to quantities shown in Table 1 shall be developed and maintained and shall be confirmed with the assistance of the Source Custodian every 6 months.
- 5.4.2 Radioactive sources not attached to structures (e.g., walls, cabinets, etc.) shall be stored in locked containers or other storage approved by Health Physics. Such containers or other storage approved by Health Physics shall have appropriate radiological posting and labeling (per DOE Order 5480.11). Note: Health Physics approved storage devices, utilizing tamper proof seals, and which are used to store multiple radioactive sources may be considered to be inventoried if the seal is unbroken, thus indicating that the contents had not been tampered with (i.e., the sources stored there had not been removed since the last inventory). Sources stored in such a manner would not need to be individually inventoried every 6 months. However, sources stored in such a manner shall be

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inventoried at least once per year. Also, such sources shall be leak tested prior to use unless the source has been leak tested within the last 6 months.

- 5.4.3 Radioactive sources shall not be permanently moved from their designated storage locations without written approval (i.e., written procedures or work permits) of the Source Custodian and Health Physics.
- 5.4.4 Radioactive sources shall be used according to Source Custodian and Health Physics approved written procedures or work permits.
- 5.4.5 Transport of radioactive sources shall be carried out according to Source Custodian and Health Physics approved procedures or work permits (i.e., when no written procedures have been developed). Such approval shall occur prior to transport. Documentation of the transport shall be maintained.
- 5.4.6 Appropriate dosimetry shall be used during the use and handling of radioactive sources.
- 5.4.7 Leak tests shall be performed on radioactive sources every 6 months. Records of such tests shall be maintained. Radioactive sources stored per section 5.4.2 (i.e., in tamper proof sealed storage devices) shall be tested prior to use unless the source has been leak tested in the last 6 months.
- 5.4.8 Leaking radioactive sources shall not be used. Such sources shall be handled (e.g., stored, disposed of, etc.) according to Source Custodian and Health Physics approved procedures or work permits.
- 5.4.9 Unsafe or potentially unsafe conditions shall be promptly corrected when identified.

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5.5 Procedures

- 5.5.1 Procedures shall be developed for the acquisition, inventory, labeling, survey (e.g., leak testing), use, transportation, disposal, emergencies, and storage. Such procedures shall be issued as controlled documents. Contractor Management, the Source Custodian, and Health Physics shall concur with such procedures prior to implementation. These procedures shall be reviewed at least once every two years and updated as necessary.
- 5.5.2 When an activity involving a radioactive source does not have an approved procedure, a Source Custodian and Health Physics approved work permit shall be provided prior to beginning that activity.
- 5.5.3 Health Physics shall have oversight responsibility for radioactive source control procedures and work permits.

5.6 Training

- 5.6.1 All Source Custodians and Source Users shall have radioactive source control training commensurate with risk and their responsibilities prior to receiving an assignment of work involving radioactive sources. Such training shall be documented.
- 5.6.2 Health Physics shall review and concur with all training material with regard to radioactive source control. Health Physics shall have oversight responsibility for auditing training records. Such training material (i.e., lecture material) shall be issued in the form of a controlled document. This material shall be reviewed at least once every two years and updated as necessary.

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5.7 Emergencies

- 5.7.1 Controlled emergency procedures shall be developed for loss, theft, damage, or leakage of radioactive sources per DOE Orders 5484.1 and 5480.11. The procedures shall, as a minimum, identify how to determine when an emergency has occurred (i.e., emergency action level), who to contact (e.g., name, title, phone number, etc.), who is in charge during the emergency, possible interim steps to take to diminish consequences of the emergency (i.e., prevent additional exposure, spreading of contamination, etc.), documentation, and training.
- 5.7.2 The ORO/EOC shall be notified immediately by telephone and written report of any lost, leaking, or damaged sources, or of a theft of such material.

5.8 Records

- 5.8.1 All radioactive source control records shall provide a readily accessible, chronological, historical record.
- 5.8.2 All such records shall be developed and stored in a manner consistent with current DOE Orders and industry practice.
- 5.8.3 Records of radioactive sources shall be maintained at the storage location, as practicable. The records shall contain the following information: source identification number, radiation type, material type (isotope and material form), source activity (in curies, uCi, mCi, etc.), date of activity determination, half-life of the isotope, Source Custodian name, date of inventory, name of person performing the inventory, dose rate on contact (as practicable) and at 12 inches from the source (as practicable).

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- 5.8.4 A copy of the NIST Traceability Certificate shall be on file for each source which is NIST traceable.
- 5.8.5 Sealed sources which are encapsulated, handled, and shipped as "special form" radioactive material shall have a valid certificate of compliance (COC) documenting compliance with 49 CFR 173 requirements for special form radioactive material on file.

5.9 Rights And Requirements of Employees

- 5.9.1 Employees using radioactive sources shall be required to comply with contractor radioactive source control procedures as a condition of employment.
- 5.9.2 Employees shall have the right to review job-related leak test results and surveys upon request.
- 5.9.3 Employees shall report promptly to Contractor Management any condition which might result in a violation of this policy or in unnecessary exposure to radiation or radioactive material.
- 5.9.4 Employees shall use personnel monitoring equipment as required by procedure, work permit, etc.
- 5.9.5 Employees shall be informed of the above rights, responsibilities, and requirements. Such instruction shall be documented. Health Physics shall have oversight responsibility for this documentation.

5.10 Compliance

- 5.10.1 Each contractor shall demonstrate compliance with this policy on or before January 1, 1991.
- 5.10.2 After January 1, 1991, contractor radioactive source control programs shall **10**

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be evaluated against this policy. As part of the compliance evaluation, the DOE will conduct random, unannounced radioactive source control surveys at the contractor's facilities.

5.11 Exemptions

5.11.1 Each contractor may request exemptions to specific requirements of this policy. Such requests shall be made in writing to the appropriate Contracting Officer's Representative (COR). The technical bases (i.e., references, calculations, etc.) for such requests shall be provided to the COR with the exemption request. The COR, with the concurrence of the ORO Safety and Health Division, will grant the exemptions if alternative radioactive source control measures proposed by the contractor adequately meet the intent of the ORO Radioactive Source Control Policy.

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Table 1
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| <u>Material</u> | <u>Microcuries</u> | <u>Material</u> | <u>Microcuries</u> |
|---------------------|--------------------|-----------------|--------------------|
| Americium-241 | 0.01 | Gold-199 | 100 |
| Antimony-122 | 100 | Hafnium-181 | 10 |
| Antimony-124 | 10 | Holmium-166 | 100 |
| Antimony-125 | 10 | Hydrogen-3 | 1,000 |
| Arsenic-73 | 100 | Indium-113m | 100 |
| Arsenic-74 | 10 | Indium-114m | 10 |
| Arsenic-76 | 10 | Indium-115m | 100 |
| Arsenic-77 | 100 | Indium-115 | 10 |
| Barium-131 | 10 | Iodine-125 | 1 |
| Barium-133 | 10 | Iodine-126 | 1 |
| Barium-140 | 10 | Iodine-129 | 0.1 |
| Bismuth-210 | 1 | Iodine-131 | 1 |
| Bromine-82 | 10 | Iodine-132 | 10 |
| Cadmium-109 | 10 | Iodine-133 | 1 |
| Cadmium-115m | 10 | Iodine-134 | 10 |
| Cadmium-115 | 100 | Iodine-135 | 10 |
| Calcium-45 | 10 | Iridium-192 | 10 |
| Calcium-47 | 10 | Iridium-194 | 100 |
| Carbon-14 | 100 | Iron-55 | 100 |
| Cerium-141 | 100 | Iron-59 | 10 |
| Cerium-143 | 100 | Krypton-85 | 100 |
| Cerium-144 | 1 | Krypton-87 | 10 |
| Cesium-131 | 1,000 | Lanthanum-140 | 10 |
| Cesium-134m | 100 | Lutetium-177 | 100 |
| Cesium-134 | 1 | Manganese-52 | 10 |
| Cesium-135 | 10 | Manganese-54 | 10 |
| Cesium-136 | 10 | Manganese-56 | 10 |
| Cesium-137 | 10 | Mercury-197m | 100 |
| Chlorine-36 | 10 | Mercury-197 | 100 |
| Chlorine-38 | 10 | Mercury-203 | 10 |
| Chromium-51 | 1,000 | Molybdenum-99 | 100 |
| Cobalt-58m | 10 | Neodymium-147 | 100 |
| Cobalt-58 | 10 | Neodymium-149 | 100 |
| Cobalt-60 | 1 | Nickel-59 | 100 |
| Copper-64 | 100 | Nickel-63 | 10 |
| Dysprosium-165 | 10 | Nickel-65 | 100 |
| Dysprosium-166 | 100 | Niobium-93m | 10 |
| Erbium-169 | 100 | Niobium-95 | 10 |
| Erbium-171 | 100 | Niobium-97 | 10 |
| Europium-152 (9.2h) | 100 | Osmium-185 | 10 |
| Europium-152 (13y) | 1 | Osmium-191m | 100 |
| Europium-154 | 1 | Osmium-191 | 100 |
| Europium-155 | 10 | Osmium-193 | 100 |
| Fluorine-18 | 1,000 | Palladium-103 | 100 |
| Gadolinium-153 | 10 | Palladium-109 | 100 |
| Gadolinium-159 | 100 | Phosphorus-32 | 10 |
| Gallium-72 | 10 | Platinum-191 | 100 |
| Germanium-71 | 100 | Platinum-193m | 100 |
| Gold-198 | 100 | Platinum-193 | 100 |

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Table 1
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| Material | Microcuries | Material | Microcuries |
|------------------|-------------|------------------------|-------------|
| Platinum-197m | 100 | Tellurium-132 | 10 |
| Platinum-197 | 100 | Terbium-160 | 10 |
| Plutonium-239 | 0.01 | Thallium-200 | 100 |
| Polonium-210 | 0.1 | Thallium-201 | 100 |
| Potassium-42 | 10 | Thallium-202 | 100 |
| Praseodymium-142 | 100 | Thallium-204 | 10 |
| Praseodymium-143 | 100 | Thorium | 1000 |
| Promethium-147 | 10 | (natural) ¹ | |
| Promethium-149 | 10 | Thulium-170 | 10 |
| Radium-226 | 0.01 | Thulium-171 | 10 |
| Rhenium-186 | 100 | Tin-113 | 10 |
| Rhenium-188 | 100 | Tin-125 | 10 |
| Rhodium-103m | 100 | Tungsten-181 | 10 |
| Rhodium-105 | 100 | Tungsten-185 | 10 |
| Rubidium-86 | 10 | Tungsten-187 | 100 |
| Rubidium-87 | 10 | Uranium ² | 1000 |
| Ruthenium-97 | 100 | (natural) | |
| Ruthenium-103 | 10 | Uranium-233 | 0.01 |
| Ruthenium-105 | 10 | Uranium-234- | 0.01 |
| Ruthenium-106 | 1 | Uranium-235 | |
| Samarium-151 | 10 | Vanadium-48 | 10 |
| Samarium-153 | 100 | Xenon-131m | 1,000 |
| Scandium-46 | 10 | Xenon-133 | 100 |
| Scandium-47 | 100 | Xenon-135 | 100 |
| Scandium-48 | 10 | Ytterbium-175 | 100 |
| Selenium-75 | 10 | Yttrium-90 | 10 |
| Silicon-31 | 100 | Yttrium-91 | 10 |
| Silver-105 | 10 | Yttrium-92 | 100 |
| Silver-110m | 1 | Yttrium-93 | 100 |
| Silver-111 | 100 | Zinc-65 | 10 |
| Sodium-24 | 10 | Zinc-69m | 100 |
| Strontium-85 | 10 | Zinc-69 | 1,000 |
| Strontium-89 | 1 | Zirconium-93 | 10 |
| Strontium-90 | 0.1 | Zirconium-95 | 10 |
| Strontium-91 | 10 | Zirconium-97 | 10 |
| Strontium-92 | 10 | | |
| Sulphur-35 | 100 | | |
| Tantalum-182 | 10 | | |
| Technetium-96 | 10 | | |
| Technetium-97m | 100 | | |
| Technetium-97 | 100 | | |
| Technetium-99m | 100 | | |
| Technetium-99 | 10 | | |
| Tellurium-125m | 10 | | |
| Tellurium-127m | 10 | | |
| Tellurium-127 | 100 | | |
| Tellurium-129m | 10 | | |
| Tellurium-129 | 100 | | |
| Tellurium-131m | 10 | | |

¹ Based on alpha disintegration rate of Th-232, Th-230, & their daughter products.

² Based on alpha disintegration rate of U-238, U-234, & U-235.

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| <u>Material</u> | <u>Microcuries</u> |
|---|--------------------|
| Any alpha emitting radionuclide not listed above or mixtures of alpha emitters of unknown composition | 0.01 |
| Any radionuclide, other than alpha emitting radionuclides, not listed above or mixtures of beta emitters of unknown composition | 0.1 |

United States Government

Department of Energy

Oak Ridge Operations

memorandum

DATE: April 10, 1990

REPLY TO

ATTN OF: SE-334:Polehn

SUBJECT: **ORO RADIOACTIVE SOURCE CONTROL POLICY**

- TO:
- W. F. Manning, Assistant Manager for Strategic Petroleum Reserve, PR-60
 - J. A. Reafsnyder, Deputy Assistant Manager for Energy Research and Development, ER-10
 - G. W. Westerbeck, FMPC Site Manager, DP-84
 - R. J. Spence, Y-12 Site Manager, DP-81
 - E. W. Gillespie, Portsmouth Site Manager, EO-221
 - D. R. Allen, Paducah Site Manager, EO-222
 - M. M. Heiskell, K-25 Site Manager, DP-852
 - K. D. Helms, Project Manager, CEBAF Site Office, ER-13
 - S. H. McCracken, Project Manager, Weldon Spring Site Remedial Action Project, EW-94

The attached policy has been revised to address remaining contractor concerns.

Please transmit the revised policy to the contractor for implementation. If you have questions, please contact J. L. Polehn of my staff at (FTS) 626-5206.

David B. Howard
 David B. Howard, Director
 Safety and Health Division

Attachment:
As stated

cc:
 D. R. Nelson, EH-352
 G. L. Love, K-25, Bldg. 1001, MS-7155

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