DCD

September 17, 1996

EA 96-248

William Switzer, District Director
Indiana Department of Transportation
Crawfordsville District
110 W. South Boulevard
Box 667
Crawfordsville, IN 47933

SUBJECT. PREDECISIONAL ENFORCEMENT CONFERENCE SUMMARY

Dear Mr. Switzer:

On September 4, 1996, representatives of the Indiana Department of Transportation, Crawfordsville District met with NRC personnel in the Region III Office located in Lisle, Illinois, to discuss the apparent violations identified in NRC Inspection Report No. 030-32466/96001(DNMS). The conference was held at the request of Region III and was transcribed.

The licensee agreed with the two apparent violations described in the inspection report and discussed their causes and corrective actions. The licensee indicated that the root cause of these apparent violations was management's failure to diligently stress to its nuclear gauge users the importance of complying with NRC requirements and the resulting serious consequences for failure to comply. The licensee committed to recertify all gauge users annually, prior to the issuance of a nuclear gauge and thermoluminescent dosimeter for the construction season. The recertification includes discussions on the safe use of, issuance and return policies for nuclear gauges. The above commitment was provided in writing to the NRC in a letter dated August 30, 1996. In addition, the nuclear gauge manual for the annual recertification was provided to NRC staff during the conference (Enclosure 1). The licensee had informed all gauge users in a memo dated August 21, 1995, that untrained and unbadged individuals shall not use nuclear gauges. The licensee reiterated this message to gauge users and area engineers in a letter dated March 22, 1996, and informed them in the same letter of the recertification requirement for all gauge users.

The licensee also indicated it was not Mr. Brooks' intention to violate NRC requirements. Rather, he did what he believed was acceptable, given the limited resources and options provided by licensee management.

The licensee generally agreed with the facts detailed in Inspection Report No. 030-32466/96001(DNMS); however, it noted the following errors: (1) the licensee contacted the State Police in addition to the Sheriff's Department regarding the stolen gauge (Page 2), (2) the project engineer contacted the RSO and asked if a TLD badge could be provided to a temporary student trainee in late August 1993, instead of between April and June 1993 (Page 4), and

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(3) the project engineer assigned the two individuals (gauge users) to more technically significant projects instead of safety significant projects (Page 4).

The attendance list is enclosed with this summary (Enclosure 2).

In accordance with 10 CFR 2.790 of the NRC's "Rules of Practice," a copy of this summary and its enclosures will be placed in the NRC Public Document Room.

Sincerely,

Original signed by Cynthia D. Pederson

Cynthia D. Pederson, Director
Division of Nuclear Materials Safety

License No. 13-26344-01
Docket No. 030-32466

Enclosures: 1. Nuclear Gauge Manual;
Recertification Training
2. Attendance List

bcc w/encls: Office of Enforcement
J. Goldberg, OGC
D. Cool, NMSS
C. Weil, NMSS
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The attendance list is enclosed with this summary (see enclosure B).

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NUCLEAR GAUGE MANUAL
REFRESHER COURSE
1996

TABLE OF CONTENTS

PURPOSE:

Nuclear moisture/density gauges are testing devices which use low level radiation to measure the density and moisture of construction materials.

The Nuclear Gauge Operators course will help you learn to use INDOT's nuclear gauges in a safe and effective manner. TAKING AND PASSING THIS COURSE (OR THE MANUFACTURER'S COURSE) BEFORE OPERATING A GAUGE IS A REQUIREMENT OF THE INDOT NUCLEAR REGULATORY COMMISSION LICENSE.

This manual was designed as a reference guide for operators to enable them to safely and correctly operate nuclear gauges. By following the procedures in this manual you can minimize your exposure to radiation. Radiation sources in all INDOT nuclear gauges are relatively small and present no danger to you as long as you use common sense and follow a few simple rules. Items regarding nuclear gauges should be routed according to the following chart:

Item	Example	Contact	Location	Phone
Emergencies	gauge damage	Radiation Safety OFF. or DMTE	Testing Lab	317-362-9484 or 1-800-622-4960 code:37767 Ext:27502 or 20645
Use,Safety Trouble-Shooting, On the road repair	source rod jammed, batteries dead	Radiation Safety OFF. or DMTE	District Materials & Tests	

OPERATOR RESPONSIBILITIES

Nuclear Gauge Operators will be expected to fulfill the following responsibilities:

1. KNOW AND FOLLOW NRC SAFETY PROCEDURES WHEN USING, TRANSPORTING AND STORING NUCLEAR GAUGES.

2. Care for the gauge according to the NRC regulations,this manual and the course instructions. and personally return the gauge in good clean condition.

3. Return your radiation monitoring device according to the schedule described in this manual.

1. SAFETY

1.1. RADIATION

Types of Radiation:

The radioactive materials in most gauges emit 4 types of radiation which the operator should know about: ALPHA particles, BETA particles, GAMMA rays, and NEUTRONS. Of these four, the alpha and beta particles are completely stopped by the walls of the source container; therefore, only the characteristics of the GAMMA RAYS and NEUTRONS need to be discussed in detail.

GAMMA RAYS (sometimes called Photons) are a form of electromagnetic radiation, somewhat similar to radio waves and light rays. They travel in straight lines at the speed of light, and are electrically neutral. However, unlike light rays, Gamma rays are extremely penetrating. When a Gamma ray (Photon) enters a material any of three things may happen.

1. The Photon may be absorbed (stopped) by the material.

2. The Photon may be deflected or "scattered" in the material, and come out of the material with a different direction and lower energy than when it entered. (Sometimes the Photon is scattered several times before being absorbed or coming out of the material.)

3. The Photon may pass through the material without being scattered or absorbed.

NEUTRONS, instead of being rays, are extremely small, and very dense particles. They are electrically neutral and quite penetrating. Unlike Gamma rays, the penetrating power of Neutrons through a material does not depend on the density of the material, but rather its composition. Neutrons are slowed down most effectively by a material containing hydrogen atoms (such as water or polyethylene). For this reason, Neutrons are used to measure the moisture content of soils and other materials.

1.2. LIMITING RADIATION EXPOSURE

In order to calculate the amount of radiation absorbed by a human being, a unit called REM is used. Because the amount of absorbed radiation is usually small, doses are usually expressed in MILLIREMS (thousandth of a REM). The millirem is actually a measure of the effectiveness of the body in absorbing radiation, and depends on the type and energy of radiation. Even though radiation emitted from a radioactive source enters your body, it will not make your body radioactive unless you inhale or ingest the material. In the case of nuclear gauges, the possibility of inhaling or ingesting radioactive material is extremely remote. The radioactive material is sealed in a "triple encapsulated" stainless steel source rod which is extremely durable.

Exposure Limitations:

Everyday we are exposed to low levels of radiation. X-ray machines, sunlight, radios, TV sets and electric lights are all sources of radioactivity in our environment.

In order to protect persons working around somewhat higher levels of radiation, such as from the nuclear gauge, the U.S. Nuclear Regulatory Commission and the Federal Radiation Council have established exposure limits for radiation workers. These limits are set forth in Title 10, Chapter 1, Code of Federal Regulations - Energy. This publication is available upon request from the Division of Research .Figure 1-1 below gives one of the basic limits set forth by Title 10.

Type of Exposure	Millirem Limits for: 13 Weeks	1-Week Rate
Sensitive Regions (whole body, eyes, gonads, skull)	1,250	96

Figure 1-1 Exposure Limits for Radiation Workers

"Whole body" radiation exposure is an overall measure of what a person has been exposed to. Note that the exposure limitation for whole body exposure is 96 millirems per week. INDOT nuclear gauges emit about 15 millirems of radiation per hour from the bottom surface of the gauge. Since you are almost always several feet from the gauge, the radiation you receive will be only about 4 millirems per 40 hour work week. This is far less than the 96 millirem limit shown in Figure 1-1. You should be aware that some portions of your body are allowed higher levels of radiation while other are allowed less limits for the skull and reproductive organs for example are lower than limits for hands of feet. The 96 millirem limit is set to protect more sensitive areas of your body, such as the skull.

CAUTION: In order to operate a nuclear gauge, you must be at least 19 years of age. The embryo or fetus of a pregnant woman is considered extremely sensitive to radiation. If you are a female operator and have any reason to think you might be pregnant it would be advisable to consult with your physician. He can give you more information about the effects of radiation on your unborn child. If you are pregnant or suspect you are, then bring this to the attention of your supervisor. Then discuss what options are available and decide whether to operate the gauge or delay operations until a later date.

There are are two basic ways in which you can decrease your exposure to radioactive sources. INCREASING YOUR DISTANCE FROM THE RADIATION or PUTTING A SHIELD BETWEEN YOU AND THE RADIATION.

Distance:

When you double your distance from the source of radiation, you decrease you radiation exposure by 3/4. This is called the INVERSE SQUARE RULE. See Figure 1-2. If you are one foot from the gauge and you move back another foot, you have doubled your distance. Your radiation exposure has decreased to 1/4 of what it was when you were one foot away.

Figure 1-2 Inverse Square Rule

When the gauge is operating, you should stand at least ten feet away. This serves two purposes: 1) it decreases your exposure to radiation, and 2) it helps prevent false readings which can occur when people, large pieces of machinery, or other nuclear gauges are too close to the gauge.

Shielding:

The source of radiation in the nuclear gauge is a capsule located in the tip of the source rod (Figure 1-3) The capsule provides some shielding of the radioactive source. The gauge itself is also made with a protective shielding, so that when the handle is in the safe position, the shielding is in place around the radioactive material. When the handle is depressed, the shielding on the bottom of the gauge is moved and the source is exposed. The gauge handle should be in the safe position ANYTIME YOU ARE NOT ACTIVELY TAKING A TEST. WHEN THE GAUGE IS NOT IN USE, THE HANDLE SHOULD BE PADLOCKED.

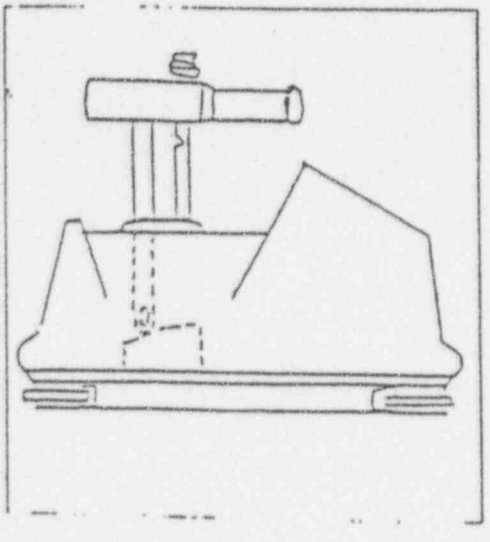

Figure 1-3 Shielding of the Source

Construction materials such as bituminous, soil, and concrete will also act as a shield when you are operating the nuclear gauge. The standard block used to take the Daily Standard Count also acts as a shield.

1.3 THERMOLUMINISCENT DOSIMETRY (TLD)

To ensure our safety and to comply with Nuclear Regulatory Commission and the State Board of Health Regulations , the radiation exposure of all nuclear gauge operators must be monitored. To monitor radiation, each operator is issued a TLD upon obtaining a nuclear gauge from the District Materials and Tests.

Your responsibilities regarding your TLD include the following:

1. You must wear a TLD anytime you are within 15 feet of the gauge. This applies to anyone who may be near the gauge on a frequent basis even if they are not the sole operator of the gauge. PERSONAL RADIATION MONITORING DEVICES (TLD) CANNOT BE SHARED. THEY MUST BE WORN BY ONLY THE INDIVIDUAL TO WHOM THEY ARE ASSIGNED.

2. Every 3 months a new TLD will be supplied from the District Materials and Tests. When you receive the new TLD, you should exchange the old for the new (even if you have not used it).

3. When you are not using/wearing your TLD, DO NOT store it within 15 feet of a nuclear gauge. Do not store it where it will be exposed to direct sunlight. Do not wear it to the doctor's or dentist's office where there is ex-ray equipment. Always store a TLD in a cool, dark place then not in use.

4. You MUST notify District Materials and Tests at least 5 business days in advance if you are:
   a. Requesting a gauge.
   b. Requesting new TLD's for additional operators
   c. Requesting re-activation of a TLD
   d. Requesting any change in TLD status.

5. Lost or Damaged TLD:

   IF you lose or damage a TLD:
   a. Call the District Materials and Tests for a replacement as soon as possible.(DO NOT operate a gauge until you receive the replacement).
   b. Type a brief explanation of what happened
   c. Date and sign
   d. Have your PE/PS date and sign
   e. Mail to the District Materials and Tests.

6. The following information is required for issuance of a TLD badge:

a. Name
b. Home Address
c. Home Phone
d. Social Security Number
e. Date of Birth

As the NRC License Designee, the Radiation Safety Officer is responsible for enforcing safety and radiation monitoring requirements. It is essential that district personnel at all levels cooperate and follow established procedures for safety and radiation monitoring. Failure to do so could jeopardize INDOT's NRC license. The District Materials and Test office maintains individual exposure records. These records will be provided to an individual both on an annual basis and upon termination.

NOTE: If you terminate your employment with the INDOT, either you or your immediate supervisor must notify the Radiation Safety Officer at the District Materials and Tests within 5 working days.

1.4 SAFETY PRECAUTIONS

TRANSPORTATION & STORAGE

When transporting the nuclear gauge in a vehicle, it must be in it's storage case, secured to prevent excessive vibration and movement, and be accompanied by the required NRC paperwork. It should be kept as far away from occupants as practical. When it is unattended in a vehicle, the vehicle must be locked to prevent theft. When using an open pickup, the gauge must be put in the cab and locked up. DO NOT leave the gauge unattended in the back of the truck.

When storing the nuclear gauge, it should be kept in the case. The gauge handle should be in the SAFE position and locked with the padlock. The key should be kept in a separate place from the gauge while in storage.

In your field office, locate a place to store the gauge away from normal activity. Avoid storing it near the work area, breakroom, or lunch area. Keep the gauge where it will be safe from theft or tampering by unauthorized people, adverse weather conditions, etc. Post the appropriate NRC radiation information sheets (Placard and "Notice to Employees") close to the gauge storage area. Make sure the sheets are clearly visible to anyone entering the "radiation area."

In Case of Accident:

If the gauge is involved in a physical accident or you suspect that the radioactive material or shielding has been damaged, follow these steps:

1. Leave the gauge and/or parts alone unless they are blocking construction equipment and/or the normal flow of traffic where it could pose a more immediate hazard. Then move the gauge well away from traffic to a clear zone. If there is any evidence to indicate a source tip has ruptured.DO NOT MOVE THE GAUGE. If it is a windy day, move all personnel upwind of the accident site.

2. Rope off an area at least 20 feet in diameter around the gauge or parts.

3. Keep people away.

4. Call the District Testing Lab immediately. Ask to speak to the Radiation Safety Officer or the DMTE.
Telephone 1-800-622-4960 Code 37767 ext. 27502 toll free
or 317-362-9484.

Preventing Gauge Damage:

The nuclear gauge is a fairly durable piece of testing equipment. However, there are some field situations which have the potential to damage the gauge. The following tips will help you keep the gauge in good working condition.

- -store the gauge where it will not be exposed to freezing conditions.
- -do not store the gauge in a damp cc.rosive environment
- -do not let the gauge get wet (it will not give accurate readings during periods of rain when the material you are testing gets excessively wet)
- -do not operate the gauge continuously on hot bituminous material.
- -keep the gauge a reasonable distance away from vibratory rollers (the farther the better)
- -do not use improper cleaning procedures
- -use only solvents sparingly
- -do not get paint on the gauge

2. GAUGE ISSUANCE AND RETURN

Prior to requesting a nuclear gauge from the District Materials and tests, check to make sure that ALL operators names are on the list of approved operators.

To obtain a nuclear gauge for use on a particular project, the nuclear gauge operator should phone at least 5 business days in advance to insure that the gauge and TLD are ready. It is sometimes possible to get more than one gauge for a project, but this is an exception rather than the rule. This will be determined on a case by case basis.

According to the guidelines set forth in INDOT's NRC license, NUCLEAR GAUGES CAN ONLY BE ISSUED AND RETURNED BY INDOT EMPLOYEES WHO HAVE ATTENDED AND PASSED THE NUCLEAR GAUGE OPERATOR'S COURSE AND POSSESS A TLD BADGE.

The nuclear gauge will be checked when it is returned to the District Materials and Tests, therefore, the assigned operator should return the gauge to answer any questions that may arise.

It is recommended that an operator pick up a gauge 2 to 3 weeks prior to the date it is needed. This allows time for the operators to familiarize themselves with the gauge operation. It also reduces problems and delays encountered with waiting until the "last minute".

2. REGULAR MAINTENANCE

2.1. CLEANING THE GAUGE

The nuclear gauge was developed for field use,but must be treated with care. Simple precautions and maintenance will extend the time between repairs and maintain its use for testing. After each use, you should wipe the exterior of the gauge to remove dirt and dust which collects during field operation.

In the Direct Transmission Method the source rod into the compacted soil. To keep particles of dirt from being drawn into the gauge and jamming the source rod,the gauge contains a small wiper near the source rod opening. Unfortunately,the wiper is not as effective when the soil is wet and the particles tend to adhere to the source rod. Under our present license we cannot wipe the source rod with a rag as we have done in the past. Therefore, frequently clean the scraper ring (only with the source rod in the safe position.)

Using the gauge on a bituminous surface will cause asphalt and aggregate to stick to the bottom of the gauge which in turn can cause air gaps. To clean the gauge bottom,ensure that the handle is locked in the SAFE position. Then use a rag dampened with mineral oil or light wt motor oil to wipe away debris. Following this wipe away all traces of the oil with a clean rag or paper towel.
DO NOT use gasoline,kerosene or any other flammable material.

Lastly never attempt to repair, lubricate, or modify the nuclear gauge or it's associated equipment in any way. If the source rod should jam, DO NOT attempt to force it loose. Instead, place the gauge in a safe and secure location away from people and call the District Materials and Test.

2.2 RECHARGING THE GAUGE

The nuclear gauges used by the INDOT all use nickel-cadmium rechargeable batteries. This type of battery has the peculiar characteristic of developing a memory of use. For example,using short recharging cycles will diminishing the battery's ability to power the gauge for longer periods of time. For this reason,it is imperative to let the batteries run down to a "low battery" reading before giving them full recharging.

When a gauge displays a "low battery" condition, you will still have a few hours of testing power remaining. Therefore, you may continue to test until the end of the day or until the gauge begins to give you consistent wild readings. At this time you will want to recharge the gauge for a FULL 16 HOURS. Failure to follow this charging procedure will result in diminished power reserves, erratic readings, and will eventually destroy one or more of the cells (batteries).

NUCLEAR GAUGE DO'S AND DON'TS

1. Do Not -Charge the batteries until you get (a) low battery indication or (b) until you consistently get wild readings.

2. Do Not -Let your gauge get wet.

3. Do Not -LEAVE YOUR GAUGE UNATTENDED UNLESS IT IS SECURED IN THE FIELD OFFICE, VEHICLE, ETC!!

4. Do Not -Transport a nuclear gauge unless you have it in its case and you have the accompanying travel papers within arm's reach.

5. Do Not -Get paint on the gauge. This will cause false readings. If you accidentally get paint on the gauge, you must clean all of it off before returning the gauge.

6. Do Not -Make a mass return of gauges. For example,one person brings back 4 or 5 gauges. Operators are to return their own gauge personally.

7. Do -Charge batteries for a full 16 hours per charging procedure for the type of gauge you are using.

8. Do -Clean the bottom of the gauge frequently.

9. Do-Call the District Materials and Test and give them new field office number and location each time you move jobs.

10. Do-Return the gauge within 5 working days after the gauge is no longer needed on your project.

11. Do-Return your old TLD within 5 days after receiving your new TLD. Also, return your TLD and holder as soon within 5 days after completing your project.

12. Do-Notify the District Materials and Test for any of the following:
    a. Change of home address and/or phone number
    b. Change of project and/or location
    c. Termination of employment
    d. Lost, stolen,damaged gauge or accessories

13. Do-Call the Testing Laboratory if you have a problem or a emergency. If you are not sure of something CALL!!!!

14. Do-Try to pick up a gauge 2 to 3 weeks prior to the start of a project. This affords you ample time to familiarize yourself yourself with the gauge. In any event, you must give us 5 working days notice before you want to pick up a gauge.

15. Do-Store the gauge with the padlock in place in the gauge handle (in the safe position).

16. Do-keep the gauge key secure and separate from the gauge.

17. Do-Store the locked gauge in a locked secure field office (and in a locked room within the field office whenever possible).

ENCLOSURE 2

Conference Attendees

Licensee
Daniel Carpenter, Construction Engineer
Michael Hostettlar, Chief Legal Council, Indiana Department of Transportation
Ronald Fine, Radiation Safety Officer
Kenneth Brooks, Project Engineer

Nuclear Regulatory Commission
Cynthia D. Pederson, Director, Division of Nuclear Materials Safety
Bruce Burgess, Enforcement Officer
Bruce Berson, Regional Counsel
B. J. Holt, Chief, Nuclear Materials Inspection Branch 1
John Madera, Chief, Nuclear Materials Licensing Branch
Michael LaFranzo, Radiation Specialist