OCCUPATIONAL RADIATION PROTECTION PROGRAM

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Directorate of Materials Management
DNSC-M

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PREFACE

This November, 2009 revision of the Defense National Stockpile Center (DNSC) Radiation Protection Guidelines supersedes all previous publications relating to radiological protection for DNSC personnel and property.

It is the stated policy and goal of the DNSC to establish appropriate and adequate procedures and controls to minimize exposure to ionizing radiation, to DNSC employees and the general public, to "AS LOW AS REASONABLY ACHIEVABLE", (ALARA). Adherence to the guidance set forth in this document will afford the protection necessary to achieve this goal and greatly minimize the biological effects of low level radiation exposure.

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DEFENSE NATIONAL STOCKPILE CENTER

OCCUPATIONAL RADIATION PROTECTION PROGRAM

1. Purpose

The policy stated herein establishes guidelines for protection against ionizing radiation and an "Occupational Radiation Protection Program" (ORPP) for the handling and storage of licensed radioactive source materials at Defense National Stockpile Center (DNSC) facilities.

2. Scope

These guidelines apply to all DNSC personnel, visitors, and contractor personnel who, by the nature of their duties, may be exposed to ionizing radiation at locations where licensed DNSC radioactive materials are stored.

3. Responsibility

3.1 The Occupational Radiation Protection Manager (ORPM) is responsible for the development and overall administration of the ORPP. It is the responsibility of the ORPM to designate Radiological Safety Officers (RSO's), and Depot Radiological Protection Officers (RPO's), to carry out the functional responsibilities included in these guidelines. These individuals shall be designated in writing and their position descriptions shall be annotated to reflect the additional duty.

3.2 The Chief of Stockpile Operations (DNSC-MO) is responsible for nominating personnel to be RPO's, assuring that they attend the required training course(s) approved by the ORPM, and ensuring the establishment of an Emergency Response Plan by the manager of each depot where licensed radioactive stockpile materials are stored.

3.3 The RSO's are responsible for monitoring the effectiveness of the depots' radiological programs and extending the training program among personnel as required.

3.4 Distribution Facility Managers and Depot RPO's are responsible for the day to day supervision of the ORPP at their respective facilities. They are also responsible for and will ascertain that prescribed monitoring and safety precautions are taken with respect to radioactive materials.

3.5 It is the responsibility of the Depot RPO's to immediately notify the appropriate responsible officials (i.e., fire department, DNSC officials, etc) and take appropriate action in the event of an incident involving the release or potential release of radioactive materials in accordance with the depots' Emergency Protection Plans.

4. Program Requirements

An active, closely supervised ORPP will be implemented at a high level of organization, training, and proficiency at each DNSC facility storing radioactive materials. In implementing and maintaining the ORPP, the following specific requirements will be observed:

4.1 Each Depot RPO will maintain current copies of this ORPP. Depot RPO's will periodically review all plans and procedures, care for and maintain instruments, inspect records and materials in storage.

4.2 All personnel entering a restricted area shall first complete a DD Form 1952, “Dosimeter Application And Record Of Occupational Radiation Exposure”. Mailing addresses shall be obtained for all Non-DNSC personnel and dosimetry results shall be forwarded to them, annually. A permanent record on DD Form 1141, Record Of Occupational Exposure To Ionizing Radiation, will be maintained for each potentially exposed person (when monitoring has been provided), by the Depot RPO. A computer generated form containing the same information as the printed DD Form 1141 is authorized; this will be referred to as the Automated Dosimetry Record (ADR).

4.3 Section 206 of Public Law 93-438 “Energy Reorganization Act of 1974”, NRC Form 3 "Notice To Employees", “Notice of Violation” involving radiological working conditions (within two working days after receipt of the documents from the Commission and for a minimum of 5 working days or until action correcting the violation has been completed, whichever is later), and the location of the NRC license will be posted so as to be clearly visible.

4.4 Each depot having licensable radioactive materials in storage will have on hand as a minimum, two instruments capable of detecting alpha and gamma radiation, one alpha and one gamma check source, and TLD’s for each employee. A supply of TLD’s shall also be maintained for use by occasional visitors at any facility that has a restricted area.

4.5 The RSO’s shall make, at a minimum, one survey per year at each depot **containing licensed materials** to review, 1) records, 2) inventories of instruments, check sources and licensed materials, 3) instrument calibration, 4) dosimetry services, and 5) Emergency Protection Plans. During the survey they shall also monitor all licensed material and evaluate radiation safety procedures through observation and discussion with the Depot RPO’s, managers, supervisors, and other employees. Further, they shall prepare a comprehensive report detailing their annual survey and forward the same to the ORPM . The survey reports shall also: 1) Utilize a format and include the checklists provided by the ORPM; 2) contain a written evaluation of public dose compliance as noted in 10 CFR 20.1302 and 3) note the specific range of employee accumulated doses for the past year.

4.6 Depot RPO's shall review, and document this review of, all exposure records (DD Form 1141 or ADR) quarterly. Annually, they shall notify each person monitored of his/her accumulated dose and obtain written acknowledgements from the employees that shall be placed in the depot records. The notification shall be in accordance with the requirements of Title 10 CFR 19.13 and include the statement: *“This report is furnished to you under the provisions of the NRC regulation 10 CFR Part 19. You should preserve this report for further reference.”*. Additionally, the Depot RPO's shall monitor operational activities relating to licensed radioactive materials, and maintain appropriate records of such operations.

4.7 Depot RPO's shall be responsible for the coordination of shipments and paperwork, including Nuclear Regulatory Commission reporting requirements . Strict compliance with 49 CFR § 173 shipping and labeling requirements shall be observed.

4.8 Once each fiscal year, RSO's shall coordinate with Distribution Facility Managers to set aside a monthly safety meeting for radiation protection training. The RSO's shall provide the training to all personnel except the guard force and clerical staff. Upon completion of the training, the RSO shall notify the ORPM, in writing, of the names of all attendees at the meeting. Training of the guard force will be accomplished in the form of written post instructions.

4.9 The ORPM shall audit the program by reviewing the annual reports submitted by the RSO's to determine compliance with the requirements of the NRC license and the ORPP and shall also annually review the overall licensed radiation protection program, NRC regulations, provisions of the NRC License and compliance status of the DNSC program. The ORPM shall report any adverse findings to senior management and shall forward each annual survey to DNSC-MO to advise of the status of the program at the depot.

4.10 Depot RPO's shall conduct a physical inventory of all NRC licensed material once each fiscal year. This inventory shall be documented in writing and kept on file at the depot. A copy shall be forwarded to the ORPM. Shipments or receipts of licensed material shall be reported by the Depot RPO's directly to the ORPM within 5 work days.

4.11 Depot RPO's shall establish a Decommissioning File at each location storing licensable material. The file shall contain the following records:

a. documentation indicating where radioactive materials have been stored, handled or used.

b. documentation of any spills or areas found to be contaminated

c. copies of all annual surveys and surveys performed after sampling repackaging or shipping activities

d. inventories and documentation regarding disposal, sale or shipmentof radioactive commodities.

5. Control Measures

The greatest emphasis should be placed on engineering control measures to reduce exposures to levels "As Low As Reasonably Achievable" (ALARA).

5.1 Ventilation, Dust Collection, Isolation, and Facility Layout. Ventilation systems are not normally utilized during regular handling and storage of licensed material within DNSC as they are normally kept in unopened, sealed containers. However, local exhaust ventilation systems may be necessary in the rare event of a special project.

Prior to the beginning of a repackaging or decontamination project, an assessment shall be made by the ORPM, the radiological officers, and other stockpile personnel, to determine if there is a need for additional controls. Engineering controls such as, but not limited to, isolation, enclosure, exhaust ventilation and dust collection shall be used to meet the NRC exposure limit criteria.

5.2 Access. The layout of storage facilities shall be such that it minimizes exposure to ionizing radiation. For example, radioactive commodities shall be consolidated and isolated to limit access. Warehouses shall generally be kept locked and sealed and a log maintained to control the issuance of numbered seals. Depot access is to be controlled by perimeter fences along the site boundary and a full time security force.

5.3 Shielding.

For materials stored inside buildings or structures, if necessary, highly dense material in drums can serve as an effective perimeter shield. Normally, lead, concrete, or a combination of the two is used to attenuate the highly penetrative gamma rays. If shielding material is installed, special attention should be paid to such details as overlapping joints, eliminating voids or non-homogeneities in the shielding material, the need for structural support for non-load bearing material such as lead, the need to ensure proper attenuation through leaky areas in the shield, (e g., glass windows, joints, seams, pipes, conduits, service boxes and doors). There is also a need for continuous maintenance of the shielding structure, to prevent deterioration.

5.4 Time. The longer, a person is exposed to radiation, the greater the biological risk. It should be understood that work operations involving radioactive stockpile commodities, particularly thorium nitrate or oxide, should take into account the length of time a person is exposed to a given dose of radiation. Personal monitoring, in conjunction with radiation surveys, are necessary to ensure that workers; a) are not exposed to radiation in excess of NRC regulations and b) exposure for a particular work task is maintained ALARA

5.5 Distance. Distance is a practical method of reducing the amount of radiation exposure to persons conducting stockpile work operations in and around radioactive materials. The levels of radiation decline rapidly as the distance is increased between the source and the person.

5.6 Protective Equipment. Every effort shall be made to reduce potential radiation exposures by the methods noted above. There may be times, however, when personal protective clothing and equipment will be the primary means of personnel protection, especially for airborne radionuclide particulates. Respirators shall be chosen for use according to the DNSC Occupational Health Guidelines for Respiratory Protection. Such respirators shall be approved for use in atmospheres containing radionuclides by the National Institute for Occupational Safety and Health (NIOSH). The specific type of respiratory protective equipment to be used shall be based on the judgment of the ORPM or a RSO.

Special training is necessary for the proper usage of personal protective clothing and equipment; such training (except for the care and use of respirators) is the responsibility of the Depot RPO's. Respiratory protection training is the responsibility of Respiratory Protection Designees as noted in the DNSC Respiratory Protection Program.

6. Precautionary Measures.

There are a number of measures that the Radiological Protection Officers and other depot personnel should be aware of at all times:

--the amount of exposure should be controlled in accordance with section 5.0 of this document,

--employee rotation (dose sharing),

--eating, drinking, smoking or chewing gum is strictly prohibited in areas containing radioactive materials,

--personal belongings such as: watches, rings, combs, etc shall not be worn while working in restricted areas,

--persons with open wounds shall not be allowed work in areas containing radioactive materials,

--if a person receives a cut or wound during a work operation involving radioactive materials, they shall immediately be removed from that area and the wound shall immediately be attended to,

--containers of licensable radioactive materials that are to be received into the Defense National Stockpile shall be thoroughly inspected for contamination and leaks prior to storage; in accordance with 10 CFR 20.1906,

--engineering controls, such as shielding, local exhaust ventilation, dust collection and isolation shall be used when and where necessary,

--handling of radioactive materials shall be carried out in a manner, which will prevent damage to the containers and reduce radiation exposure to ALARA,

--personnel shall exercise good personal hygiene habits (e.g., washing and showering thoroughly) when conducting work operations involving contact with radioactive materials,

--personnel shall wear personal protective equipment when conducting work operations where they may come into contact with airborne radioactive materials, or their gases,

--personnel shall be monitored by dose rate and contamination surveys during and after contact with licensed radioactive materials,

--radiation doses measured by personal dosimetry shall he recorded immediately after determination of the dose,

--shipment of licensed materials shall be in accordance with all federal, state, and local regulations,

7. Waste Disposal.

Shipment of radioactive waste is performed by a Department of Defense (DOD) Broker under contract to the DOD Executive Agent for Low-Level Radioactive Waste (US Army Joint Munitions Command). The broker is responsible for packaging the items and shipping them in accordance with applicable DOT regulations. The RPO is responsible for ensuring that all work performed by the broker is performed in accordance with the ALARA principle, standard radiological health practices, and this manual.

8. Warning Signs. Labels. Markings and Placards.

8.1 General. Documents, notices, signs, or forms shall be conspicuous, and shall be replaced if defaced or otherwise rendered illegible.

8.2 Notices. Items a., b, & d. below shall be posted such that workers have access to them as they travel to/from work. The other items can be posted with a notice as to where persons entering a Radioactive Materials Area (RAM) can review them:

a. NRC Form 3, Notice to Employees.
b. 10 CFR Parts 19, 20, 21
c. NRC license for DNSC and amendments
d. Notice of Violation, or any other applicable infraction, involving radiological working conditions.
e. Section 206, Energy Reorganization Act

8.3 Radioactive Material (RAM) Areas. Radioactive Material Areas shall be posted at each entrance of a building, room, or area. An area within a building may be designated a RAM area by the use of stanchions positioned such that the posting is clearly visible from each avenue of approach.

a. Restricted areas where dose rates exceed 5.0 mR/hr at any point shall be posted with conspicuous signs in accordance with 10 CFR 20.1902(a).

b. Any area which contains more than 1,000 microcuries of licensed material shall be posted with conspicuous signs in accordance with 10 CFR 20.1902(e).

9. Exposure Criteria and Evaluation.

There are some basic assumptions that have been derived in formulating radiation protection guidelines. They are: 1) the biological effects of low level radiation are not precisely known, 2) there is no known level of radiation below which there will be no biological effects, and 3) there is a linear relationship between biological effects and dose.

Permissible levels of radiation exposure in an occupational environment are set higher than in a non-occupational environment.

9.1 DNSC Exposure Criteria.

9.1.1 The maximum permissible occupational dose is 5.0 rems per year. The maximum permissible dose to members of the public is 100 millirem per year.

9 1.2 The DNSC maximum permissible dose rate within a controlled area shall not exceed 0.50 mR/hr. A Restricted Area shall be established where dose rates exceed 0.50 mR/hr at a distance of one foot from the material.

9.1.3 TLD's shall be used by ALL personnel entering a restricted area WHERE THEY ARE LIKELY TO RECEIVE, IN ONE YEAR, A DOSE IN EXCESS OF 500 mRem. The RSO will annually evaluate the need for personnel dosimetry at the depot and document the evaluation in the annual survey.

9.1.4 The DNSC maximum permissible dose rate at the perimeter fence of the storage facility shall not exceed background.

9.1.5 Minors shall not be permitted to enter restricted areas.

9.1.6 Because of the DNSC mission and operational structure, exposure to radiation is limited. It is, however, recognized that radiation exposure can produce damaging effects to embryos and fetuses, especially when received during certain periods of gestation. Because of this sensitivity, it is DNSC policy to minimize fetal exposure to radiation. DNSC employees who are at risk for occupational exposure and who are pregnant, or believe that they could be pregnant, are encouraged to notify their supervisor and/or Radiation Protection Officer, in writing, and to discuss the situation, risks, and possible consequences of continued exposure. All such discussions will remain confidential. All female employees likely to receive an occupational dose, and all supervisors at NRC licensed sites, shall be given a copy of NRC Regulatory Guide 8.13, "Instructions Concerning Prenatal Radiation Exposure" and instructed in the potential risks of exposure to ionizing radiation during pregnancy.

Upon receipt of a written notification containing the estimated date of conception, pregnant employees shall be provided with an alternate work assignment comparable to their current position that will eliminate occupational exposure to radiation during the remainder of their pregnancy.

Declared pregnant workers (DPW) will not be exposed to more than 100 millirem during the gestation period after they have declared their pregnancy in writing to their supervisor. Supervisors are responsible for informing the RPO of all such declarations as soon as possible, providing a copy of the declaration to the RPO and taking appropriate action to limit the worker's potential exposure for the remainder of the pregnancy. If the worker has already received 100 millirem from the time of conception to the time of declaration, contact the ORPM for additional guidance. DNSC employees unable to continue their regular duties because of this limitation will be provided with an alternative work assignment, free from occupational radiation exposure, that will have no adverse effect on their rate of pay, benefits or promotion.

10. Standards and Regulations.

Applicable standards, regulations and guidelines shall be fully understood and complied with when handling, storing, or, shipping licensed radioactive materials in the Defense National Stockpile. A list of these standards can be found in Appendix B.

11. Surveys

Annual radiological surveys shall be conducted at each facility containing licensed material by an RSO. They shall include, but not be limited to, a physical survey of the material and equipment, review of records, review of training, and interviews of the Distribution Facility Manager and RPO.

As a minimum the survey shall include the requirements outlined in 10 CFR Part 20. 1501. Surveys shall also include measurements of dose rates at contact with the container (where practical), at one foot distance, at the perimeter of any restricted area, and at the depot perimeter if the depot contains a restricted area. (NOTE: In lieu of radiological measurements at the Depot perimeter, measurements may be taken within the controlled area at a point where levels of radiation do not exceed background.) The RSO shall also document the location of licensed materials in the depot and assure that an inventory was conducted within the past 365 days.

12. Decontamination & Decommissioning

When closing out a facility or "decommissioning" a specific storage building, area, material or equipment, residual radioactive contamination must be addressed. The procedures, level or limits established by the Nuclear Regulatory Commission (NRC) in their document NUREG 1757 “Consolidated Decommissioning Guidance: Decommissioning Process for Materials Licensees” shall be used. Specific procedures shall be developed by the ORPP Manager. Decontamination actions shall be documented in writing.

13. Instrumentation

13.1 Monitoring instruments shall have sufficient sensitivity, precision, and dynamic range to accommodate the type of radiation being measured.

13.2 The monitoring level on the instruments should be set at the level of radiation expected to be encountered. Review of previous survey results in the area will provide the expected levels.

13.3..Annual calibration of all monitoring instruments is MANDATORY. Calibration must be performed by a laboratory possessing a valid NRC or Agreement State license. When the instruments are received from the calibration facility, establish a baseline for future operational checks by taking a reading with the appropriate check source. Place a written record of the date, reading, instrument and source serial numbers in the depot calibration file.

13.4 TLD’s must be obtained from, processed and evaluated by, the Department of the Army Ionizing Radiation Dosimetry Center.

14. Emergency Procedures

14.1 DNSC-MO is responsible to ensure that each Manager, at depots where radioactive material is stored, establishes an Emergency Protection Plan. These procedures shall be reviewed and/or updated annually. The revisions must be reviewed by the RPO.

14.2 Prior arrangements should be established with local police and fire departments, hospitals, in-house and outside emergency squads and other medical facilities. Evacuation routes and assembly points should be designated. Documentation of meetings/contacts with outside agencies shall be maintained.

15. Medical Surveillance

A pre-employment and annual medical examination program for stockpile employees potentially exposed to hazardous and radioactive materials shall be conducted. Complete medical records for each employee shall be maintained by the servicing health unit.

16. Records

16.1 The Nuclear Regulatory Commission requires each licensee to keep exposure, monitoring, survey, disposal, and decontamination records. These records shall be kept indefinitely at the depots where the licensed material is stored. Copies of radiation surveys will be forwarded to the DNSC Headquarters.

16.2 The depot RPO at each site where licensed source material is stored will establish a Radiological Data Book containing license data, exposure data, calibration data, the DNSC ORPP and all other documents related to the source material at the site. Included shall be written records of quarterly exposure reviews, annual radiation exposure notifications, and initial and annual radiation safety training

16.3 Dosimetry Records: See Defense Logistics Agency One Book “Personnel Dosimetry and Recordkeeping” for scope and disposition.

17. Training

17.1 Radiological officers shall be given at least 40 hours formal classroom training commensurate with their assigned duties and specific to their responsibilities within the DNSC ORPP. Training courses must be approved by the ORPM. As a minium, the training shall include: the fundamentals of ionizing radiation, its characteristics, and appropriate units of measure, evaluation techniques, instrumentation, biological effects, NRC Regulations, and control measures. Refresher training shall be provided triennially. Additionally radiological officers shall receive training in DoT Regulations.

17.2 All depot personnel (except clerical staff and security personnel) shall receive annual training regarding potential hazards, precautions to minimize exposure, work practices and operating procedures, personal hygiene, information contained in NRC Regulatory Guide 8.13, and use of personal protective clothing and equipment. The RSO's shall develop a detailed, site specific, outline which will be kept on file at the depot. Attendance at all training sessions shall be documented and lists kept on file (See paragraph 4.8). At the conclusion of the training, a written test shall be administered; the passing grade shall be 70%. Persons failing the test shall be retrained and tested.

17.3 Security personnel who may encounter radiological hazards during the performance of their duties will be properly instructed, annually. The scope of the training will be appropriate to the level of exposure as determined by the RSO and may be in the form of written instruction rather than formal classroom training.

DEFINITIONS

APPENDIX A

DEFINITIONS

Absorbed dose means the energy imparted by ionizing radiation per unit mass of irradiated material. The units of absorbed dose are the rad and the gray (Gy).

Activity is the rate of disintegration (transformation) or decay of radioactive material. The units of activity are the curie (Ci) and the becquerel (Bq).

Adult means an individual 18 or more years of age.

Airborne radioactive material means radioactive material dispersed in the air in the form of dusts, fumes, particulate, mists, vapors, or gases.

Airborne radioactivity area means a room, enclosure, or area in which airborne radioactive materials, composed wholly or partly of licensed material, exist in concentrations:

(1) In excess of the derived air concentrations (See Appendix B, 10 CFR Part 20) or,

(2) To such a degree that an individual present in the area without respiratory protective equipment could exceed, during the hours an individual is present in a week, an intake of 0.6 percent of the annual limit on intake (ALI) or 12 DAC hours.

ALARA (acronym for "as low as is reasonably achievable") means making every reasonable effort to maintain exposures to radiation as far below the dose limits in this part as is practical, consistent with the purpose for which the licensed activity is undertaken, taking into account the state of technology, the economics of improvements in the relation to state of technology, the economics of improvements in relation to benefits to the public health and safety, and other societal and socioeconomic considerations, and in relation to utilization of nuclear energy and licensed materials in the public interest.

Background Radiation means radiation from cosmic sources, naturally occurring radioactive materials, including radon (except as a decay product of source or special nuclear material) and global fallout as it exists in the environment from the testing of nuclear explosive devices. "Background radiation" does not include radiation from source, byproduct, or special nuclear materials regulated by the Commission.

Bioassay (radiobioassay) means the determination of kinds, quantities or concentrations and in some cases, the locations of radioactive material in the human body, whether, by direct measurement (in vivo counting) or by analysis and evaluation of materials excreted or removed from the human body.

Byproduct material means

(1) Any radioactive material (except special nuclear- material) yielded in, or made radioactive by, exposure to the radiation incident to the process of producing or utilizing special nuclear material; and,

(2) The tailings or wastes produced by the extraction or concentration of uranium or thorium from ore processed primarily for its source material content, including discrete surface wastes

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resulting from uranium solution extraction processes. Underground ore bodies depleted by these solution extraction operations do not constitute "byproduct material" within this definition.

Collective dose is the sum of the individual doses received in a given period of time by a specified population from exposure to a specified source of radiation.

Committed dose equivalent means the dose equivalent to organs or tissues of reference that will be received from an intake of radioactive material by an individual during the 50-year period following the intake.

Committed effective dose equivalent is the sum of the products of the weighting factors applicable to each of the body organs or tissues that are irradiated and the committed dose equivalent to these organs or tissues.

Controlled area means an area, outside a restricted area but inside the site boundary, access to which can be limited by the licensee for any reason.

Declared Pregnant woman means a woman who has voluntarily informed her employer, in writing, of her pregnancy and the estimated date of conception.

Deep-dose equivalent which applies to external whole-body exposure, is the dose equivalent at a tissue depth of 1 cm.

Dose or radiation dose is a generic term that means absorbed dose, dose equivalent, effective dose equivalent, committed dose equivalent, committed effective dose equivalent, or total effective dose equivalent.

Dose equivalent means the product of the absorbed dose in tissue, quality factor, and all other necessary modifying factors at the location of interest. The units of dose equivalent are the rem and sievert.

Dose Rate is a measure of dose per unit of time.

Effective dose equivalent is the **sum** of the products of the dose equivalent to the organ or tissue and the weighting factors applicable to each of the body organs or tissues that are irradiated.

Exposure means being exposed to ionizing radiation or to radioactive material.

External dose means that portion of the dose equivalent received from radiation sources outside the body.

High radiation area means an area accessible to individuals, in which radiation levels could result in an individual receiving a dose equivalent in excess of 0.1 rem in 1 hour at 30 centimeters from the radiation source or from any surface that the radiation penetrates.

Individual monitoring means

(1) The assessment of dose equivalent by the use of devices designed to be worn by an individual,

(2) The assessment of committed effective dose equivalent by bioassay (see Bioassay) or by determination of the time-weighted air concentrations to which an individual has been exposed ,or

(3) The assessment of dose equivalent by the use of survey data.

Internal dose means that portion of the dose equivalent received from radioactive material taken into the body.

Licensed material means source material, special nuclear material, or byproduct material received, possessed, used, transferred or, disposed of under a general or specific license by the Commission.

Limited quantity means a quantity of radioactive material not exceeding the materials package limits of 49 CFR 173.423 which conforms to the requirements in 49 CFR 173.421.

Limits (dose limits) means the permissible upper bounds of radiation doses.

Low specific activity (LSA) material generally means uranium or thorium ores and their physical or chemical concentrates; a material of low activity and heavy weight as noted in 49 CFR 173.403).

Member of the Public means any individual except when that individual is receiving an occupational dose.

Minor means an individual less than 18 years of age.

Monitoring means the measurement of radiation levels, concentrations, surface area concentrations or quantities of radioactive material and the use of the results of these measurements to evaluate potential exposures and doses.

Occupational dose means the dose received by an individual in the course of employment in which the individual's assigned duties involve exposure to radiation or to radioactive material from licensed and unlicensed sources of radiation, whether in the possession of the license or other person. Occupational dose does not include dose received from background radiation or as a member of the general public.

Public dose means the dose received by a member of the public from exposure to radiation or radioactive material released by a licensee, or to any other source of radiation under the control of a licensee. It does not include occupational dose or doses received from background radiation.

Radiation (ionizing radiation) means alpha particles, beta particles, gamma rays, x-rays, neutrons, high-speed electrons, high-speed protons, and other particles capable of producing ions. Radiation, as used in this program, does not include non-ionizing radiation, such as radio-or microwaves, or visible, infrared, or ultraviolet light.

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Radiation area means an area, accessible to individuals, in which radiation levels could result in an individual receiving a dose equivalent in excess of 0.005 rem (0.05 mSv) in 1 hour at 30 centimeters from the radiation source or from any surface that the radiation penetrates.

Rem is the special unit of any of the quantities expressed as dose equivalent The dose equivalent in rems is equal to the absorbed dose in rads multiplied by the quality factor, 1 rem = 0.01 sievert (Sv)

Restricted Area means an area, access to which is limited by the licensee for the purpose of protecting individuals against risks from exposure to radiation.

Shallow-dose equivalent which applies to the external exposure of the skin or an extremity is taken as the dose equivalent at a tissue depth of 0.007 centimeter averaged over an area of 1 square centimeter.

Sievert (Sv) is the Standard International (SI) unit of any of the quantities expressed as dose equivalent. The dose equivalent in sieverts is equal to the absorbed dose in grays multiplied by the quality factor, 1 Sv = 100 rems.

Site boundary means that line beyond which the land or property is not owned, leased, or otherwise controlled by the licensee.

Source material means:

(1) Uranium or thorium or any combination or uranium and thorium in any physical or chemical form; or

(2) Ores that contain, by weight, one-twentieth of 1 percent (0.05 percent), or more, of uranium, thorium, or any combination or uranium and thorium (see 40 CFR 40.4). NOTE Source material does not include special nuclear material.

Survey means an evaluation of the radiological conditions and potential hazards incident to the production, use, transfer, release, disposal, or presence of radioactive material or other sources of radiation When appropriate, such an evaluation includes a physical survey of the location of radioactive material and measurements or calculations of levels of radiation, or concentrations or quantities of radioactive material present.

Total Effective Dose Equivalent (TEDE) means the sum of the deep-dose equivalent (for external exposure and the committed effective dose equivalent (for internal exposures).

Unrestricted area means an area, access to which is neither limited nor controlled by the licensee.

APPLICABLE REGULATIONS

APPENDIX B

APPLICABLE REGULATIONS

1. Title 10, Code of Federal Regulations (Energy), parts 19, 20, 40, and 71.

2. Title 29, Code of Federal Regulations (Labor), part 1910.

3. Title 40, Code of Federal Regulations (Environment), all applicable parts.

4. Title 49, Code of Federal Regulations (Transportation), parts 171 – 189.

5. All Applicable State Rules and Requirements governing the use, storage transportation and disposal of radioactive source material.

6. DLA One Book Personnel Dosimetry and Recordkeeping

7. DNSC Respiratory Protection Program.

APPENDIX B

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UNITS OF RADIOLOGICAL MEASUREMENT

APPENDIX C

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UNITS OF RADIOLOGICAL MEASUREMENT

MULTIPLY # OF → by → TO OBTAIN # OF
TO OBTAIN # OF ← by ← DIVIDE # OF

becquerel	2.703×10^{-11}	curies
curies	3.70×10^{10}	disintegrations /sec
curies	10^{3}	millicuries
curies	10^{6}	microcuries
curies	10^{12}	picocuries
curies	10^{-3}	kilocuries
curies	3.7×10^{10}	becquerel
dis/min	4.505×10^{-10}	millicuries
dis/min	4.505×10^{-7}	microcuries
dis/sec	2.703×10^{-8}	millicuries
dis/sec	2.703×10^{-5}	microcuries
gray	100	rad
kilocuries	10^{3}	curies
microcuries	$3\ 7 \times 10^{4}$	dis/sec
microcuries	2.2×10^{6}	dis/min
millicuries	3.7×10^{7}	dis/sec
millicuries	2.22×10^{9}	dis/min

APPENDIX C

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UNITS OF RADIOLOGICAL MEASUREMENT

MULTIPLY # OF →	by →	TO OBTAIN # OF
TO OBTAIN # OF ←	by ←	DIVIDE # OF

R	2.58×10^{-4}	C/kg of air
rads	0.01	gray
rads	0.01	J/kg
rads	100	ergs/gm
rads	6.242×10^{7}	MeV/g
rem	0.01	sievert
microcuries/cm^3	2.22×10^{12}	dpm/m^3
microcuries/cm^3	2.22×10^{9}	dpm/liter
dpm/m^3	0.4505	pCi/m^3
sievert	100	rem

APPENDIX C

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DNSC RADIOLOGICAL OFFICERS & STAFF

APPENDIX D

DEFENSE NATIONAL STOCKPILE CENTER RADIOLOGICAL OFFICERS & STAFF

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Ft. Belvoir, VA 22060

M. Pecullan- ORPM & RSO

RADIOLOGIAL PROTECTION OFFICERS

Dewey Blair – DNSC, New Haven, IN
Eric Deal – DNSC, Hammond, IN
Frank Falgier – DNSC, Hammond, IN

RADIOLOGIAL SAFETY OFFICERS

Robert Skruck – DNSC, New Haven, IN
Cam Delhoste – DNSC, New Haven, IN

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GUIDANCE FOR DEMONSTRATING COMPLIANCE WITH PUBLIC DOSE

APPENDIX E

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Guidance for Demonstrating Compliance with Public Dose

Background

The ORPP, requires the RSO to perform an evaluation at each depot to ensure that exposures to individual members of the public do not exceed 1.0 mSv (100 mrem) in a calendar year. The Nuclear Regulatory Commission has issued specific guidance on the methods used to perform this evaluation. The following provides guidance on performing this evaluation and the retention of records associated with the evaluation.

Regulatory Requirement

10 CFR 1301 states,

1) The total effective dose equivalent to individual members of the public from the licensed operation does not exceed 0.1 rem (1 millisievert) in a year, exclusive of the dose contributions from background radiation, from any medical administration the individual has received, from exposure to individuals administered radioactive material and released in accordance with §35.75, from voluntary participation in medical research programs, and from the licensee's disposal of radioactive material into sanitary sewerage in accordance with §20.2003, and

(2) The dose in any unrestricted area from external sources, exclusive of the dose contributions from patients administered radioactive material and released in accordance with §35.75, does not exceed 0.002 rem (0.02 millisievert) in any one hour.

10 CFR 1302 states that compliance is demonstrated by:

(a) The licensee shall make or cause to be made, as appropriate, surveys of radiation levels in unrestricted and controlled areas and radioactive materials in effluents released to unrestricted and controlled areas to demonstrate compliance with the dose limits for individual members of the public in §20.1301.
(b) A licensee shall show compliance with the annual dose limit in §20.1301 by --
(1) Demonstrating by measurement or calculation that the total effective dose equivalent to the individual likely to receive the highest dose from the licensed operation does not exceed the annual dose limit;

A member of the public is an individual in a controlled or unrestricted area who is not receiving an Occupational Dose.

Compliance Methods

The dose to a member of the public is comprised of internal and external exposure (i.e., Total Effective Dose Equivalent (TEDE)). NRC regulations require that the total effective dose equivalent (TEDE) from all exposure pathways not exceed 100 mrem per year. This exposure is comprised of equal parts of internal and external exposure (i.e., 50 mrem internal and 50 mrem external). In order to perform the evaluation, all potential sources of external and internal radiation exposures and all locations of use, transport, and storage of radioactive material at the depot must be identified. For DNSC depots, we will use a combination of measurements, process knowledge, and calculations to demonstrate compliance. Since the types of radioactive material stored or handled at DNSC depots are solids in sealed containers, then the internal pathway can be eliminated and the total dose limit (100 mrem) can be assumed to occur through external exposure.

Step 1 Determine the Dose In The Unrestricted Area

Determine the location in an unrestricted area where a member of the public would receive the highest dose from licensed operations (*Unrestricted area* means an area, access to which is neither limited nor controlled by the licensee). This location is typically outside the depot perimeter fence. Determine the dose rate by reviewing the results of monitoring by perimeter surveys. Since it is DNSC policy to maintain the dose rate at the perimeter fence at background, the annual dose to a member of the public would be zero. This should be noted in a written discussion in the annual survey report.

Step 2 Determine the Dose In The Controlled Area

If members of the public are routinely present in a controlled area, locate the building(s) where they are situated and determine the dose rate by reviewing the results of monitoring. A conservative approach is to select the highest measurement and assume that the dose rate remained at that level for an entire year.

Assume that the member of the public is present at that location for 24 hours per day, 365 days per year. This provides an occupancy factor of 1. If the result of the calculation using an occupancy factor of 1 shows that the public dose limit is not exceeded, there is no need for further evaluation.

If the calculation demonstrates that the public dose limit is exceeded with an occupancy factor of 1 the following assumption may be made:

For example, the RSO knows, based upon process knowledge that workers do not work 24 hours per day, 365 days per year. To gain an estimate of a more realistic occupancy the RSO assumes 40 hours per week, 52 weeks per year. This will safeside the results because the RSO knows that, at this location, the workers do not work a full work day, every day of every week during the year.

If the result of this calculation shows that the public dose limit is exceeded then more realistic assumptions of the individuals' occupancy may be made. When this approach is used, the RSO must document the justification for the use of the reduced occupancy factor. One method would be to interview workers and supervisors.

Step 3 Records

The depot must maintain records (annual survey report) to demonstrate compliance with the dose limit until the NRC terminates the license. In general the following must be included:

- The surveys or measurements used in the calculations,
- The justification of site specific occupancy factors,
- A map or diagram showing the perimeter of the storage area and the location of highest dose and
- The results of the calculations must be maintained

Example Calculations

Calculations for compliance are performed as follows. The calculations shown assume a maximum measured dose rate of 0.030 mrem/hr.

- *Occupancy Factor*

  (40 hr/wk)(52 wks/yr) = 2,080 hrs/yr

- *Maximum Dose to Member of Public*

  (0.030 mrem/hr)(2,080 hr/yr) = **62.4 mrem**

ANNUAL SURVEY REPORT TEMPLATE

APPENDIX G

DEFENSE NATIONAL STOCKPILE CENTER

OCCUPATIONAL RADIATION PROTECTION PROGRAM ANNUAL SURVEY

XXXXXXXXXXXXXXXX DEPOT

XXXXXXX 200X

Prepared by

Directorate of Materials Management
DNSC-M

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OCCUPATIONAL RADIATION PROTECTION PROGRAM SURVEY

XXXXXXXXXXXX DEPOT

EXECUTIVE SUMMARY

On Xxxxxxxxxxxxxx xx, 200x, Ms Xxxxxxxxxxx Xxxxxxxxxxxx, Radiological Safety Officer, performed a survey of of the radiological operations at the DNSC Xxxxxxxxxxxxxx Depot in Xxxxxxxxxxxxx, XX. The results of the survey indicated that the depot had an effective Occupational Radiation Protection Program. Xxxxxxxxx items were identified that did not meet the requirements of the DNSC Nuclear Regulatory Commission License or the DNSC ORPP and are identified in sections X, XX, and XX of this report. There were xxxx health and safety concerns identified as a result of the storage and handling of radioactive material at Xxxxxxxxxxxx. Exposures for depot personnel have been maintain ALARA.

Implementation of the following recommendations will improve the overall management and regulatory compliance of the ORPP at Xxxxxxxxxxx.

a. Xxxxxxxxxxxxxx [ORPP section x.x]

b. Xxxxxxxxxxxxxx[10 CFR 20.xx]

c. Xxxxxxxxxxxxxx[10 CFR 19.xx]

DISCUSSION

I. ADMINISTRATION

Mr. Xxxxxxxx Xxxxxxxxxx was designated as the Radiological Protection Officer.

LICENSE

Radiological operations were authorized under NRC license STC-133, Amendment No. 23, issued August 5, 2002, expiring on February 28, 2010. The license authorizes the storage, sampling, repackaging and transfer natural uranium and thorium ores, concentrates or solids. The license was implemented under the DNSC ORPP manual dated December x, 2002.

INVENTORY

The license authorizes the DNSC to possess a total of 2,000,000 kg of radioactive material in the form of uranium and thorium contained in ores, concentrates, and solids. Inventories at specific locations were not limited. DNSC records dated Xxxxx xx, 200x indicate that the depot possessed a total of x,xxx,xxx pounds of thorium nitrate, x,xxx,xxx pounds of tungsten concentrates and x,xxx,xxx pounds of columbium/tantalum concentrates with a total of xx.xx curies. The weights agree/disagree with depot records. A physical inventory was last conducted by Xxxxxxxxxx Xxxxxxx on Xxxxxxxxxx xx, 200x. Inventory results were in agreement with records.

II. DOSIMETRY

Thermoluminescent dosimeters (TLD) are available for all employees with access to the radioactive materials; a supply is kept on hand for visitors. TLD's are supplied and analyzed by the U.S. Army Ionizing Radiation Dosimetry Center (USAIRDC) at the Redstone Arsenal. USAIRDC possess an NVLAP certification. All TLD's are stored in xxxxxxxxxxxxxxxxxxxxxxxxxxx and are issued to workers when they xxxxxxxxxxxxxxxxxxxxxxxxxxx.

The writer reviewed the results of the personnel monitoring for the past year. A total of xx TLD's had been issued to personnel working at the depot. The monitoring results indicated that the exposures were below the 5.0 Rem annual limit specified by the ORPP. The range of recorded annual exposures was xx to xx Rem.

Each person issued a TLD had completed an exposure history (Form 1952). Copies were maintained by the RPO. Exposure records had been reviewed quarterly and the RPO provided each worker with an annual report for the previous year.

Internal dosimetry is not routinely performed due to the nature of storage.

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PUBLIC DOSE COMPLIANCE

Dose rate measurements were made at the perimeter of the depot which indicated that levels were at background. Therefore the annual dose to members of the public in the unrestricted area outside the depot was zero. The property inside the depot fence is a controlled area***. There are no restricted areas on the depot. There are restricted areas at the depot in xxxxxxxxxxxxxx***.

There are no members of the public routinely present in the controlled area. Members of the public are routinely present in the controlled area at xxxxxxxxxxxxxxxx. Annual dose was calculated at xx.xx mrem per year which is within the allowable limits (100 mrem) noted in 10 CFR 20.1301 (see attached calculation).

III. TRAINING

The RPO has received the formal radiological safety classroom training required by the ORPP [section 17.1] and ***has also (has not)*** received training in DoT Regulations.

General worker training of depot employees and security personnel was accomplished by the RSO on Xxxxxxxxxxx xx, 200x. The RSO maintained a detailed outline of the training topics presented during the class. Scope of the training met the requirements of the ORPP [section 17.2].

IV. EMERGENCY RESPONSE

Emergency Plan *(Provide a narrative including but not limited to the date of the latest revision and the date of the lastest discussion or agreements with offsite responders.)*

Emergency response personnel

V. RADIATION SURVEYS

Last survey
Instrumentation-this survey
Dose rates

VI. RECEIPTS, SHIPMENTS, AND DISPOSAL

No receipts, shipments or disposals were made since the last annual survey.

VII. INSTRUMENTATION (See attached spreadsheet)

The depot had an adequate supply of instrumentation on hand to ensure successful operation of the ORPP. Instrumentation consisted of an Xxxxxxxxxxxx xxxxxxxxx with a xxxxxxxxxxxx. All calibrations had been accomplished within the allowable (every 365 days) time frames by the Xxxxxxxxxxxxxx Company of Xxxxxxxxxxxxxxx, XX.

Calibration Certificates

VIII. INCIDENTS

No incidents were reported since the last survey.

IX. STORAGE AREAS

Locations
Type construction
Building security (doors, locks, seals)
Shielding

X. POSTING

NRC Form 3
Section 206, Public Law 93-438
NFPA signs
“CAUTION RADIATION AREA”
“CAUTION RADIOACTIVE MATERIALS”

XI. OTHER

Projects
Audits
NRC Inspections

CONCLUSION

The ORPP, at the DNSC Xxxxxxxxxxx Depot, was effective. Implementing the following recommendations will improve the overall management and regulatory compliance.

1.

2.

3.