

Wyoming Department of Transportation

Radiation Protection Program



Rev 09/10/2014

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PREFACE

Wyoming is a non-agreement state and therefore falls under the authority of the Nuclear Regulatory Commission. The Wyoming Department of Transportation has been issued a license by the Nuclear Regulatory Commission for the procurement, possession and usage of sealed source radioactive materials. Continuation of this license requires that WYDOT maintain an effective Radiation Protection Program. In order to comply with Federal regulations this Radiation Safety Program has been prepared as a guide in all matters related to radiation protection and control for the Wyoming Department of Transportation (WYDOT).

The Wyoming Department of Transportation has established a policy, which is intended to assure that employee and public exposure to ionizing radiation remains “AS LOW AS REASONABLY ACHIEVABLE” (ALARA). To accomplish this goal, WYDOT has instituted strong administrative and physical control over radioactive material stored, transported, or used by the department.

This Radiation Protection Program follows set guidelines for training, transportation, protection and all other rules, which apply to this State as set by the Nuclear Regulatory Commission.

All questions concerning the information or guidelines contained within this document should be directed to the Wyoming Department of Transportation Radiation Safety Officer.

Wyoming Department of Transportation Radiation Safety Officer

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SECTION 1.0 RADIOACTIVITY

In 1895 Henri Becquerel studied fluorescing minerals. While studying uranium, Becquerel accidentally discovered that it emitted invisible rays. Soon after Becquerel's discovery, Marie Curie made additional discoveries concerning the nature of radiation emanating from radium.

In 1900 Ernest Rutherford discovered three types of radiation: alpha, beta, and gamma. Radioactivity occurs when atoms of a certain composition spontaneously transform and release energy and/or pieces of the atom. Each release is called a disintegration, or decay. This spontaneous emission by the nucleus is called radioactivity.

The atom

The atom consists of two parts: the nucleus and the electron cloud. The nucleus is located at the center of the atom and contains protons and neutrons. The electron cloud surrounds the nucleus. Atoms, which have the same number of protons but a different number of neutrons, are called isotopes. Many isotopes are unstable. Such unstable isotopes, both naturally occurring like radium and man made like cesium and americium, undergo changes in their nuclei.

These changes yield energy in the form of radiation and produce a more stable neutron/proton ratio in the nucleus. In general, a neutron/proton ratio of less than 1.5: 1 is stable. During this rearrangement the isotope gives off radiation, and it is therefore called a radioisotope.

There are four basic types of radiation that we are concerned with: alpha, beta, gamma and neutron. If these types of radiation had no effect on matter, we might regard radiation merely as interesting phenomena. But radiation does affect the material exposed to it.

When radiation passes through living things, it gives up energy to the tissue and cells. The energy deposits may cause damage to or destroy the cell.

If too many cells are damaged or destroyed, radiation sickness or death may occur. For this reason, radiation exposure of personnel handling radioactive materials must be held to safe limits.

SECTION 1.1 DEFINITIONS OF RADIATION TYPES

ALPHA

Alpha particles are composed of a helium nucleus (2 protons and 2 neutrons) and are a result of the decay of the heavier elements with an atomic number of 82 or greater (82 + protons). Because of its large mass and strong electrical charge, it can only travel a short distance before it loses its energy. When an element emits alpha radiation and loses two protons, it actually changes into a different element. Alpha particles can be stopped by a sheet of paper.

BETA

Beta radiation is caused by an unfavorable proton to neutron ratio. This causes the ejection of a high-energy electron from the nucleus of an atom undergoing nuclear disintegration. Because of their small size and longer range, beta particles can penetrate the skin and cause ionization in any material in which they are absorbed. Beta radiation can be stopped by a 1/16 in. sheet of aluminum.

GAMMA

Gamma radiation is pure electromagnetic energy such as visible light, radio waves, microwaves, and x-rays. Visible light and gamma rays have no mass, no electrical charge and travel at the speed of light. However, gamma rays are much more energetic and penetrating than visible light. Gamma rays originate from the product nucleus after radioactive decay and are capable of ionizing matter. Gamma radiation can be stopped by 2 ½ in. of lead.

NEUTRON

Neutron radiation is caused by fission. For example, by bombarding Beryllium with alpha particles produced by the decay of Americium-241, an unstable isotope of carbon is produced. The natural decay process that allows the carbon atom to reach a stable state requires the release of a neutron from the carbon nucleus. The problem of shielding against neutrons is they must first be slowed down. This is done by a process called thermalization. Thermalization is best achieved by using a particle of the same mass as the neutron. As the neutrons collide with these particles, they are slowed effectively. After thermalization, they must be absorbed by another material. Neutron thermalization is best achieved by a material with high hydrogen content such as water, cadmium, and polyethylene.

SECTION 1.2 STANDARD OF MEASUREMENT FOR RADIATION

Although there are several types of radiation measurement, the user of a nuclear gauge needs to be familiar with only two. These are the rem (or millirem) and the curie.

The rem is defined in terms of energy absorbed in tissue multiplied by a factor to allow for the effectiveness of the particular type of radiation involved.

For example, neutrons are approximately 10 times as effective as gamma rays in producing biological effects.

The rem, however, is a relatively large unit. In many instances, the term millirem (mrem) is used. There are 1000 millirems in a rem.

The following example gives you an idea of how these units are used. A radiation dose of 500-1000 rems to a human would most probably be fatal.

The natural background radiation to which we are exposed amounts to about 350 mrems per year or 0.35 rems per year.

Most gauge operators receive less than 100 mrems per year of radiation from occupational exposure. The curie is not a measure of radiation dose.

The curie defines the activity of a radioisotope in terms of its disintegration rate at which radiation is emitted. A millicurie is one thousandth (1/1000) of a curie.

SECTION 1.3 RADIATION PROTECTION STANDARDS

Nuclear gauges may be hazardous unless proper safety precautions are taken.

Since the potential harm from radiation is not obvious, the exposure of personnel must be kept to a safe limit by following a few simple rules that assure working with or around nuclear gauges will pose no threat to a person's health and safety.

- 1) Any amount of radiation is assumed to be harmful and exposure to radioactive materials should take place only if some benefit is expected.
- 2) Standards for limiting a radiation dose to any individual should ensure that the probability of biological injury is extremely small.
- 3) Every reasonable effort should be made to keep exposure as far below recommended dose limits as possible.

In the U.S the Federal Radiation Council provides guidance for all federal agencies in formation of radiation protection standards, taking into account the recommendations of advisory boards.

In turn the Nuclear Regulatory Commission and individual state agencies assure the establishment and implementation of the standards for the activity under their control. For users of radioactive materials, radiation protection standards require that from all sources of occupational exposure:

- 1) The annual total whole body dose should not exceed (5 rems) or 5000 mrem per year. The whole body includes the head, trunk, arm above the elbow, and legs above the knee.
- 2) The specified annual dose limit to the skin or any extremity (shallow dose equivalent) is (50 rems) or 50,000 mrem per year.
- 3) The specified annual dose limit to the eye (lens of the eye) 15 rems or 15,000 mrem per year.

In addition to these limits, federal and state regulations require that every reasonable effort be made to maintain radiation exposures “**AS LOW AS REASONABLY ACHIEVABLE**”. This is commonly referred to as the **ALARA** principle.

In keeping with this principle, even though the permissible dose limit is 5000 mrem per year, the Wyoming Department of Transportation shall investigate any radiation dose received by a gauge user in excess of 1250 mrem per quarter.

In accordance with NRC code of Federal Regulations, part 19, 20 the following documents are available for examination by any individual engaged in activities licensed by the Nuclear Regulatory Commission:

10 CFR 19, Notices, Instructions, and Reports to workers inspections.

10 CFR 20, Standards for Protection against Radiation.

NRC License No. 49-04602-01, including all conditions and incorporated documents.

Operating Procedures applicable to licensed activity.

Copies of gauge operating rules and procedures and copies of the license are available with each nuclear gauge and on request from the RSO. Any employee who believes that a violation of the regulations or license conditions exists should notify the RSO.

Distribution of annual dosimeter readings

All annual dosimeter reports will be sent to all users who were issued badges from the previously completed year. They will be sent “confidential” to those users still employed with WYDOT through WYDOT internal mail. Users who no longer work with WYDOT will receive them by mail if a forwarding address is available.

SECTION 1.4 RADIOISOTOPES USED IN NUCLEAR GAUGES

The Wyoming Department of Transportation uses only one type of nuclear gauging device. It is described below along with its radioisotopes.

TROXLER MODEL 3440 NUCLEAR DENSITY GAUGE

These instruments are designed to measure moisture and surface density of soil, soil stone aggregates, cements, asphalt surfacing, and asphalt treated bases. They contain cesium-137 and americium-beryllium sources. The cesium -137 source is used for density measurements and is located in the tip of the source rod. The americium-241 / beryllium source is used for moisture measurements and is located in the center of the gauge base. The radiation dose profile for the Model 3440 is included in the appendix.

TROXLER MODEL 3222 DEPTH MOISTURE GAUGE

This gauge is designed to detect moisture at different test depths. It contains americium 241: beryllium and the source is located in the center of the gauge control unit. This gauge belongs to the Geology section of WYDOT, but is stored in our nuclear storage and controlled by the RSO. This gauge is not usable and is never issued. Plans are underway to have this gauge decommissioned.

All types of radiation are present in the Troxler 3440 moisture-density gauge. Encapsulation of the sources and shielding keeps the exposure at minimal levels; under average conditions, a full time employee working with a Troxler gauge will receive less than 200 mRem per year. Alpha and beta particles produced by the radioisotopes are stopped by internal encapsulation and shielding of the gauge.

REGULATORY AUTHORITY

SECTION 2.0 WYOMING DEPARTMENT OF TRANSPORTATION & THE NUCLEAR REGULATORY COMMISSION

Wyoming is a non-agreement state and therefore falls under the regulatory authority of the Nuclear Regulatory Commission. WYDOT will meet all the rules and regulations set forth by the NRC concerning all byproduct materials such as cesium-137 and americium-241.

Should a safety or health complaint not be resolved after all channels within WYDOT have been exhausted, The NRC should be contacted for further guidance. Attempts to resolve the problem through WYDOT must be documented.

TRAINING

SECTION 3.0 PURPOSES AND SCOPE

The Wyoming Department of Transportation, in accordance with our materials license, has instituted a comprehensive and on going training program designed to instruct gauge users and supervisors in the operation of nuclear gauges and the associated radiation precautions.

This program is applicable to all individuals who will operate or supervise the operation of nuclear moisture/density gauges.

SECTION 3.1 OBJECTIVES AND PROGRAM INSTRUCTION

The object of the gauge-user training is to instruct the employee in such a way that they will be able to use nuclear gauges to measure the moisture and density of soils, soil stone aggregates, and other construction materials in the proper and safest way.

Once the course of instruction is completed, gauge users will be able to effectively use the gauge, transport the gauge in accordance with federal regulations, and take appropriate action in the event of an accident or emergency.

Authorized gauge users will be expected to participate in a comprehensive training program consisting of 8 hrs of classroom training, on the job training, and yearly refresher training.

SECTION 3.2 CLASSROOM AND ON THE JOB TRAINING

The initial classroom training shall be conducted by the WYDOT Radiation Safety Officer but is also available from the gauge manufacturer.

The training will cover the following topics:

- 1) General gauge use
- 2) Basic radiation theory and health physics
- 3) Radiation safety precautions
- 4) Exposure limits
- 5) NRC Regulations
- 6) Employee rights
- 7) Proper transportation and storage
- 8) Emergency procedures

A 50-question test will be given at the end of the course to determine individual comprehension of the material.

At least 70% of the answers must be correct for an individual to be authorized to use a gauge containing radioactive material. Those individuals not receiving a passing score will be allowed to retake the course at a later date.

Upon successful completion of the course the individuals name will be entered in a database with their personal information and date of certification and a certificate will be issued.

SECTION 3.3 REFRESHER TRAINING

When a gauge is requested for use all users will complete a yearly 10-question HAZMAT refresher test. This test must be completed with a 70% passing grade before the gauge will be issued and personal dosimeter is ordered.

The gauge will be delivered by the RSO and a verbal hands-on refresher will be given on the operation of the nuclear gauge. No gauge will be delivered until all personal dosimetry is available, an acceptable grade has been scored on the refresher test, and the RSO is satisfied the user is aware of operating procedures, transportation and storage issues, security, and safe handling and practices.

ADMINISTRATIVE CONTROLS

SECTION 4.0 ORGANIZATIONS AND STRUCTURE

An organizational structure has been established within WYDOT to ensure implementation and compliance with all radiation safety policies, regulations, and guidelines.

This structure represents the lines of control through radiation safety policy, questions, and concerns should flow.

This structure also indicates the chain of responsibility concerning radiation safety and compliance with applicable rules and regulations.

SECTION 4.1 RADIATION SAFETY OFFICER

The Radiation Safety Officer (RSO) has the authority to regulate the possession, use, transportation, storage, receipt, and transfer of radioactive materials licensed to WYDOT.

The RSO is responsible for the enforcement of all Federal and WYDOT regulations with regard to radioactive material.

The RSO is also responsible for investigating all radiation safety complaints and any over exposures.

RADIATION SAFETY OFFICER QUALIFICATIONS

Charles K. Cisco has 15 years experience working with nuclear moisture/density testing devices. Since 1993 he has had experience in the field use of nuclear testing gauges and was first certified as a user by Dan Valerius, then RSO for the Wyoming Department of Transportation.

Successful completion of an 8 hr TROXLER ELECTRONICS LABORATORIES TRAINING COARSE FOR THE USE OF NUCLEAR TESTING EQUIPMENT.
10/13/1995

Successful completion of 8 hr. TROXLER ELECTRONICS LABORATORIES HAZMAT CERTIFICATION
06/26/2003

Successful completion of 40 hr. Radiation Safety Officer Training Course offered by RADIATION SAFETY AND CONTROL SERVICES, Inc
December 8 – 12, 2003

Successful completion of 40 hr. Radiation Safety Officer Training Course offered by RADIATION SAFETY AND CONTROL SERVICES, INC
December 1 – 5, 2008

Subjects included in the courses listed are:

1. Principles and practices of radiation protection.
2. Leak Testing procedures.
3. Mathematics and calculations basic to the use and measurement of radioactivity.
4. Biological effects of radiation.
5. Radioactivity measurement standardization and monitoring techniques and instruments.
6. Accident and incident procedures.
7. Procedures for nuclear gauge storage and transportation.
8. General safety precautions.

Gauge Operation

1. Instrument theory
2. Operating procedures
3. Maintenance
4. Field application

SECTION 4.2 ALTERNATE RADIATION SAFETY OFFICER

An alternate Radiation Safety Officer has been established for the Wyoming department of Transportation. He should only be contacted only in an emergency and when the Radiation Safety Officer and the other two names on the contact list are unavailable. **He is not available for gauge operation and non-emergency questions.**

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Radiological Services Program Manager
Wyoming Office of Homeland Security
Phone: 307-777-4951

SECTION 4.3 AUTHORIZED USERS

Licensed material shall be only be used by, or under the supervision and in the physical presence of, individuals who have received the training listed in section 3.2, Classroom and on the job training, and have received copies of, and training in, the licensee's operating and emergency procedures, and have been designated by the Radiation Safety Officer.

RADIATION SAFETY / GENERAL

SECTION 5.0 NUCLEAR GAUGE STORAGE

Nuclear gauges are stored in a restricted area in the basement of the Wyoming Department of Transportation, Materials Laboratory. This storage area is accessible only by the Radiation Safety Officer. A second set of keys are stored in the facilities program managers' office as required by the City of Cheyenne Fire and Rescue.

There are never more than 10 Troxler Model 3440 Moisture/Density gauges and 1 Troxler Model 3222 Depth Moisture Gauge in the storage area at one time. This number reflects our entire inventory of sealed source gauges.

This restricted storage area has one steel door with two keyed locks. The door is posted with the required signing. The area outside of the storage area is mainly used for storage of archives and facility maintenance equipment. A site map with radiation measurements is included in appendix of this manual and exposures are checked annually. Measurements have been ≤ 2 mrem/hr. A current storage area site map is included in the appendix.

SECTION 5.1 TEMPORARY WORK SITE STORAGE

The Wyoming Department of Transportation Materials License States that gauges may be used at temporary job sites anywhere in the state of Wyoming. Gauges are issued to certified users working on job sites around the state. Every effort is made to assure that nuclear gauges sent to the field are stored in a safe manner. The Nuclear Regulatory Commission states in **10 CFR Part 30** that *“a portable gauge licensee must use a minimum of two independent physical controls that form tangible barriers to secure portable gauges from unauthorized removal whenever the portable gauges are not under the control and constant surveillance of the licensee”*.

Requirements for temporary storage are:

The gauge will be stored inside a lockable cabinet or storage locker inside of a locked storage area. There will be two independent locking systems in place before the lock on the gauge transport case.

The storage cabinet shall be 15 feet from the nearest employee work area. The storage cabinet shall be locked.

The storage area must have the following items posted:

- Notice to employees (NRC Form 3)
- Telephone number of the Radiation Safety Officer
- Sign with Trefoil symbol stating “Caution Radioactive Material”

At temporary storage, the gauge shall be stored inside its transport case with the source rod in the locked and shielded position. Both the transport case and source rod handle will be locked.

Access to the gauge shall be limited to the authorized users.

If a storage box that meets the requirements of 10 CFR Part 30 is not in place at the project, a gauge may not be stored at the site.

Locked storage inside project labs are not acceptable storage areas due to their proximity to employees.

When the gauge is in the back of a vehicle, it must meet the same requirement of 10 CFR Part 30 and have two independent locking systems to prevent unauthorized removal or use.

Overnight storage of a nuclear gauge in a vehicle is prohibited.

The RSO will inspect the storage area and vehicle to ensure that these requirements are met before a nuclear gauge will be issued.

SECTION 5.2 SEALED SOURCE LEAK TEST

Sealed source leak testing will be done in a way as to ensure each gauge is checked at intervals not to exceed six (6) months.

The Radiation Safety Officer shall collect samples on wetted 55mm filter paper on which is written:

The gauge serial number

The model number of the gauge

The date the sample was taken

The sample will be analyzed using equipment used by the Wyoming Office of Homeland Security.

The results of the leak tests are recorded in micro curies.

If the sample indicates 0.005 micro curies of removable contamination is present, the gauge will be sent back to the manufacturer for repairs.

In addition to the bi-annual testing, gauges will be leak tested upon initial receipt, before final disposal, and in the event of emergency action taken.

The Radiation Safety Officer will keep records of leak tests.

SECTION 5.3 SEMI-ANNUAL INVENTORY

The Radiation Safety Officer shall conduct a physical inventory of all nuclear gauges in possession of the Wyoming Department of Transportation.

This inventory will be done in May and November and shall be done at the same time as the bi-annual leak test.

The inventory form shall include the gauge manufacturer, serial number, the source element and quantity, and the gauge location and will be signed and dated by the Radiation Safety Officer.

SECTION 5.4 SURVEY METER CALIBRATIONS

WYDOT currently uses four survey instruments supplied by the Wyoming Department of Homeland Security; two Ludlum 14c Geiger Counters and two Canberra MRAD 113 Pocket Radiation Detectors. These instruments are exchanged yearly on their calibration due dates for recently calibrated meters. These meters meet the criteria in the section entitled "Radiation Safety Program – instruments" in NUREG – 1556, Vol 1, Rev 1, Consolidated Guidance about Materials Licenses: Program-Specific Guidance about Portable Gauge Licenses, dated November 2001.

If an incident should occur anywhere in the state of Wyoming, State Troopers with the Wyoming Highway Patrol all have in their vehicles, a survey meter that also meets the criteria listed above.

A copy of the calibrations is included in the appendix and also kept on file by the RSO.

SECTION 5.5 ORDERING AND RECEIPT OF GAUGES

The request for new and additional gauges is decided by the Materials Staff Engineers and the State Materials Engineer. There has been no need for additional gauges since 1998.

If additional gauges were ordered, The Radiation Safety Officer would perform a leak test within 24 hours of receipt of the gauge or gauges. If the leak test showed contamination, then the gauge manufacturer will be notified and the gauge returned through an approved method. If no contamination is detected, the gauge will be put into the nuclear gauge storage area, added to the inventory and await use.

New gauges are delivered to:

Wyoming Department of Transportation
5300 Bishop Blvd
Bldg #6101
Cheyenne, WY 52009-3340

SECTION 5.6 DISPOSAL OF GAUGES

If disposal of a gauge becomes necessary, it is returned to Troxler. An acknowledgment from Troxler is required once they have received the gauge.

The gauge is then removed from WYDOT nuclear gauge inventory and also the property inventory maintained by WYDOT.

The Radiation Safety Officer shall maintain all record for gauge disposals and sales.

SECTION 5.7 AREA SURVEYS

An area survey of the nuclear storage area is done annually. Radiation exposure rates are collected at four (4) different locations around the two inside walls of the storage area. The two outside walls are exterior walls and are below grade. An area survey of the nuclear gauge storage area is shown in the appendix.

SECTION 5.8 RECORDS: PERSONAL MONITORING, & PRENATAL CARE

Authorized users files, area surveys, sealed source leak tests, personnel monitoring records, gauge receipts, WYDOT's Material Use License and any other pertinent paper or records shall be kept by the Radiation Safety Officer for inspection.

PERSONAL MONITORING

Authorized users shall use personal monitoring whenever they are transporting or using a nuclear gauge. Personal monitoring is provided when you have completed all of the requirements necessary to be a certified user. WYDOT uses TLD whole body detector badges provided by Global Dosimetry. Global Dosimetry is a NVLAP approved laboratory.

Certified users shall use only the badge assigned to them. A gauge will not be issued and delivered until personal dosimetry is assigned and in place.

A control badge used for measuring background radiation will accompany all badge orders for any badges not used in the Cheyenne area. These badges should be kept where they will not be exposed to radiation other than normal background radiation. These badges also measure radiation exposure in transit. Readings from the control badge are subtracted from the user's exposure.

The Radiation Safety Officer shall keep all exposure records

The badge holder may request to see his/her exposure record at any time. The request must be made in writing and requested from the Radiation Safety Officer. If a request is made, a copy of the person's exposure will be made within 5 days and sent in an envelope marked "confidential" through WYDOT's internal mail.

All badge holders shall receive a written exposure report annually. This report will be sent in an envelope marked "confidential" through WYDOT's internal mail. Any questions concerning the information on the exposure report should be directed to the Radiation Safety Officer.

PRENATAL RADIATION EXPOSURE AND MONITORING

The Radiation Safety Officer for the Wyoming Department of Transportation will instruct individuals working with licensed radioactive materials on the health effects of radiation exposure to an embryo/fetus of a declared pregnant woman.

A declared pregnant woman is a woman who voluntarily informed WYDOT, in writing, of her pregnancy and the estimated date of conception.

The written declaration should be submitted to the Radiation Safety Officer and such declaration will remain in effect until the declared pregnant woman withdraws the declaration in writing or is no longer pregnant.

10 CFR 20 Subpart C: Occupational Dose Limits, state that occupational exposure of a declared pregnant woman should not exceed 500 mRems for the length of the pregnancy. WYDOT will begin fetal monitoring of the declared pregnant woman upon receipt of the declaration of pregnancy.

Any required or requested changes to the declared pregnant woman's job duties during pregnancy shall be discussed with, and approved by, the declared woman's supervisor and the Radiation Safety Officer.

SECTION 5.9 DOSIMETER BADGE RESPONSIBILITIES

If an authorized gauge user loses, his/her badge the use of the gauge is prohibited until a new badge is obtained.

A written explanation shall be sent to the Radiation Safety Officer stating how the badge was lost. A temporary badge will be ordered and issued to the user for the remainder of that quarter. If a badge is lost at any time during the quarter, an average exposure dose that the badge holder received during the previous four quarters will be assessed for that quarter for the lost badge. This dose will be added to the dose received on the replacement badge.

If an amount of radiation exposure shown to be excessive is reported for a badge during a quarter, that user will be interviewed by the Radiation Safety Officer for a possible explanation. The user will be required to send the explanation in writing to the RSO. If no explanation exists, the amount of exposure will be added to the user's permanent record, and the gauge will be leak tested to assure it is safe to use. All quarterly exposures in excess of 1250 mrem will be investigated.

The badges will be ordered, distributed, and collected by the Radiation Safety Officer through the Materials Program. Badges are received at the Materials Lab and distributed to authorized users around the state. Badges are usually delivered personally but may be mailed to the office the user is working out of if that office has a physical address and not a P.O. Box. Area offices will be notified in advance so they can collect the expired badges for exchange. Make sure to include the control badge. When all expired badges have been exchanged, they are returned to Global Dosimetry by mail. A Radiation Exposure Report usually comes back to the RSO within three weeks.

SECTION 5.10 GAUGE REPAIR

A small area of the Nuclear Storage Area is set aside as a service area. This area is a restricted area and is only accessible by the Radiation Safety Officer. The door has two separate locks and is posted with the appropriate signs and warnings. The door shall be locked when unattended even for short periods. There is no other entrance to the storage room. Anyone can enter the area provided they are with or have the permission of the Radiation Safety Officer and they are wearing personal dosimeters and have a specific reason for being there.

Actual repair work is performed by the RSO and limited to minor repairs and servicing. This consists of minor electrical work, cleaning of the gauges (including the source rod), sealed source leak tests, servicing the gauge which includes, battery charging and replacement, lubrication and other repair work not involving removal of the source rod or its encapsulation. A badge is worn by the RSO when he is performing the repairs and cleaning.

Authorized users are not qualified nor encouraged to perform maintenance or cleaning in the field. If they experience a problem with the gauge they should contact the Radiation Safety Officer by phone and he may suggest some fixes and suggestions that they may try. The RSO will never suggest they try anything that could be harmful to the user or the gauge. If they are unable to correct the problem, the RSO will make every effort to get them a replacement gauge as soon as possible. The RSO will deliver the replacement gauge and bring the malfunctioning gauge back to the Materials Lab in Cheyenne. The RSO will attempt to correct the problem and if unsuccessful will arrange to send the gauge either back to the manufacturer or to a qualified service center.

SECTION 6.0 TRANSPORTATION

Vehicles used to transport nuclear gauges shall be equipped with a system mounted in such a way as to prevent lateral and horizontal movement of the transport case containing the gauge.

Gauges shall be placed in their transport cases with the source rod in the locked and shielded position. The transport cases shall then be placed in a mounting system that will allow the transport case to be locked and secured with two independent locking mechanisms. The locking systems must not only secure the gauge from being removed from the case, but also from the case being removed from the vehicle. A lock on the transport case is advisable but does not count as one of the two independent systems. **Both locking systems must secure the gauge being removed from the case and the case being removed from the vehicle with the gauge inside.**

Only authorized gauge users may be inside the vehicle when the gauge is being transported and a TLD badge must be worn.

There are two envelopes included with the gauge. The information contained in these envelopes is identical and contain a bill of lading, gauge documents and emergency response information with emergency procedures and contact phone numbers. The smaller envelope shall be kept in the cab of the transporting vehicle when the gauge is being transported. Yellow caution tape for isolation of the gauge in the event of an accident is in the transport case and should be carried in the vehicle.

All vehicles used to transport gauges shall be equipped with a two-way radio or some other form of communication.

SECTION 6.1 HANDLING PRECAUTIONS

The responsibility for safe use of a nuclear gauge at the job site ultimately falls on the “*authorized user*”. The “authorized user” has both the responsibility and the authority to keep unauthorized persons away from the operating area of the gauge. The operating area consists of an area fifteen (15) feet from the gauge.

WYDOT considers all employees not authorized to use the gauge as members of the general public. Members of the public shall not be unnecessarily exposed to radiation.

If any problem should arise involving the “authorized user” maintaining a safe working environment with regard to radioactive materials, he / she should contact the Radiation Safety Officer for assistance.

PROCESS FOR ISSUING NUCLEAR GAUGES

The process for issuing a nuclear gauge involves several steps to insure the safe transfer of radioactive material.

When a nuclear gauge is needed for a project, a request from the resident engineer or program manager is sent by email to the Radiation Safety Officer at the Materials Program in Cheyenne. This request should include names of people that will be using the gauge. The RSO will check the names of the potential users along with their date of birth and social security numbers to determine if training is needed. A time will be scheduled to certify new users and give the refresher course to certified users. Dosimeters will also be ordered for the potential users.

Before a gauge is checked out of the nuclear storage room, an effort is made to ensure the gauge is in good working condition, all accessories are included in the case, and the batteries have a full charge. An entry is made in the logbook stating the gauge serial number, where the gauge is being transferred to, the resident engineer and the date of transfer. An entry is also made on the gauge inventory sheet stating the new location of the gauge.

When the dosimeters arrive, a date is set to deliver the gauge. The RSO will deliver the gauge and perform any training necessary for the users. At the time of delivery, an inspection will be made of the temporary storage area and vehicles to ensure they meet the requirements for storage and transportation.

During the time the gauge is being used in a location the Radiation Safety Officer will do periodic unscheduled inspections of the facility and vehicles to ensure that the rules and regulation are being followed.

The Transportation of a nuclear gauge is a serious and important part of the job. It is hoped that everyone participating not only follows regulations, rules and practices but exercise common sense.

SECTION 6.2 EMERGENCY PROCEDURES

In the event of an accident or incident involving nuclear gauges, quick and correct action is important. Included with each gauge are emergency procedures and contact names and phone numbers. All state troopers with the Wyoming Highway Patrol carry survey meters in their vehicles in the event the RSO cannot be reached. WYDOT's Radiation Safety Officer will respond as soon as possible to any emergency involving a nuclear gauge. Until the RSO arrives, follow the emergency procedures included with the gauge. The gauge user must remain with the gauge until it can be moved to a safe location.

In the event a nuclear gauge is lost or stolen the user should contact the Radiation Safety Officer as soon as possible. If unable to reach any of the emergency contact numbers, the user should contact the Wyoming Highway Patrol otherwise the RSO will contact The Wyoming Highway Patrol and advise them of the situation. The RSO will also inform:

**U.S. NUCLEAR REGULATORY COMMISSION, REGION IV
611 RYAN PLAZA DRIVE, SUITE 400
ARLINGTON, TX 76011-8054**

PHONE: (817) 860-8100

The authorized user should continue to attempt to contact the individuals on the emergency contact list.

REVIEW

SECTION 7.0 ANNUAL AUDITS

This program should be reviewed annually by the Radiation Safety Officer to insure that it is operated in a consistently safe and effective manner, that all rules and regulations in place are current and being followed and to insure that any problems and deficiencies are dealt with and corrected in a satisfactory manner.

The annual audit will be performed by the Radiation Safety Officer and will be done in December at the end of the year. A copy of the most recent annual audit is included in the appendix.

**Charles Cisco
Wyoming Department of Transportation
Radiation Safety Officer**

APPENDIX

Operating and safety procedures with contact names and phone numbers

Emergency procedures

Copy of survey meter calibration

Area survey map of the nuclear gauge storage area

Radiation Profile and dose equivalent rates for the Troxler 3440 Moisture-Density gauge.

A copy of the most recent annual audit checklist

Testing results for Type A Packages for Troxler Gauge Cases

Troxler Nuclear Gauge Emergency Response Information

Wyoming Department of Transportation 50 question Radiation Safety Certification Test and answer key.

Wyoming Department of Transportation 10 question Haz-mat yearly refresher test and answer key.

Most recent leak test results