MATERIALS LICENSE

Amendment No. 06

Pursuant to the Atomic Energy Act of 1954, as amended, the Energy Reorganization Act of 1974 (Public Law 93-438), and Title 10, Code of Federal Regulations, Chapter I, Parts 30, 31, 32, 33, 34, 35, 36, 39, 40, and 70, and in reliance on statements and representations heretofore made by the licensee, a license is hereby issued authorizing the licensee to receive, acquire, possess, and transfer byproduct, source, and special nuclear material designated below; to use such material for the purpose(s) and at the place(s) designated below; to deliver or transfer such material to persons authorized to receive it in accordance with the regulations of the applicable Part(s). This license shall be deemed to contain the conditions specified in Section 183 of the Atomic Energy Act of 1954, as amended, and is subject to all applicable rules, regulations, and orders of the Nuclear Regulatory Commission now or hereafter in effect and to any conditions specified below.

301863

Licensee	
1. Mead Paper Corp. Fine Paper Division	In accordance with letter dated September 16, 1996 3. License Number 34-06188-09 is amended in its entirety as follows:
2. 11th and Mulberry Streets Chillicothe, OH 45601	4. Expiration Date May 31, 2003
	5. Docket or Reference No. 030-30448

6. Byproduct, Source, and/or Special Nuclear Material	7. Chemical and/or Physical Form	8. Maximum Amount that Licensee May Possess at Any One Time Under This License
A. Cesium-137	A. Sealed Source (Texas Nuclear Model 570-5715C)	A. No single source to exceed 4,000 millicuries
B. Cesium-137	B. Sealed Source (Texas Nuclear Model A-2102)	B. No single source to exceed 150 millicuries
C. Cesium-37	C. Sealed Source (Ohmart Corp. Model A-5771)	C. No single source to exceed 35 millicuries
D. Californium-252	D. Sealed Sources (Ohmart C[illegible] Model 33131)	D. No single source to exceed 2.5 micrograms
E. Cesium-137	E. Sealed Sources (Ohmart Corp. Model A-2102)	E. No single source to exceed 50 millicuries
F. Cesium-137	F. Sealed Sources (Ohmart Corp. Model A-2102)	F. No single source to exceed 50 millicuries
G. Cesium-137	G. Sealed Sources (Texas Nuclear Model 696894)	G. No single source to exceed 100 millicuries
H. Cesium-137	H. Sealed Sources (Ohmart Corp. Model A-2102)	H. No single source to exceed 500 millicuries
I. Cesium-137	I. Sealed Sources (Kay-Ray/Sensall Source Services Model 7700-Y)	I. No single source to exceed 100 millicuries

270132

COPY

License Number
34-06188-09

MATERIALS LICENSE
SUPPLEMENTARY SHEET

Docket or Reference Number
030-30448

Amendment No. 06

6. Byproduct, source, and/or special nuclear material	7. Chemical and/or physical form	8. Maximum amount that licensee may possess at any one time under this license
J. Cesium-137	J. Sealed Sources (Kay-Ray/Sensall Source Series Model 7700-Y)	J. No single source to exceed 500 millicuries
K. Americium-241	K. Sealed Sources (Amersham Model AMC.P1)	K. No single source to exceed 150 millicuries

9. Authorized Use:

A. For use in Texas Nuclear Model 5183A or Model 5192 source holders for level measurements.

B. For use in Ohmart Corp. Model SR-1 source holders for density measurements.

C. For use in Ohmart Corp. Model SHRM source holder for flow measurements.

D. For use in Ohmart Corp. Model SHN source holder as a component of a NMG-2 moisture gauge.

E. For use in Ohmart Corp. Model SHWA source holder as a component of a NMG-2 moisture gauge.

F. For use in Ohmart Corp. Model SR-1A source holder for density measurements.

G. For use in Texas Nuclear Model 5201 source holder for density measurements.

H. For use in Ohmart Corp. Model SHD source holder for level measurements.

I. For use in Rosemont Kay-Ray/Sensall Model 7062BP source holders for level measurements.

J. For use in Rosemont Kay-Ray/Sensall Models 7063P and 7063PS source holders for level measurements.

K. For use in NDC Systems Model 104 thickness gauges.

COPY

License Number
34-06188-09

MATERIALS LICENSE
SUPPLEMENTARY SHEET

Docket or Reference Number
030-30448

Amendment No. 06

CONDITIONS

10. Licensed material shall be used only at the licensee's facilities located at 11th and Mulberry Streets, Chillicothe, Ohio.

11. The Radiation Safety Officer for this license is James H. Segelhorst.

12. Licensed material shall be used by or under the supervision of James H. Segelhorst, Blaine C. Berg, Pamela C. Brown, Timothy D. George, Robert Marshall, individuals who have successfully completed the manufacturer's training program for gauge users, the 40-hour training course described in letter dated March 11, 1996 or an equivalent training course, and have been instructed in the licensee's operating and emergency procedures and have been designated by the Radiation Safety Officer.

13. A. Sealed sources and detector cells shall be tested for leakage and/or contamination at intervals not to exceed 6 months or at such other intervals as specified by the certificate of registration referred to in 10 CFR 32.210.

B. Notwithstanding Paragraph A of this Condition, sealed sources designed to emit alpha particles shall be tested for leakage and/or contamination at intervals not to exceed 3 months.

C. In the absence of a certificate from a transferor indicating that a leak test has been made within 6 months prior to the transfer, a sealed source or detector cell received from another person shall not be put into use until tested.

D. Sealed sources need not be leak tested if:

(i) they contain only hydrogen-3; or

(ii) they contain only a radioactive gas; or

(iii) the half-life of the isotope is 30 days or less; or

(iv) they contain not more than 100 microcuries of beta and/or gamma emitting material or not more than 10 microcuries of alpha emitting material; or

(v) they are not designed to emit alpha particles, are in storage, and are not being used. However, when they are removed from storage for use or transferred to another person, and have not been tested within the required leak test interval, they shall be tested before use or transfer. No sealed source or detector cell shall be stored for a period of more than 10 years without being tested for leakage and/or contamination.

License Number 34-06188-09

MATERIALS LICENSE
SUPPLEMENTARY SHEET

Docket or Reference Number 030-30448

Amendment No. 06

E. The leak test shall be capable of detecting the presence of 0.005 microcurie of radioactive material on the test sample. Records of leak test results shall be kept in units of microcuries and shall be maintained for inspection by the Commission. If the test reveals the presence of 0.005 microcurie or more of removable contamination, a report shall be filed with the U.S. Nuclear Regulatory Commission and the source shall be removed immediately from service and decontaminated, repaired, or disposed of in accordance with Commission regulations. The report shall be filed within 5 days of the date the leak test result is known with the U.S. Nuclear Regulatory Commission, Region III, 801 Warrenville Road, Lisle, Illinois 60532-4351, ATTN: Chief, Nuclear Materials Safety Branch. The report shall specify the source involved, the test results, and corrective action taken. Records of leak test results shall be kept in units of microcuries and shall be maintained for inspection by the Commission. Records may be disposed of following Commission inspection.

F. Tests for leakage and/or contamination shall be performed by the licensee or by other persons specifically licensed by the Commission or an Agreement State to Perform such services.

14. Sealed sources or detector cells containing licensed material shall not be opened or sources removed from source holders by the licensee.

15. The licensee shall conduct a physical inventory every 6 months to account for all sources and/or devices received and possessed under the license.

16. Installation, initial radiation survey, relocation, or removal from service of device containing sealed sources shall be performed by James Segelhorst, individuals who have successfully completed the 40-hour training course described in letter dated March 11, 1996, or an equivalent training course and have been designated by the Radiation Safety Officer, Texas Nuclear, Ohmart, or by persons specifically licensed by the Commission or an Agreement State to perform such services. Removal and reinstallation of NDC gauges shall be performed by James Segelhorst or individuals who have completed NDC's training course as described in letter dated August 5, 1996 (with attachment), and have been designated by the Radiation Safety Officer. Removal and reinstallation of NDC gauges shall be performed as described in procedure RAD009 (Rev. 6/95) as described in letter dated March 22, 1996. Maintenance and repair of devices and installation, replacement, and disposal of sealed sources shall be performed only by persons specifically licensed by the Commission or an Agreement State to perform such services.

17. Prior to initial use and after installation, relocation, dismantling, alignment, or any other activity involving the source or removal of the shielding, the licensee shall assure that a radiological survey is performed to determine radiation levels in accessible areas around, above, and below the gauge with the shutter open.

This survey shall be performed only by persons authorized to perform such services by the Commission or an Agreement State. A record of the results of this survey shall be maintained for the duration of the license.

License Number
34-06188-09

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SUPPLEMENTARY SHEET

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030-30448

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18. Film badges will be worn by personnel when installing, performing initial radiation survey, relocating, or removing gauges from service. Film badges will be exchanged monthly.

19. The licensee shall operate each gauge within the manufacturer's specified temperature and/or environmental limits such that the shielding and shutter mechanism of the source holder are not compromised.

20. The licensee shall assure that the shutter mechanism is locked in the closed position during periods when a portion of an individual's body may be subject to the direct radiation beam. The licensee shall review and modify as appropriate its "lock-out" procedures whenever a new gauge is obtained to incorporate the device manufacturer's recommendations.

21. Each gauge shall be tested for the proper operation of the on-off mechanism and indicator, if any, at no longer than 6-month intervals or at such longer intervals as specified by the manufacturer and approved by U.S. Nuclear Regulatory Commission.

22. The licensee shall maintain records of information related to decommissioning at the location listed in Condition 10. of this license as specified in 10 CFR 30.35(g) until this license is terminated by the Commission.

23. In addition to the possession limits in Condition 8, the licensee shall further restrict the possession of licensed material to quantities below the minimum limit specified in 10 CFR 30.35(d) for establishing decommissioning financial assurance.

24. Except as specifically provided otherwise in this license, the licensee shall conduct its program in accordance with the statements, representations, and procedures contained in the documents, including any enclosures, listed below. The U.S. Nuclear Regulatory Commission's regulations shall govern unless the statements, representations, and procedures in the licensee's application and correspondence are more restrictive than the regulations.

    A. Application received March 1, 1988;

    B. Application dated March 16, 1993;

    C. Letters dated August 25, 1989, October 20, 1989, February 12, 1990, and March 10, 1993, June 22, 1995 (except Appendix B and references to servicing NDC gauges), March 11, 1996, March 22, 1996, and September 16, 1996.

FOR THE U.S. NUCLEAR REGULATORY COMMISSION

Date *18 November 1996*

By *William P. Reichhold*
Nuclear Materials Licensing Branch, Region III

COPY

BETWEEN:

License Fee Management Branch, ARM
and
Regional Licensing Sections

(FOR LFMS USE)
INFORMATION FROM LTS

S7

Program Code: 03120
Status Code: 0
Fee Category: 3P
Exp. Date: 20030531
Fee Comments:
Decom Fin Assur Reqd: N

LICENSE FEE TRANSMITTAL

A. REGION

1. APPLICATION ATTACHED
   Applicant/Licensee: MEAD PAPER CORPORATION
   Received Date: 960923
   Docket No: 3030448
   Control No.: 301863
   License No.: 34-06188-09
   Action Type: Amendment

2. FEE ATTACHED
   Amount: *
   Check No.:

*ADDL INFO
398985-S7

3. COMMENTS

Signed D. Hersey
Date 9-24-96

B. LICENSE FEE MANAGEMENT BRANCH (Check when milestone 03 is entered /✓/)

FEE NOT REQUIRED

1. Fee Category and Amount: 3P

2. Correct Fee Paid. Application may be processed for:
   Amendment ✓
   Renewal
   License

3. OTHER

Signed AC 9/30/96
Date

1996 SEP 27 AM 11:00

RECEIVED BY LFDCB
Date Sept. 27, 1996
Log Sep 11 III
By AC
Date Completed 9/30/96

OCT 0 8 1996

Mead

Fine Paper Division

Post Office Box 2500
Chillicothe, Ohio 45601
614-772-3111

September 16, 1996

U.S. Nuclear Regulatory Commission
Region II
Material Licensing Section
801 Warrenville Road
Lisle, IL 60532-4351

Reference # C398985

Dear Mr. Reichhold

The purpose of this letter and supporting documentation is to request the ability to move and if necessary remove NDC Probes. The employees that are specifically trained according to our procedure RAD009 and have attended and successfully completed the NDC course would have this ability. All movement and storage would be according to our specific procedures which your agency has on file under letter date March 22, 1996.

We appreciate your consideration of this request. If you have any questions, please call me at (614) 772-3012.

Sincerely,

James H Segelhorst

James H. Segelhorst, CSP, RSO
Mead Fine Paper, Chillicothe Division

Continuation of 398985
FEE NOT REQUIRED

RECEIVED
SEP 23 1996
REGION III

SEP 23 1996

301863

NDC
SYSTEMS

5314 North Irwindale Avenue
Irwindale, California 91706 USA
Tel (818)960-3300 Fax (818)939-3870

Pulp & Paper Division
3999 N. Mt. Juliet Road
Mt. Juliet, TN 37122
(615) 754-5146

August 5, 1996

Mr. James Segelhorst
RSO
Mead Fine Paper
P. O. Box 2500
Chillicothe, OH 45601

Dear Mr. Segelhorst:

This letter is to acknowledge our meeting at your facility on July 1, 1996. This meeting was at your request to conduct a radiation training class for your personnel, to review and approve your document RAD009 (Rev. 6/95) entitled Removal and Reinstallation of NDC Probes, and to observe and supervise the removal and reinstallation procedure of an NDC Gauge Probe Model 104F located on your paper machine.

These objective were met. Your personnel were given a radiation safety seminar. Your procedure document for handling the probe was reviewed and approved as complying with safe practices. We also went to your machine with the trained personnel to observe the removal and reinstallation of an NDC Systems probe. They conducted the exercise you had outlined in your document RAD009.

Therefore it is our conclusion that you and your personnel are well trained in the techniques necessary for the safe handling of NDC Systems probes (Model 104F).

Sincerely,
NDC SYSTEMS

Dick Woodard /mH

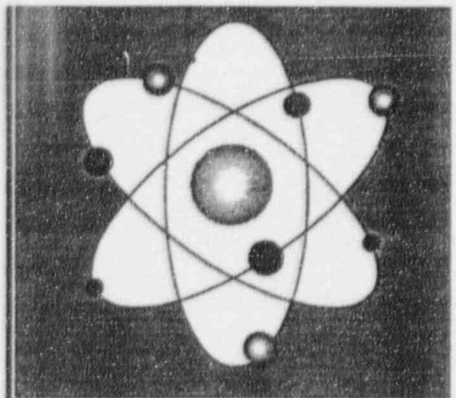
Dick Woodard
VP/General Manager
Pulp & Paper Division

NDC Systems Pulp & Paper Division
3999 North Mt. Juliet Road
Mt. Juliet, Tennessee 37122
Tel (615) 754-5146 • Fax (615) 754-5147

NDC SYSTEMS

RADIATION SAFETY
TRAINING

NDC SYSTEMS PULP AND PAPER DIVISION
3999 N. Mt. Juliet Road, Mt. Juliet, TN 37122 615-754-5146 Fax 615-754-5147



Safe Use of NDC Nuclear Sensors

The NDC Model 100 and 300 Series of Mass Measurement Gauges

NDC Systems
730 E. Cypress
Monrovia, Calif. 91016
(818) 358-1871
Fax (818) 303-5770

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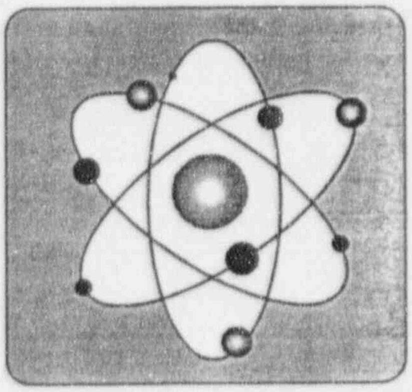
Introduction

Nuclear gauges are tools. Just as a power saw or a welding torch may be dangerous unless proper safety precautions are taken, a nuclear gauge may also be dangerous. But because a radiation injury is not as apparent or immediate as injury from a sharp blade or flame, the safety precautions are not as obvious either. By following a few simple rules, you can be assured that working with or around nuclear gauges will pose no threat to your health and safety.

This course will introduce you to radioactivity, describe how radiation is used for industrial measurements, and explain how you can ensure that you and your co-workers receive little or no exposure to radiation from NDC equipment.

1 What is Radiation

To understand nuclear gauges, you must first understand some basic facts about radiation, its origins and its possible effects.

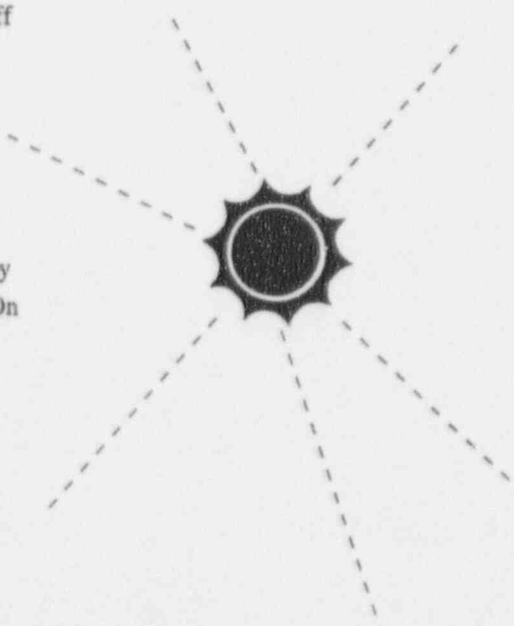


Radiation is energy that is transferred (radiated) from a source to an object. Nuclear radiation occurs when atoms, the building blocks of all matter, break down or when their components - protons, neutrons and electrons - interact with each other.

There are many other kinds of radiation, such as:

- Visible light
- Heat
- Ultraviolet light
- Microwaves

Like other types of radiation, they do not continue after the source is turned off or removed. And like other forms of radiation, they can be shielded.



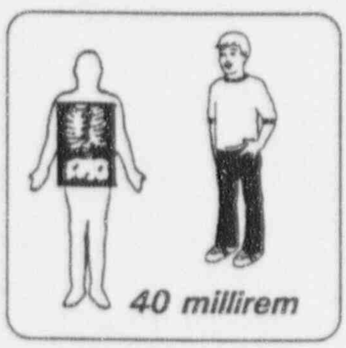
Although many of us associate the word "radiation" with danger and illness, radiation is not necessarily harmful. A burning log, for example, gives off radiant energy that warms a cold room. Sunlight is necessary for life. A microwave oven uses radiation to cook dinner. On the other hand, the burning log emits dangerous fumes and can injure if you get too close. When you lie in the sun too long, you can get a sunburn, which is a mild radiation burn. However, the hazards that come to mind when we think of radiation are most often associated with what is called "*ionizing radiation.*"

What is Radiation
continued

Ionizing radiation is energy that is powerful enough to strip the electrons from an atom, and thereby change the way it interacts with other atoms. If the affected atom is part of a living cell, the cell may be damaged. The cells most susceptible to radiation are rapidly dividing cells such as those in bone marrow, reproductive organs, and lymphoid tissues such as the spleen. On the other hand, rapidly dividing cancer cells are also susceptible to radiation, which is why it can be useful for medical treatment.

We are all exposed to ionizing radiation every day. Although we cannot control most natural background radiation, the amount we receive each year is so low that it presents little health hazard. Background radiation is covered in more detail in Section 5.

Natural background radiation is emitted from soil and rocks, from the food we eat, from the houses we live in and from cosmic rays.



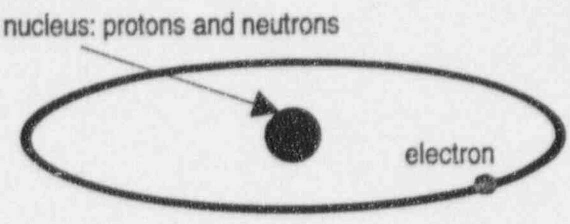
Our own bodies contribute about 40 millirem to our annual radiation exposure.

Sources of man-made radiation include medical and dental X-rays, color televisions, cigarettes, and some luminous watch dials.

Long airflights expose us to increased cosmic radiation, as does the altitude at which we live.

What is Radiation
continued

An atom is the smallest particle of any material that remains that material. Gold, iron, oxygen and uranium are all made of atoms. When atoms combine chemically they form molecules. Sodium chloride is table salt, combining a sodium atom and a chlorine atom. Ordinary water is two hydrogen atoms combined with one oxygen atom. You can divide two helium atoms and still have helium. If you take a helium atom apart, however, you no longer have helium. Instead, you have a nucleus of two protons and two neutrons, surrounded by two orbiting electrons.



An Atom

All atoms have a nucleus of one or more *protons*, usually surrounded by an equal number of *electrons*. Except for the lightest element, hydrogen, all atoms also include at least one *neutron* in the nucleus.

Unit	Charge	Weight (*atomic mass unit*)
Proton	Positive (+1)	1
Neutron	None	1
Electron	Negative (-1)	1/1836

Because the number of protons and electrons is usually the same for each atom, most atoms have a net charge of 0. The number of protons determines whether the atom is iron or oxygen, or any other element, and the number of electrons determines the atom's ability to combine with other atoms to form molecules. The number of neutrons generally increases with the number of protons, although not all atoms of the same material have the same number of neutrons. By their nature and structure, some atoms are inherently stable while others tend to come apart over time, losing neutrons, protons and electrons. Unstable atoms are called *radioisotopes*.

While radioisotopes break down spontaneously, other atoms may break apart when triggered by radiation from outside the atom. In either case, some of the energy that previously held the atom together is released and radiates away.

Some of the atoms in any radioisotope, such as uranium^{238} or americium^{241}, are continuously breaking down and releasing energy. Although we can never predict when a given atom will break down, the rate for any sample can be determined. The time required for half the atoms in a sample to break down is known as the radioisotope's *half-life*. Eventually, all the atoms in a sample will decay into a stable form. Many atoms go through several radioactive stages before becoming stable.

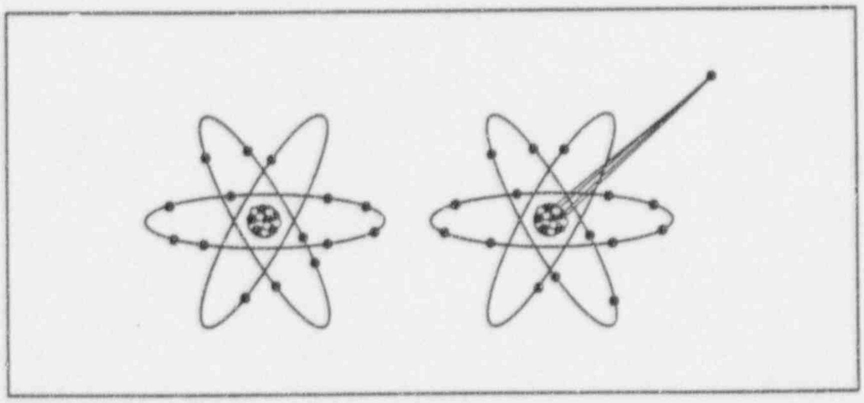
What is Radiation
continued

> ☞ Be aware of your environment.
>
> Ionizing radiation can be neither seen nor felt.

The way that an atom releases radiation can be compared to a flash bulb on a camera. When the bulb is triggered, energy is released as a flash of light. The bulb then changes its form to a spent (and stable) bulb and is no longer able to flash. The release of ionizing radiation is similar, except that there is no visible flash. A decaying atom gives off energy as radiation and then changes into a new form. Unlike the flash bulb, you *cannot* see ionizing radiation and cannot tell if the atom is still decaying and capable of giving off radiation.

Most NDC gauges use a radioisotope called *americium*^{241}, which begins with 95 protons and 146 neutrons. Eventually it decays to a stable isotope of lead. Other NDC gauges use:

- *curium*^{244} - begins with 96 protons and 148 neutrons
- *krypton*^{85} - 36 protons and 49 neutrons
- *strontium*^{90} - 38 protons and 52 neutrons
- *promethium*^{147} - 61 protons and 86 neutrons



Radioactive Decay

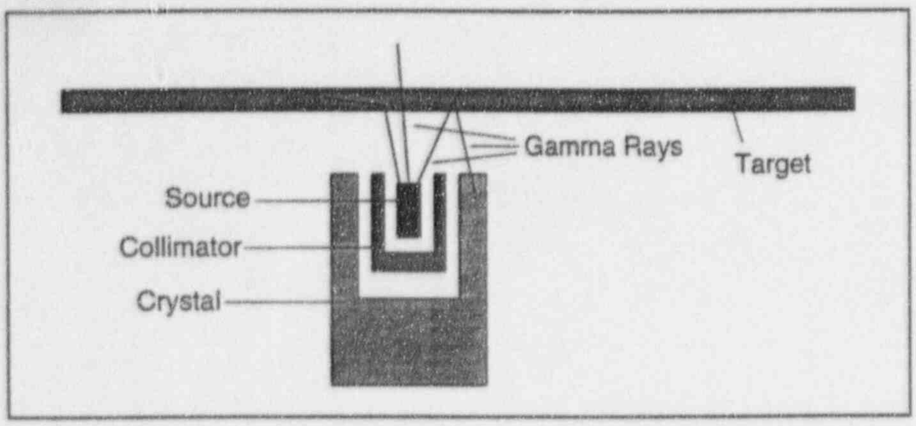
2 NDC Measurement Gauges

There are three types of NDC gauges:

- Gamma
- XRF
- Beta

Each uses radiation to measure the customer's product. Tungsten shielding ensures that radiation is emitted in only one direction, even when the shutter is open.

1. Gamma Gauges (*Models 101, 102, 103, 104*)

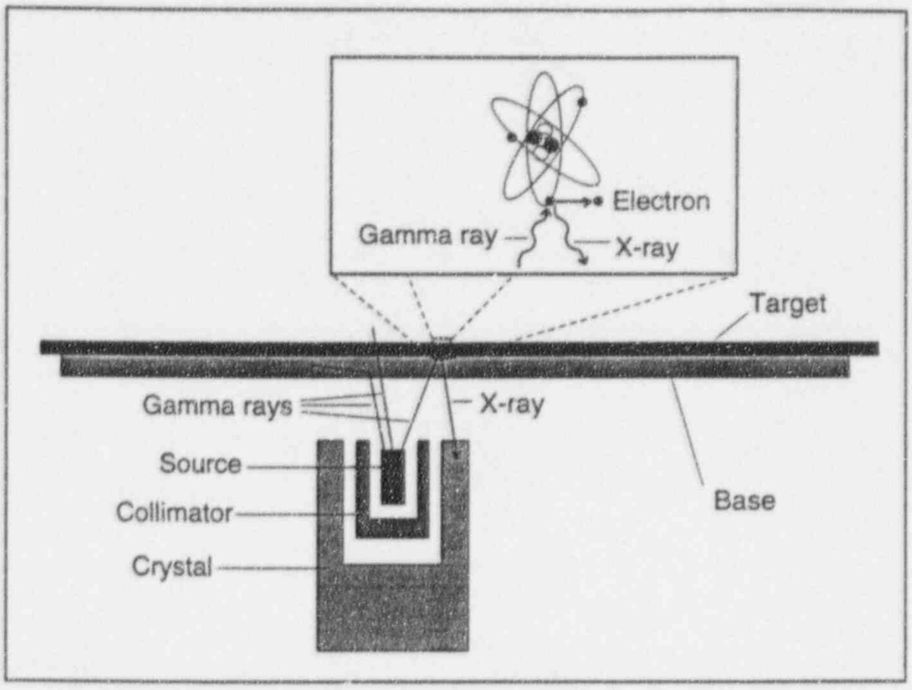


Gamma Backscatter Measurement

Gamma rays are emitted from the source and travel towards the product. Some are absorbed, some travel through and some are backscattered towards the crystal in the sensor head. The sodium iodide scintillation crystal absorbs the reflected rays and converts them to flashes of light. These flashes are picked up and amplified by the photomultiplier tube and then electronically counted and processed to give a mass measurement of the target. Because the gamma rays travel at the speed of light, the measurement is not affected by line speed.

NDC Measurement Gauges
continued

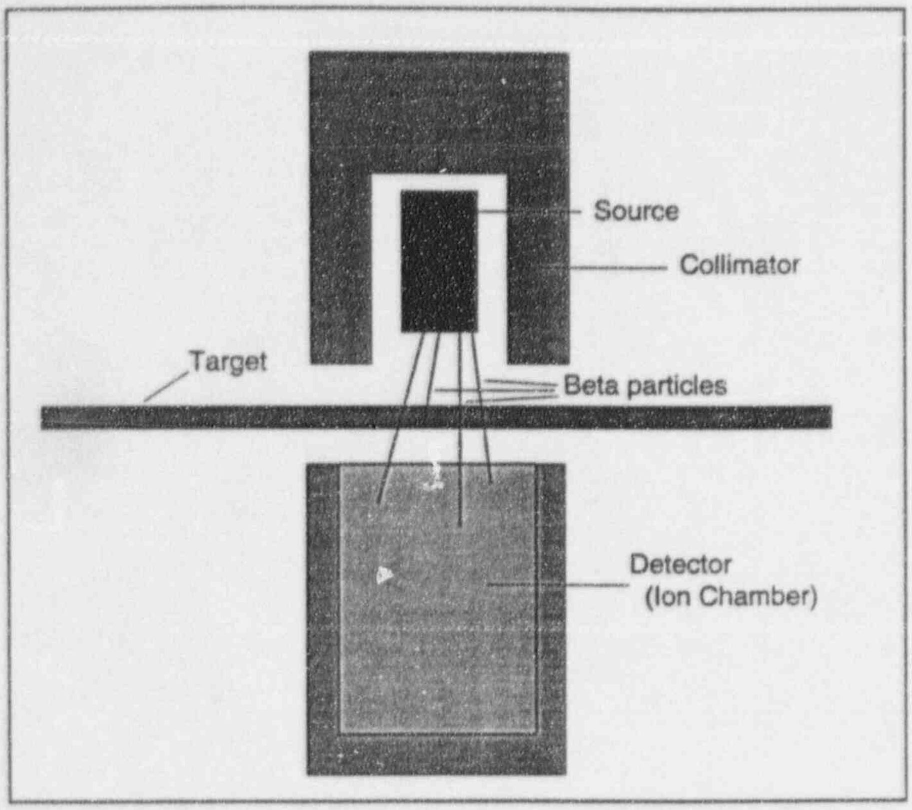
2. XRF Gauges (*Models 105 and 107*)



XRF Measurement

Gamma rays are emitted from the source and travel towards the product. As with the gamma gauges, some pass through and some are absorbed by the product. Others however, may momentarily dislodge orbiting electrons. When this happens, a portion of the energy that held the electron in its orbit is converted to an X-ray, which may then return to the sensor. This energy is then detected by the scintillation crystal and processed in the same way as the gamma gauges. Because the amount of energy associated with any X-ray is unique to the element from which it came, the gauge can be used to measure a given element even when mixed with other materials. The process of using gamma rays to generate X-rays is known as *X-ray fluorescence* (*XRF*).

3. Beta Gauges (*Models 301, 302 and 303*)

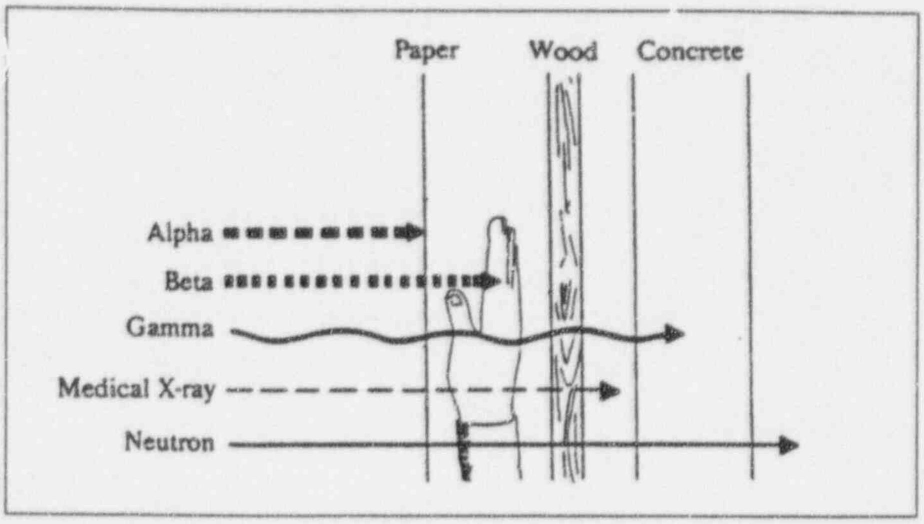


Beta Measurement

As the source in the upper sensor head decays, beta particles (electrons) are emitted towards the product. Depending on the thickness or mass of the product, some are absorbed and some pass through to the ion chamber detector in the lower sensor head. The detector counts the incoming beta particles and the gauge electronics correlate the count rate to the thickness or mass of the product.

3 Types of Radiation

This booklet touches on several types of ionizing radiation.



Penetrating Powers of Different Types of Ionizing Radiation

❑**Alpha** particles are relatively heavy helium nuclei consisting of two protons and two neutrons. They are emitted by americium^{241}. Because of their large size and electrical charge, they have the potential to cause serious damage but can be ignored for all practical purposes since they are easily shielded and cannot escape the stainless steel source capsule.

❑**Beta** particles are electrons or positrons that have more energy and can travel several feet. NDC's Model 301, 302 and 303 gauges use strontium^{90}, krypton^{85}, and promethium^{147} to produce beta particles.

❑**Bremsstrahlung** (*braking radiation*) is electromagnetic radiation caused by the sudden slowing of an electron in an intense electric field. It is similar to visible light waves but too short to be seen by the human eye. Bremsstrahlung radiation from Model 301 and 302 gauges is not used for measurement but is a potential safety concern. Beta particles from Model 303 gauges do not have enough energy to generate bremsstrahlung radiation.

❑**Gamma** rays, like bremsstrahlung and X-rays, are a form of electromagnetic radiation that is too short to be seen by humans. As noted in Sec. 1, gamma rays are generated in the nucleus as an atom decays. Model 101, 102, 103, and 104 gauges use americium^{241} to produce gamma rays that strike the target and then bounce back towards the detector (crystal)

in the sensor head. The number of gamma rays that return to the detector depends on the thickness or mass of the target, and this gives us a basis for measurement.

Types of Radiation
continued

- **X-Rays** are essentially the same as gamma rays and bremsstrahlung radiation, except that they are created when gamma rays or free electrons strike a target and momentarily dislodge other electrons from their orbits. The energy that held those electrons in their orbits is released as X-rays that can be detected by the sensor's crystal. Model 105 and 107 gauges use curium^{244} or americium^{241} to generate gamma radiation that strikes the target material.

- **Cosmic radiation** is high-energy radiation from outside the earth's atmosphere. Most of it consists of protons, neutrons and alpha particles. We live with a considerable amount of cosmic radiation, especially at higher elevations. For example, at sea level the annual background dose is 33 to 37 mrem per year. A person living in Denver at approximately 5,000 feet elevation receives an annual dose of 40 to 60 millirems per year. At 20,000 feet, one would receive 300 to 450 mrem per year. A traveller on a jet aircraft receives approximately 1 millirem per 1000 miles. The meaning of these numbers is discussed in Sec. 4. By way of comparison, the maximum allowable occupational dose is **5000 millirem per year**.

4 Definitions

Radiation **contamination** and **exposure** are not the same thing.

Contamination

represents a spill, leak, splash or other unwanted presence of radioactive material in a given location. Any contamination increases the risk of physical contact with the radioactive material. Although americium and other source materials are poisonous as well as radioactive, the source itself is contained in a stainless steel or brass capsule that prevents contamination. Moreover, all sources except krypton are ceramics that would not be digested or absorbed into your body. (The krypton source is a gas that will dissipate if the capsule is damaged.) The last section of this booklet covers recommended procedures for dealing with real or potential damage to the source capsule.

Radiation exposure

occurs when an individual is unprotected from ionizing radiation. Reasonable care will minimize exposure. Steps to minimize exposure are covered in Sec. 7 of this booklet.

Roentgen

pronounced "*runt-gen*" with a hard G, is the basic unit of radiation exposure. It represents the quantity of energy that passes through a unit area and is expressed in terms of energy per given mass. By definition, **one roentgen equals 83 ergs per gram.**

REM

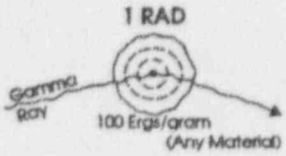
or *Roentgen Equivalent Man* represents the energy absorbed by living tissue. Another unit called the **Sievert**, equal to 100 Rem, is coming into use. Because different forms of radiation affect tissue in different ways, each type of radiation is assigned a different measure of **Radiobiological Effectiveness (RBE)**. In general, heavier particles such as protons, neutrons and alpha particles have the potential to cause more damage so they have a higher RBE. Radiobiological Effectiveness is covered in more detail in Sec. 6.

Millirem

One **millirem** (*mrem* or *mr*) equals 1/1000 rem.

RAD

or *Radiation Absorbed Dosage* is the traditional unit of energy dosage, or absorbed energy for non-living tissue. **One rad equals 100 ergs per gram.** A new term, the "Gray" has been introduced but is not yet widely used. One gray = 1 rad.



Dose Rate

is the dose received per given unit of time. This can be expressed as an average if the exposure is intermittent. The most common rates are rems or millirems per year, week or hour.

Curies (Ci), Becquerels (Bq)

are measures of radioactivity, representing the rate of disintegration in a given sample.

One curie equals 37 billion disintegrations per second.

One becquerel equals 1 disintegration per second.

1 curie = 37 billion becquerels.

The U.S. has traditionally measured activity in terms of curies, but is now conforming to international use of becquerels. Because one becquerel is such a small amount, we often speak of billions of becquerels. One billion becquerels is referred to as a "*gigabecquerel*" and abbreviated "*GBq*."

The levels of activity for NDC gauges are listed below:

Model	Activity	
	millicurie	GBq
101	150	5.55
102	150	5.55
103	150	5.55
104	80	2.96
105	100 - 250	3.7 - 9.26
107	100	3.7
301	10	0.37
302	200	7.5
303	500	18.5

Definitions
continued

Activity is a more meaningful measure of radiation than the size or weight of the source. For example, one gram of radium emits 1 curie (37 GBq) of radiation, while one gram of cobalt^{60} emits approximately 1140 curies (42180 GBq). Because of its low activity level and construction, it is virtually impossible to experience a significant acute dose from any NDC sensor.

keV

or *thousands of electron volts*, is a measure of the energy of the emitted rays. Americium^{241}'s gamma rays are emitted at 60 keV. When they interact with the electrons of the target material, they lose some of their energy and return to the crystal at 50 keV. A dental X-ray may be as high as 150 keV and some Beta gauge emissions are approximately 1,200 keV. The lower the energy level, the less ability to affect the material through which it passes, including living cells.

5 Background Radiation is All Around Us

Background radiation is the naturally occurring radiation that exists all around us. Besides cosmic radiation discussed above, there is also some natural radiation in our bodies. Naturally occurring potassium^{40} exposes us to approximately 19 millirem of gamma and beta rays per year, carbon^{14} adds 1.5 millirem and radium in our bones amounts to about 73.7 millirem per year.

The ground we walk on and the natural materials we use to build our homes also include a small amount of radioactive material. Radioactivity from these sources adds about 30 millirem per year.

Source of Dose	Dosage (mr/yr)
Potassium in the body	19
Carbon in the body	1.5
Radium (*bones only, uniform distribution*)	6.7
Radium (*bones only, non-uniform distrib.*)	67
Soil and building materials	30
Cosmic rays at sea level	33-37
Cosmic rays at 5,000 ft.	40-60
Cosmic rays at 10,000 ft.	80-120
Cosmic rays at 15,000 ft.	160-240
Cosmic rays at 20,000 ft.	300-450

Radiation Dosages to Human Body Due to Natural Background Radiation

Clearly some radiation is a natural and constant part of our environment, although no one should unnecessarily increase his or her exposure.

6 Injury From Radiation

Any living cell can be damaged by radiation if the dose is large enough. On the other hand, current research on animals and humans indicates that we can and do tolerate some radiation without harm. No one knows the threshold for damage, or even if there is a threshold. Because of this uncertainty, common sense and current law stress the idea of **ALARA** (***As Low as Reasonably Achievable.***) At the present time, no radiation dose, other than zero, is accepted as having no biological effect.

Radiation damage can take two forms:

Somatic

("*of or relating to the body*") damage appears in the irradiated person. The larger the dose, the sooner the evidence of injury appears. The minimal dose for observable effects is about *100 REM*, received in a few hours or less, at which point there may be a decrease in the white blood cell count. The first noticeable effects appear with a whole-body dose of about *200 REM*, when the person may experience flu-like symptoms such as nausea, vomiting, general weakness and fatigue.

Genetic

effects show up in the descendants of the original subject. If the original victim's ovaries or testes were exposed to radiation, his or her offspring could be affected in any manner ranging from eye color to catastrophic birth defects. The amount of damage probably depends on the dose, but the details are not well understood.

Different types of radiation interact in different ways with the material they pass through. For example, gamma and X-rays travel relatively long distances without losing energy to the atoms and molecules they bypass. On the other hand, neutrons and protons, with their large mass, transfer a relatively large amount of energy to the material in which they come in contact. Because alphas and protons have an electrical charge, their potential for damage is even greater. As a result, different types of radiation have different degrees of *Radiobiological Effectiveness* (*RBE*). This means, as the table below shows, that alpha particles, neutrons and protons have far more potential to cause harm than electrons, gamma and X-rays. Expressing exposure in terms of REM or millirem takes these differences into account.

Injury From Radiation
continued

Type of Radiation	RBE
Beta	1
Gamma	1
X-Ray	1
Neutron	2-11*
Proton	10
Alpha	20

(RBE for neutrons depends on their energy level.)

RBE of Different Types of Radiation

Some parts of our bodies are more sensitive than others. For example, the skin is less sensitive than the eyes, gonads or bone marrow, and the bone, nerves and muscles are less sensitive than the skin.

200 REM received in a few hours or less, the minimum whole body dose for an observable effect, is the equivalent of about 2,000 X-Rays, or 40,000 hours at a distance of 1 foot in front of the NDC gamma sensor. A single whole-body dose of 300 to 500 rem may be fatal but much larger highly focused doses are used to treat tumors. A dose of 400 to 800 rem to the sex organs will cause sterility but smaller doses can cause genetic changes. These types of acute injury are not likely with your gauge, barring gross irresponsibility such as holding the sensor face against your body for many hours or staring at it from a very short distance.

We also know that a highly focused dose may be less dangerous than the same dose spread over the entire body. The maximum whole body dose for adult occupational workers is *5 rem per year*. Occupational workers under the age of 18 are allowed *0.5 rem per year*. The lens of each eye is allowed *15 rem* and the skin is allowed *50 rem*, measured over the whole body or at the area that receives the highest dose. (Members of the general public are allowed *0.1 rem per year*.) These figures do not include medical or background dosages.

Anyone likely to receive 10% or more of these doses must wear a film badge or other personal monitor to track his or her exposure. Because users of NDC equipment are not likely to receive a significant dose, film badges and monitors are not required. Thousands of experiments and observations have shown no illness or injury to humans at current legal limits.

Injury From Radiation
continued

Federal regulations specify that a fetus is allowed *500 mrem* from the time the mother declares she is pregnant. If the mother is approaching or has already received that dose by the time the pregnancy is declared, the fetus may be exposed to an additional *50 mrem*. In any case, further exposure should be as low as possible, and evenly distributed throughout the pregnancy. It should be noted that the risk of approaching these limits with NDC equipment is remote. More information on the safe use of NDC sensors while pregnant can be obtained from NDC Systems.

All dose limits discussed in this section are upper limits. If lower exposures are feasible, the NRC requires exposure to be **As Low As Reasonably Achievable - ALARA**. Larger doses are allowed only under special highly regulated circumstances.

☞ **The legal limit for exposure to radioactivity is**

A - L - A - R - A

As Low As Reasonably Achievable

7 Minimizing Your Exposure

As noted earlier, nuclear gauges are tools. If used with reasonable care, the operator and other nearby personnel should not be exposed to any more radiation than a clerk at the other end of the plant.

There are three factors that affect radiation exposure:

- Distance
- Time
- Shielding

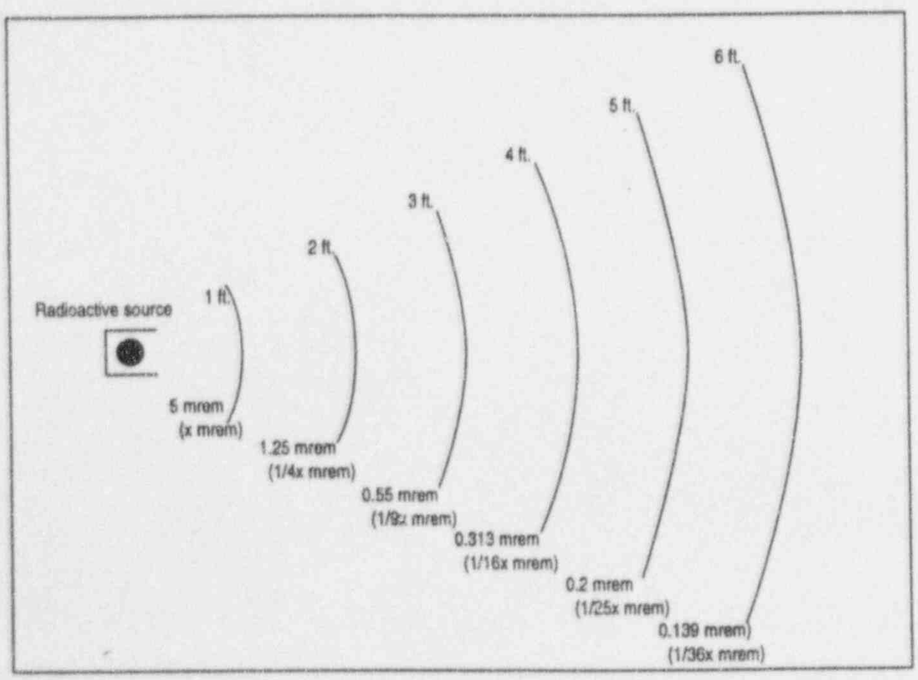
> ☞ *Time*, *Distance* and *Shielding* are the key to minimizing exposure.

Distance

The law of inverse squares shows that doubling the distance from a radioactive source reduces the exposure by 4. Likewise, cutting the distance in half will multiply exposure by four. This calculation is discussed in more detail below.

$$R = \frac{K}{d^2}$$

For example, the radiation profile on page 21 shows that the radiation level (R) for NDC gamma and XRF gauges is less than 5 mrem at 1 foot from the source. This allows us to calculate that K = 5. (Although the measured value is closer to 4 mrem per hour, we use 5 for this illustration to err on the side of safety).



Exposure Falls Off as Distance Increases

Minimizing Your Exposure

continued

$$K = 5(d^2) = 5(1^2) = 5$$

$$R = \frac{5}{2^2} = \frac{5}{4} = 1.25$$

$$R = \frac{5}{.5^2} = \frac{5}{.25} = 20$$

Now that we know K = 5, we can use this equation to calculate the exposure for any distance. Suppose d = 2 feet. In this case, $R = 5/2^2 = 5/4 = 1.25$ REM. Suppose d = 6 inches. In this case, $R = 5/.5^2 = 5/.25 = 20$ REM.

Always point the sensor away from people and keep the distance from the sensor face to operators as large as possible. In no case should the sensor be located so that an operator or other personnel would normally be within three feet of the sensor face.

The radiation profile also shows that the gamma and XRF profile is "*isotropic*," which is to say it is more intense directly in front of the sensor and falls off to the sides and as it gets farther from the source. The beta gauge radiation profile is also isotropic except that the more complex mechanical construction of the source head does not evenly block radiation to the sides.) Using the NRC's standards, a worker would have to remain one foot in front of the NDC sensor face for more than 1000 hours before he or she received the maximum annual dose of 5000 mrem. Given the likely use of the gauge, that amount of exposure is highly unlikely.

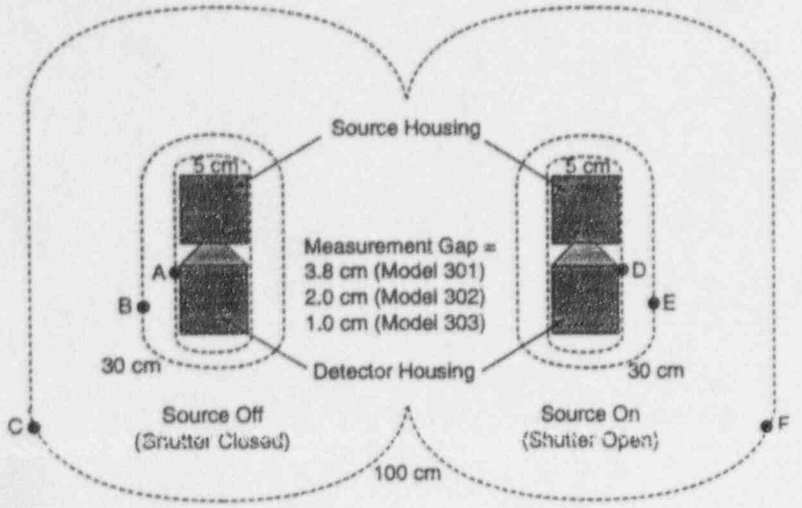
Time

The less time you spend near the sensor head, the less radiation you are exposed to. Do not let your hands or any other part of your body remain in front of the sensor any longer than necessary.

Shielding

Gamma and X-rays easily penetrate wood and water, but are stopped by lead and tungsten. Alpha particles are easily blocked by paper or skin. Beta particles can penetrate the skin, but are shielded by plastics or metal. The physical design of the sensor head ensures that no significant radiation escapes to the sides or rear. The tungsten shutter that closes over the sensor head ensures that no significant radiation escapes when the shutter is closed. If you must work for a short time in front of the sensor, close the shutter until you are finished. If the gauge must be measuring while an operator is near the sensor head, install a lead shield between the sensor and operator.

Minimizing Your Exposure
continued



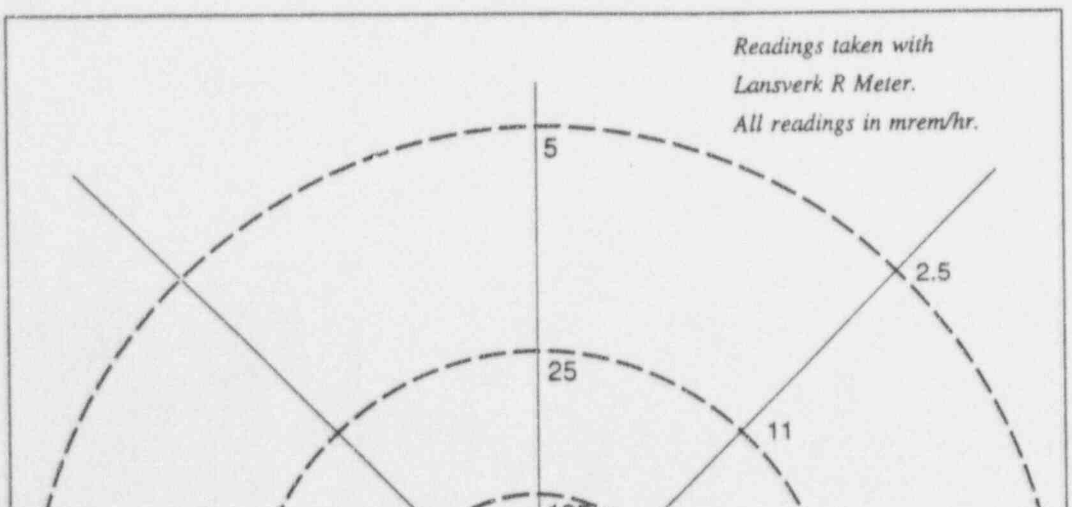
Typical Radiation Profile Isodistance Contours (mrem/hr)

Model 301	Model 302	Model 303
A1 = 0.2	A1 = 0.75	A1 = 0.22
A2 = 0.2	A2 = 0.75	A2 = 0.1
B1 = 0.1	B1 = 0.2	B1 = BG
B2 = 0.1	B2 = 0.2	B2 = BG
C1 = BG	C1 = 0.1	C1 = BG
C2 = BG	C2 = 0.1	C2 = BG
D1 = 70.7	D1 = 71	D1 = 27.2
D2 = 3.0	D2 = 9.7	D2 = 0.1
E1 = 28.3	E1 = 1.8	E1 = 0.1
E2 = 1.2	E2 = 0.3	E2 = 0.1
F1 = 0.6	F1 = 0.13	F1 = BG
F2 = 0.25	F2 = 0.1	F2 = BG

301 - Sr-90
302 - Kr-85
303 - Pm-147

BG = Background

Beta Gauge Radiation Profiles



Gamma and Beta Gauge Radiation Profiles - Am-241

8 Your Plant Safety Program

The radiation safety program can be incorporated into your existing occupational safety program or run separately. There are two major reasons for creating a radiation safety program:

- Safety of personnel in the event of an accident or emergency,
- Maintenance of good records for accountability to regulatory agencies and to minimize the impact of liability claims associated with a hazardous material.

Radiation safety should be the concern of every person working with radiation. If you are applying for a Specific license (*see below*), your company must appoint a Radiation Safety Officer (RSO) who is responsible for:

- Technical assistance in planning and execution of work where radiation safety is a factor,
- Appraisal of safe operation of the radiation source,
- Notification of personnel working around the source of any special hazards,
- Reporting of radiation hazards or unsafe practices to the proper authorities,
- Seeking advice from qualified authorities when necessary,
- Keeping records of wipe and shutter tests,
- Keeping informed of the status and location of the gauge,
- Periodically providing radiation safety training,
- Other duties as deemed appropriate by management.

9 License Types

The U.S. Nuclear Regulatory Commission (NRC) administers two types of licenses: **Specific** and **General**. A General license allows the device to be used at a single site without special training. All NDC gauges are generally licensed devices. Generally licensed customers may move sensor Models 101, 102, 103, 107 and all 104 models within their facility. Models 105, 301, 302 and 303 sensors may only be moved by someone with a Specific license allowing them to do so. A Specific license, depending on the specific conditions of the license, allows the holder of the license to possess or transport the equipment. Many customers with portable 104P and 104PD gauges apply for a Specific license to transport their gauge between work sites. Extra training is required to ensure the safety of all concerned. NDC can assist with your application for a Specific license but cannot apply for you. If you have a Specific license, the terms of that license supersede any requirements in a General license.

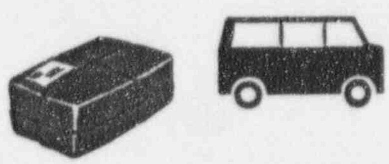
Canadian users should refer to their gauge manual and Atomic Energy Control Board license for applicable conditions and regulations. Users in other countries should consult their relevant national authorities.

10 Leak and Shutter Tests

State and Federal regulations require that the radioactive source be tested at specified intervals for capsule integrity by performing a leak test and for proper shutter operation by an examination of the shutter function. Leak test samples may be collected by the user but the test itself must be performed by a person specifically licensed to do so. Model 101, 102, 103 and 104 sensors require testing once every three years. Models 104P, 104PD, 105, 301 and 303 tests are required at six month intervals. This does not apply to the Model 302 sensors. Because Krypton-85 is a gas and the amount in the capsule is very small, it will dissipate into the atmosphere as soon as the source capsule is damaged. Results must be retained by the user and available for inspection by the proper authorities. NDC can provide these tests at a nominal charge or you can arrange for them yourselves. The first tests are performed before the gauge is shipped from the factory. A shutter check must be performed and documented at six month intervals on all sensors.

As discussed earlier, a General license is all that is needed if the gauge is always used at the same location. However, if the portable Models 104P and 104PD are moved from facility to facility, a Specific license and extra training is needed to ensure the safety of all concerned. The gauge console itself requires no special handling except normal precautions as for any expensive piece of electronic equipment.

11 Shipping the Sensor



- The sensor should be shipped by a common carrier such as Federal Express. It cannot legally be sent through the U.S. Mail.
- If the sensor is ever lost or stolen, immediately notify your state health office or the NRC, the manufacturer (NDC), and your Radiation Safety Officer (RSO). Telephone numbers for NRC and state health offices are in your gauge manual. If you suspect the sensor is stolen, the police should be contacted.
- The sensor should be shipped with the shutter closed. If the shutter is lost or damaged, wrap the head in a lead shield that is at least 1/8" thick. Contact NDC for current instructions on shipping the sensor.

12 Transporting the Sensor by Automobile

A specific license is required to transport a sensor by automobile. The following information applies to the Model 104P and 104PD portable gauges.

The Model 104P or PD sensor should be kept in a locked trunk when travelling and stored in a secure office when not in use.

Emergency procedures *(See below)* and a completed transport manifest must be carried in the car at all times when transporting the sensor. When the driver is at the vehicle's controls, these papers must be

(A) within his immediate reach while he is restrained by the lap belt and
(B) either readily visible to a person entering the driver's compartment or in a holder mounted to the inside of the driver's door.

When the driver is not at the vehicle's controls, these papers must be

(A) in a holder mounted to the inside of the door on the driver's side, or
(B) on the driver's seat.

The container holding the sensor must be blocked and braced in the trunk or back of a station wagon, away from the passenger compartment. The unit must not be visible. When traveling overnight, store the sensor in the locked trunk of the vehicle.

The company name and telephone number must be attached to the outside of the case. The case must **always** be placarded with a radiation warning label when it is inside the vehicle. The placard may be removed when the case is taken out of the vehicle. Some agreement states require placarding in a visible spot whenever the sensor is in the vehicle. Check the relevant regulations before crossing state borders.

The sensor cannot legally be carried aboard a passenger aircraft without the pilot's express permission. Most airline pilots will refuse permission when asked.

13 Procedure in Case of Suspected or Actual Damage to the Source

The radioactive source in the NDC sensor has been tested for resistance to impact, puncture, vibration, pressure, temperature, and thermal shock. Because of its construction, it is highly unlikely that the source will ever be damaged unless the sensor is visibly crushed or mangled. Dropping the sensor is *not* enough to damage the source, although it is possible to put the electronic components out of commission.

If you suspect a leak, this procedure will help prevent the spread of radioactive material. It should be carried out by the radiation safety officer, if possible, and conducted in as limited a physical area as possible. (These procedures do not apply to the Model 302 sensors. Because Krypton-85 is a gas and the amount in the capsule is very small, it will dissipate into the atmosphere and cease to be a problem as soon as the source capsule is damaged).

Procedure in Case of Suspected or Actual Damage to the Source
continued

1. Using gloves, tongs or a shovel, place the entire sensor in a plastic bag and seal, or in any container with a tight lid. Place the gloves, tongs or shovel in a similar plastic bag or container.
2. Isolate the sealed unit in an unused and secure area.
3. All personnel involved should thoroughly wash their hands.
4. If possible, rope off the area involved until the proper authorities have arrived to investigate.
5. Notify the nearest State Department of Public Health or the nearest NRC office. See your gauge manual for a list of state and NRC offices.
6. Call NDC Systems collect during normal West Coast working hours at **(818) 358-1871.** Call Chemtrec at **(800) 424-9300** on weekends or after normal working hours. If you are calling from outside the United States or Canada, telephone **(202) 483-7616.**

Rev: 8/95
Quiz: 101

RADIATION SAFETY QUIZ

True or False

1. Visible light is a type of radiation.

2. Heat is a type of ionizing radiation.

3. Ionizing radiation is high energy radiation.

4. Cosmic radiation, originating in outer space, is generally not as harmful as radiation emitted from the NDC probe.

5. Radiation-wise, living in Los Angeles is more hazardous than living in Denver.

6. Extended exposure to gamma radiation from an NDC sensor probe causes objects to become radioactive.

7. The radioactive source in the gamma gauge is fragile.

8. Radiation contamination and radiation exposure are the same thing.

9. In order to receive radiation contamination you must actually contact a radioactive substance.

10. The NDC gamma probe contaminates the operator every time the gauge is used.

11. Never attempt to repair a damaged probe yourself.

12. The rem is the special unit of dose equivalent that applies to human tissue.

13. Radium is a naturally occurring radiation source.

14. 500 mrem = 0.5 rem.

15. Danger from radiation depends upon the degree of exposure.

16. The possibility of receiving an overexposure to radiation from the NDC gamma gauge are slight.

17. Every living cell can be damaged and killed by radiation if the dose is large enough.

18. Because a user of the NDC gauge may receive small amounts of exposure over a long period of time, the operator must be concerned with chronic and not acute exposure.

19. A single exposure of 100 mrem is safer than four exposures of 25 mrem.

20. Genetic changes can be produced with doses that are too small to cause an observable effect.

21. Gamma rays are more dangerous than medical X-rays.

22. All human tissue is equally sensitive to radiation damage.

23. It is safer to receive no ionizing radiation than small doses of radiation.

24. The stated permissible dosages include radiation received from medical procedures.

25. Children are much less sensitive to radiation than adults.

26. Certain parts of the body are more sensitive to radiation.

27. The radiation from the NDC probe is isotropic, that is, whether you approach it straight on or from the side does not matter; you will receive the same dose either way.

28. Aluminum foil is a good shield against radiation.

29. The shutter should be closed whenever the gauge is not actively in use.

30. If your name appears on a specific license you are responsible for understanding the terms and conditions of that license.

31. Supervision by a specific licensee is needed in order to ship the gamma gauge legally.

32. The gamma gauge must be stored in a secure area, such as a locked cabinet.

33. All representatives of your company taking the gauge on field trips must have radiation training.

<u>Multiple Choice</u>

34. What type of radiation does the NDC Model 100 gauge emit?

    a. Alpha Radiation
    b. Beta Radiation
    c. Gamma Radiation
    d. X-rays
    e. Other

Multiple Choice (Continued)

35. The radioactive source in the NDC probe has been tested for resistance to: (Circle all that apply)

a. Pressure
b. Temperature
c. Vibration
d. Thermal Shock
e. Impact
f. Puncture
g. None of the above

36. Your friend who does not work with radiation is permitted:

a. The same amount
b. A greater dosage
c. A less dosage

37. If you are 38 years old, your maximum accumulated whole body dose is:

a. 5 rem
b. 110 rem
c. 100 rem
d. 100 mrem/week
e. 50 rem

38. The inverse square law for radiation can be written:

$$R = k(1/d^2)$$

(where k is a constant and d is the distance between the source and the target)

If the radiation from a source is 4 rem/hr. at 1 cm, what is the radiation level at 2 cm?

a. 16 rem
b. 8 rem
c. 4 rem
d. 2 rem
e. 1 rem

Multiple Choice (Continued)

39. A test for leakage of radioactive material must be performed on the Model 104P or PD sensor probe at intervals not exceeding:

    a. 2 weeks
    b. 1 month
    c. 3 months
    d. 6 months
    e. 1 year
    f. 5 years

Written Answers

40. List two types of radiation used for industrial gauging.

41. Radiation naturally occurring in the human body is due to small quantities of __________.

42. Living at seal level, one would receive a background radiation level of ___________ mrem/year cosmic rays.

43. The NDC gauging probe emits gamma radiation. Where is the detector?

44. The energy of the emitted gamma photons is approximately _____________ thousand electron volts (keV). (For comparison, the energy of dental X-rays can be as high as 150 keV. Beta gauge emissions are approximately 1200 keV. The lower the energy, the safer the radiation.)

45. The unit of radiation exposure is the ______________.

46. The rem is the special unit of dose equivalent. It stands for _____ _____ _____.

47. The unit of source strength or activity is the ____________.

48. The radioactive source used in the NDC gamma probe is Am-241. What is the radioactivity of this source in terms of the units found in the above question?

49. List the two major reasons for creating a radiation safety program.

50. List three responsibilities of the Radiation Safety Officer.

51. List three contacts that must be notified as soon as possible if the gamma gauge is ever stolen or lost.

Written Answers (Continued)

52. To render a person sterile, the reproductive organs alone would have to receive a single exposure of ____________.

53. To see any observable effect of radiation, it has been estimated that the equivalent of _________ chest X-rays in a short time is necessary.

54. What does the term ALARA mean?

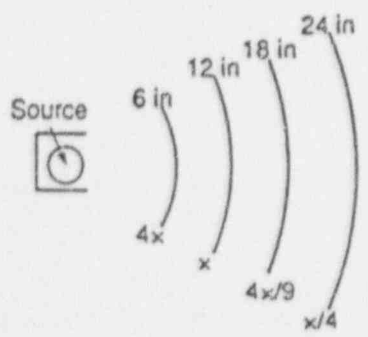
55. As a user of the gamma gauge, your maximum permissible annual dose equivalent for whole-body radiation is __________ rem, not to be received in amounts greater than ____________ mrem/week.

56. List three ways exposure to radiation can be limited.

57. With the shutter closed, the dosage rate directly on the surface of the probe is ________.

58. Radiation intensity follows the inverse square law. This means that exposure is divided by four each time you double the distance between the source and the target. If you triple the distance, exposure is divided by nine. At the following distances from the gamma probe, how long could you remain in front of the probe face and receive less than the weekly permissible dose?

Assume that exposure is 4 mrem per hour at 1 foot and that you are allowed to receive 100 mrem per week.



6 inches: ________ hours
12 inches: ________ hours
18 inches: ________ hours

59. What is the dosage from the source described in #38 at a distance of 10cm? State your answer in mrem/hr.

60. The gamma gauge should be shipped by common carrier. List an example of a common carrier.

NOV 1 8 1996

James H. Segelhorst
Radiation Safety Officer
Mead Paper Corporation
Fine Paper Division
11th and Mulberry Streets
Chillicothe, OH 45601

Dear Mr. Segelhorst:

Enclosed is Amendment No. 06 to your NRC Material License No. 34-06188-09 in accordance with your request.

Please review the enclosed document carefully and be sure that you understand all conditions. If there are any errors or questions, please notify the U.S. Nuclear Regulatory Commission, Region III office at (630) 829-9887 so that we can provide appropriate corrections and answers.

Please be advised that your license expires at the end of the day, in the month, and year stated in the license. Unless your license has been terminated, you must conduct your program involving byproduct materials in accordance with the conditions of your NRC license, representations made in your license application, and NRC regulations. In particular, note that you must:

1. Operate in accordance with NRC regulations 10 CFR Part 19, "Notices, Instructions and Reports to Workers; Inspections," 10 CFR Part 20, "Standards for Protection Against Radiation," and other applicable regulations.

2. Notify NRC, in writing, within 30 days:

   a. When the Radiation Safety Officer permanently discontinues performance of duties under the license or has a name change; or

   b. When the licensee's mailing address changes (no fee is required if the location of byproduct material remains the same).

3. In accordance with 10 CFR 30.36(b) and/or license condition, notify NRC, promptly, in writing, and request termination of the license when you decide to terminate all activities involving materials authorized under the license.

4. Request and obtain a license amendment before you:

   a. Change Radiation Safety Officers;

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b. Order byproduct material in excess of the amount, or radionuclide, or form different than authorized on the license;

c. Add or change the areas of use or address or addresses of use identified in the license application or on the license; or

d. Change ownership of your organization.

5. Submit a complete renewal application with proper fee or termination request at least 30 days before the expiration date of your license. You will receive a reminder notice approximately 90 days before the expiration date. Possession of byproduct material after your license expires is a violation of NRC regulations. A license will not normally be renewed, except on a case-by-case basis, in instances where licensed material has never been possessed or used.

In addition, please note that NRC Form 313 requires the applicant, by his/her signature, to verify that the applicant understands that all statements contained in the application are true and correct to the best of the applicant's knowledge. The signatory for the application should be the licensee or certifying official rather than a consultant.

You will be periodically inspected by NRC. Failure to conduct your program in accordance with NRC regulations, license conditions, and representations made in your license application and supplemental correspondence with NRC will result in enforcement action against you. This could include issuance of a notice of violation, or imposition of a civil penalty, or an order suspending, modifying or revoking your license as specified in the General Policy and Procedures for NRC Enforcement Actions. Since serious consequences to employees and the public can result from failure to comply with NRC requirements, prompt and vigorous enforcement action will be taken when dealing with licensees who do not achieve the necessary meticulous attention to detail and the high standard of compliance which NRC expects of its licensees.

Sincerely,

Original Signed By
W. P. Reichhold
Nuclear Materials Licensing Branch

License No.: 34-06188-09
Docket No.: 030-30448

Enclosure: Amendment No. 06

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