AMERICAN TUBULAR INSPECTION, INC.

NRC

TRAINING AND SAFETY MANUAL

RADIATION SAFETY PROCEDURES MANUAL

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TABLE OF CONTENTS

RADIATION SAFETY TRAINING MANUAL

OPENING STATEMENT:

It is the objective of this program to train and qualify pipe inspection personnel in the proper use of radioactive materials, to reduce hazard to other personnel on job sites, as well as encouraging all employees to take a leadership role in promoting good health physics practices in order to keep exposure to radioactive materials as low as is reasonably achievable.

The subject matter outlined in this manual will be covered in depth and supplemented with slides and/or other training aids. The training course is not designed to be given to employees without the aid of lecture and training aids. The course will be presented in the following components:

A. 16 hours of classroom instruction.
B. 8 hours of on-the-job field training.

Upon completion of the above, the employee shall indicate an understanding of and proficiency in the subject matter as follows:

A. Demonstrate correct utilization of safety equipment to the Radiation Safety Officer.
B. Pass a written examination with a minimum grade of 70 on a base of 100 (Ref: Part V).

Upon completion of classroom and field instruction and subsequent to satisfactory compliance with the above stated measures of understanding and proficiency, the employee will receive the following documents:

A. A certificate of completion of the radiation safety training course, signed by the Radiation Safety Officer and/or Instructor.
B. A wallet-size identification card, also signed by the Radiation Safety Officer and/or Instructor. (Ref: Part V).

This course will be taught by an approved instructor in lecture sessions. All lecture material will be based on this Training Manual. If additional materials or information are presented, they will be referenced in the training log. The training log will be maintained in our license file for State or Federal inspection purposes.

I. FUNDAMENTAL CONCEPTS OF RADIOACTIVITY

A. Radioactivity: An element is said to be radioactive if it can spontaneously decay or be transformed into another element. This transformation is always accompanied by emission of nuclear radiation. The same element can occur as either radioactive or stable. These variations of the same element are called isotopes. Isotopes are defined as atoms of the same element having the same atomic numbers (Z numbers) but different mass numbers (A numbers). That is, the same number of protons, but a different number of neutrons. Therefore Pb-206, Pb-207, and Pb-208, are all isotopes of the same element, lead. All isotopes of the same element have the same chemical properties whether they are radioactive or stable.

B. Characteristic Particles: The spontaneous radiation emitted by the radioactive elements are generally: Alpha, Beta, and Gamma. Other radiation such as X-ray and Neutron must be induced and will be considered briefly.

1. Alpha Particles have a mass equal to that of the helium nucleus and are shot out with a velocity about one-tenth that of light, and have a positive charge of 2. They possess great ionizing power but relatively little penetrating power --- only a few centimeters in air at atmospheric pressure.

2. Beta Particles consist of negatively charged particles moving with varying speeds. The penetrating power of the beta particle depends upon the speed of the particle. Those which move most rapidly possess the greatest penetrating power. Generally, 4 cm of aluminum stops all beta particles.

3. Gamma Rays are electromagnetic radiations originating from a radioactive isotopic elemental transition. They have no charge but possess great penetrating power. They present special health problems because of their deep penetration and high energy disposition. Dense materials are required to effectively shield gamma radiation.

4. Neutrons are elementary nuclear particles with a mass approximately the same as that of a hydrogen atom and electrically neutral; its mass is 1.008982 atomic mass units. Neutrons are commonly divided into sub-classifications according to their energies as follows: thermal, around .025 ev; spithermal, 0.1 ev to 100 ev; slow, less than 100 ev; intermediate, 10^2 to 10^{12}ev; fast, greater than 0.1 Mev. They are easily shielded with paraffin or hydrogen containing materials.

C. Detection of Radiation:

1. Ionization Counter - An ionization chamber in which a delimited beam of radiation passes between the electrodes without striking

them or other internal parts of the equipment. The electric field is maintained perpendicular to the electrodes in the collecting region; as a result, the ionized volume can be accurately determined from the dimensions of the collecting electrode and the limiting diaphragm.

2. G-M Counters

   a. PSM = 700 EON, Gamma 150, and Ludlum 4 are portable, battery operated radioactivity survey and counting rate meters sensitive to gamma and medium energy beta radiation. These instruments have three full scale ranges. These meters shall be calibrated every six months.

   b. Rate meter and Spectrometer is a general purpose nuclear counting instrument. The unit features preset count or time with background subtract capabilities. A ten turn potentiometer which adjusts window width when analyzer is used.

   c. Pocket Dosimeters - The direct reading Pocket Dosimeter reads instantaneously the total accumulated dosage. The dosimeter is designed for the detection and measurement of X- and gamma radiation only. Pocket dosimeters should be worn by the person handling radioactive materials if the radiation dose exceeds 20 MR/hr at one meter.

   d. Film Badge Service - The light-weight plastic holder contains a slide-in film packet that is evaluated, generally, monthly. The use of ultrasensitive films and exclusive evaluation techniques make it possible to provide accurate evaluation of even very low doses. X-, gamma, and beta radiation can be detected by this means.

D. Measurement of Activity:

1. Curie - That quantity of a radioactive nuclide disintegrating at the rate of 3.700×10^{10} atoms per second. Abbreviation: C

   a. Microcurie: One millionth of a curie (3.7×10^{4} disintegrations per second). Abbreviation: uc

   b. Millicurie: One thousandth of a curie (3.7×10^{7} disintegrations per second). Abbreviation: mc

2. Roentgen - An exposure dose of X- or gamma radiation such that the associated corpuscular emission per 0.001293 grams of air produces, in air, ions carrying 1 electrostatic unit of quantity of electricity of either sign.

3. Rad - The unit of absorbed dose, which is 100 ergs/gram in any medium. The rad is a measure of the energy imparted to matter (i.e., retained by matter) by ionizing radiation per unit mass of irradiated material at the place of interest.

4. RBE (Relative Biological Effectiveness) - The RBE is a factor which is used to compare the biological effectiveness of absorbed radiation doses (i.e., rads) due to different types of ionizing radiation. More specifically, it is the ratio of an absorbed dose of X-rays or gamma rays to the absorbed dose of a certain particular radiation required to produce an identical biological effect in a particular experimental organism or tissue. This ratio is sometimes called the Relative Biological Efficiency Factor.

5. Rem (Roentgen Equivalent Man) - The rem is the unit used to express human biological doses as a result of exposure to one or many types of ionizing radiation. The dose in rems is equal to the absorbed dose in rads times the RBE factor of the type of radiation being absorbed. Thus, the rem is the unit of RBE dose.

E. Technical Aspects of Any Isotope:

1. Half-Life - All radioactive isotopes have a special property associated with them known as half-life. Half-life is the time required for the activity of a given radioactive species to decrease to half of its initial value due to radioactive decay. The biological half-life is the time required for the amount of a specified element which has entered the body (or a particular organ) to be decreased to half of its initial value as a result of natural, biological elimination processes. The effective half-life of a given isotope is the time in which the quantity in the body will decrease to half as a result of both radioactive decay and biological elimination.

2. Energy of Emission - All isotopes have definite amounts of energy associated with each particle being emitted. These energies are characteristic of the isotope.

3. Effect of Distance - Generally speaking, the greater the distance from the source of radiation, the less the dose received by personnel. The intensity of radiation is diminished by an inverse square relationship with distance. A source measuring an intensity of 100 mr at a distance of one foot would measure 100 mr/5^2 at a distance of five feet; in other words, a radiation dose of 4 mr at the five foot distance.

4. Shielding of Various Materials - A shield can be any material or obstruction which absorbs radiation and, thus, tends to protect personnel or materials from the effects of nuclear radioactivity. Alpha particles, for example, can be shielded with a piece of paper. Beta particles can generally be absorbed through 2 cm of aluminum. Gamma rays, however, are the most penetrating, and dense shielding materials must be employed to reduce radiation.

F. Glossary and Terminology:

1. Isotope - Forms of the same element having identical chemical properties but differing in their atomic masses (due to different numbers of neutrons in their respective nuclei) and in their nuclear properties (e.g. radioactivity, fission, etc.).

2. Maximum Permissible Concentration (MPC) - The highest currently acceptable concentration of radioactive substances (usually expressed as microcuries per cubic centimeter (uc/cc) in air, water, or food to which an individual may be exposed throughout a stated period of time, without expectation of injury.

3. Maximum Permissible Dose (MPD) - That dose of ionizing radiation that a person may receive in his lifetime without producing any appreciable bodily injury. The presently accepted MPD is (N-18) x 5 rem. N is the individual's age (greater than 18).

4. Half Value Layer (HVL) - The thickness of a shielding material that will reduce a radiation intensity to half its original intensity.

5. Stay Time - The peiod during which personnel are allowed to remain in a radiation and/or contaminated area before accumulating their permissible dose.

6. Inverse Square Law - A general property of physics which states that if the distance from a point is doubled, then the radiation at the second point will be 1/4 of the radiation which is present per unit area at the first point.

$$\frac{R_1}{R_2} = \frac{(d_2)^2}{(d_1)^2}$$

II. BIOLOGICAL EFFECTS OF RADIATION

A. Characteristics of Radiation:

1. Ionization in Tissues - Radiation in tissues varies in relation to (a) the energy of the radiation, (b) the absorbed dose, (c) the time span over which the dose was received, (d) the amount of body area irradiated, plus (e) other factors not so well defined. Ionization of the atoms which make up the chemical constituents of the tissue cells, as the result of interactions with the incident radiation, is probably the basic cause of injury. Irradiation within the cell can result in (1) death of t cell, (2) complete destruction of the cell's ability to reproduce, (3) partial, incomplete, or faulty function (as of glandular cells) as well as, (4) production of genetic mutations.

2. Radiosensitivity of Tissue - Various types of tissue respond quite differently to a given kind and dose of radiation. Generally speaking, the following may be accepted as a list of common cells and/or tissues in the order of decreasing radiosensitivity:

   a. Lymph tissue (cells of the body fluid)

   b. White blood cells and immature red blood cells in the bone marrow

   c. Cells lining the gastro-intestinal tract

   d. Cells of the reproductive organs

   e. Skin

   f. Blood vessels and body cavity lining

   g. Tissue of the liver and adrenal glands

   h. Other tissues, including bone, muscle, and nerves

3. Time Factor vs. Total Dose - The biological effect of radiation depends not only on the total amount absorbed (dose), but also on the rate of absorption (dose rate). For example, 600 r would probably be fatal to a man if it were absorbed by the whole body within a period of one day; but would probably have no noticeable effect if absorbed over a period of 30 years because the body tissue is able to recover when the dose rate is low. Effects of radiation which appear within approximately a month are termed acute effects. This includes the immediate (0 to 48 hours) and the delayed (1 to 5 weeks) effects. Chronic effects would include those which result in persistent changes (radiation dermatitis), vascular or atrophic changes, and long term effects (appearing after one year -- tumor induction, cataract formation).

B. Radiation Doses to be Considered in Normal Safety Precautions:

1. Acute Effects of Whole-Body Penetrating Ionizing Radiation on Human Beings

Dose in Less Than One Week (r)	Effects
0 - 150	No acute effects other than blood changes. May be a serious long-time hazard.
150 - 250	Nausea and vomiting within 24 hours. Minimal incapacitation after 2 days.
250 - 350	Nausea and vomiting in under 4 hours. Some mortality will occur in 2 to 4 weeks. Symptom free period 45 hours to 2 weeks.
350 - 600	Nausea and vomiting likely before 2 hours. Mortality probable in 2 to 4 weeks. Incapacitation prolonged.
Greater than 600	Nausea and vomiting almost immediately. Mortality in 1 to 2 weeks.

2. Tolerance Dosages

a. 100 Millirems/week for whole body or

b.

Area of Body	Rems/Calendar Quarter
Whole body; head and trunk; active blood forming organs; lenses of eyes; or gonads	1.25
Hands and forearms; feet and ankles	18.75
Skin of whole body	7.5

C. Safety Precautions: Generally, the following safety facts should be known and observed:

1. Safety Through Distance - Distance can be an effective safety measure from a source. Safe distances should be known for the amounts of radioactive material being handled.

Examples of exposure rates at various distances from a 100 mc source:

Radioactive Material	mr 3 feet	mr 6 feet	mr 9 feet
Ir-192	61	15.25	6.8
I-131	25	6.25	2.8

2. Safety Through Shielding - Certain materials are effective shields against radiation. The half-layer value is the amount of shield necessary to reduce the radiation one-half.

Half-layer value for some common materials:

Radioactive Material	Lead	Steel	Concrete
Co-60	0.49"	0.87"	5.0"
Cs-137	0.25"	0.68"	2.1"
Ir-192	0.19"	0.5"	1.9"

3. Safety Through Stay Time - The safety of an individual may be gained by controlling the amount of time he is exposed to radiation. If exposure attains an unsafe limit, personnel should be rotated.

III. HEALTH PHYSICS REGARDING USE OF RADIOACTIVE MATERIALS

A. Monitoring Job Site Before Initiation of Work

1. Using a low level survey meter, and before work initiation monitor the area. Record the observations on a sketch of the area.

2. Certify the area clean before commencing the job.

B. Handling Equipment The following items shall be worn at times when handling the radioactive material while health physics problems are present:

1. Disposable rubber gloves will always be worn in handling radioactive materials, thus, preventing the possibility of contamination to the person who is actually handling the radioactive material.

2. Face masks shall be worn at all times when a gaseous radioactive material is being used in a field study. The face mask shall be a type approved by the National Bureau of Mines and should contain an excellent organic filter agent.

3. In some radioactive material applications it is necessary to wear protective clothing and/or use handling tongs.

C. Pocket Dosimeters can be worn by personnel who are handling the radioactive materials. If, however, personnel also carry personal film badges, then the option is present as to whether the pocket dosimeter be worn. The advantage to the pocket dosimeter is direct reading, and if the radiation level is not excessive (generally 1 to 10 mc of Iodine-131 will be handled per injection), then it should be the option of the field safety officer as to whether pocket dosimeters be worn.

D. Film Badges - It will be mandatory for all personnel working in the restricted area (an area greater than 2 mr/hr) to wear a film badge.

E. Tracer Packaging - All packages received from the supplier containing radioactive materials shall be monitored prior to their leaving the facilities. The dosage limits shall comply to the D.O.T. regulations (CFR Part 49, H.M. Manual) which stipulate a maximum of 200 mr/hr at surface of a shipping container and a maximum of 10 mr/hr at a distance of one meter from the surface of the container. Packages received from the supplier generally bear a diamond shaped Yellow III label.

F. Handling and Field Equipment Check List: The specific application may require additional radiation detection equipment than that listed below, but, generally, the field equipment will consist of the following items:

Fire Extinguisher
First aid kit
Kim-Wipes (Industrial Type)
Sponges
Large and small polyethylene storage bags for containing contaminated equipment, sponges, etc.
Masking and plastic electrical tape
Plastic wash bottles
Rubber gloves (disposable)
Labels for the return of radioactive waste
Film Badges
Concentrated wash solution
Low level survey meter
Goggles

G. Operating Procedure:

1. Pre-job knowledge and planning -- the Radiological Safety Supervisor must know:

   a. Types of radiation involved.

   b. Intensity of radiation.

   c. Relative hazard of each type of radiation.

   d. What the "stay time" (maximum allowable exposure time) is.

   e. What the possible contamination problems are.

   f. Any internal contamination problems.

   g. What industrial nuisance removable contamination will create.

   h. What controls must be dictated to protect personnel.

   i. Plan methods for controlling access to mixing and injection areas.

2. Specific Procedures will vary with the individual job applications. In general, the following procedures should be followed:

   a. Plan the job in advance.

   b. Monitor the area and measure the background radiation level.

   c. Optimum mixing location should be selected. Radioactive material should be mixed with injection fluid as close to well head as possible.

   d. Define the area which is prohibited to unauthorized personnel. (2 mr/hr is the maximum allowable radiation to people not wearing film badges.)

   e. Mix radioactive material with injection fluid with special consideration given to splashing, wind conditions and any other outside influence which could interfere with the safe handling of the material.

f. Plastic or rubber gloves should be worn at all times while handling radioactive materials. If wind velocity is sufficient to cause blowing, goggles and respirator should be used.

g. Exposure time should be controlled. If exposure approaches the maximum permissible limit, personnel should be rotated.

h. Allow no eating, smoking, or drinking in the restricted area.

i. Following the completion of the operation, the entire area should be monitored.

j. Radioactive Contamination Inspection Date Sheet should be filled out and given to customer.

H. Emergency Procedures: Emergencies vary greatly in their respective hazards. Sometimes these emergencies are in the form of spills, fires, or explosions which, consequently, result in the spread of radioactive contamination. Emergency procedures contained in the National Bureau of Standards, Handbook No. 48, are given here as a guide. It must be recognized that these procedures are general and any specific emergency would certainly involve additional procedures not specifically covered in this outline.

1. Spills involving no radiation hazard to personnel:

a. Notify all personnel in the area at once.
b. Permit only a minimum number of personnel in the vicinity of the spill.
c. Confine the spill immediately.
d. Notify the Radiation Safety Officer.
e. Decontaminate.
f. Monitor all personnel involved in the spill and cleaning.
g. Permit no person to resume work in the area until it has been surveyed and approved by one of the approved individual users specified on the N.R.C. and/or Agreement State Radioactive Material License.

2. Spills involving radiation hazard to personnel:

a. Notify all personnel not involved in the spill to vacate the area at once.
b. If the spill is liquid and the hands are protected, right the container.
c. If the spill is on the skin, flush thoroughly.
d. If the spill is on the clothing, discard outer or protective clothing at once.
e. Switch off all fans. Vacate the room.
f. Notify the Radiation Protection Officer as soon as possible.

g. Take immediate steps to decontaminate personnel involved.
h. Decontaminate the area.
i. Permit no person to resume work in the area until a survey is made and approval is received from the R.S.O.
j. Prepare a complete history of the accident, and give details in the Emergency Procedures Report.

3. Injuries to personnel involving radiation hazards:

a. Wash minor wounds immediately under running water while spreading the edges of the gash.
b. Call a physician, preferably one who is qualified to treat radiation injuries.
c. Permit no person involved in a radiation injury to return to work without the approval of the attending physician.
d. Report all radiation accidents (wounds, over-exposure, injection, inhalation) to your supervisor.
e. Prepare a complete history of the accident and give the details in the Emergency Procedures Report.

4. Vehicle wreck while transporting radioactive materials:

a. Do not leave the area unattended by qualified personnel.
b. Notify the investigating officer.
c. Notify the Radiation Safety Officer.
d. Survey the area and close off any area where the level is above 2 mr/hr.
e. Decontaminate the contaminated area (if any).
f. The R.S.O. will notify the proper Federal and State Agencies.

5. Fire and other major emergencies:

a. Notify all personnel in the area at once.
b. Attempt to put out all fires if radiation hazard is not immediately present.
c. Notify the Fire Department.
d. Notify the Radiation Safety Officer.
e. Govern the fire fighting or other emergency activities by the restrictions of the Radiation Safety Officer.
f. Following the emergency, monitor the area and determine the emergency devices necessary for safe decontamination.
g. Decontaminate.
h. Permit no person to resume work without approval of the Radiation Safety Officer.
i. Monitor all persons involved in combating the emergency.
j. Prepare a complete history of the accident and give the details in the Emergency Procedures Report.

I. Monitoring Techniques for Personnel:

1. Check hands (finger tips), shoes (soles and heels), face (nostrils) first.

2. Remove any contaminated clothing to a covered bin and continue monitoring.

3. Check hands ALWAYS before eating, drinking, or smoking. Cleanse carefully of contamination (scrub with soap and water), and check again.

J. Transportation and Disposition of Radioactive Waste:

1. Transportation of Radioactive Material:

a. Radioactive materials being transported must meet the same requirements as packaging of materials.

b. When transporting radioactive materials in a passenger automobile, the materials should be carried in the trunk compartment at the furtherest point possible away from the driver or passengers.

c. When transporting radioactive materials in a truck, the materials should be carried in a D.O.T. 7-A container, at the furtherest point possible away from the driver or passengers.

d. Any vehicle transporting radioactive materials should be posted with suitable signs.

e. Radioactive materials should be packed in such a manner so that there is no danger of spilling or loss.

f. In the event of an accident while transporting radioactive materials, efforts should be made to minimize the exposure of any persons. This could include any action such as roping off the area and notifying investigation officers. The Radiation Safety Officer should be notified immediately in order that the State or Federal Agency may be contacted if necessary.

2. Storage of Radioactive Materials:

a. Radioactive materials shall be stored in a suitable shielded container and will be covered at all times with suitable lids to prevent unnecessary exposure. Only authorized personnel shall have access to the storage facility. Suitable markings will be placed at the location.

b. An additional storage unit of suitable construction will be provided for the temporary storage of empty containers (e.g. lead pigs) or contaminated objects such as tools, rags, clothing, etc. This storage unit shall remain locked at all times. Radiation warning signs will be posted. (Not applicable to pipe inspection companies.)

3. Records and Reports: The following records and reports will be made:

a. Records showing the radiation exposures of all personnel for whom monitoring is required. These records will be preserved for five years after employee's termination.

b. Each Licensee shall report by telephone and telegraph to the Federal or State Agency, the theft or loss of any source of radiation immediately upon knowledge of it.

c. Each Licensee shall notify the Federal or State Agency upon an incident causing an individual to receive radiation in excess of the permissible limit.

4. Waste Disposal:

a. Disposal by release into sanitary sewage systems -- No Licensee shall discharge radioactive material into a sanitary sewage system, unless, it is readily soluble in water and does not exceed the MPC as specified in 10 C.F.R. or applicable State regulations.

b. Disposal by burial -- No Licensee shall dispose of radioactive material by burial without a permit obtained from the Federal or State authorities.

c. Disposal by incineration -- No Licensee shall dispose of radioactive material by means of incineration.

d. All radioactive waste materials will be turned over to a supplier who is licensed to receive radioactive waste, or they will be transported to a State or Federally approved waste disposal site.

e. Sealed sources of radioactive materials will be returned to the manufacturer for disposal.

5. Markings:

a. Radiation warning signs prescribed by this section shall be the standard radiation colors (magenta or purple on yellow background), with the conventional three-bladed symbol and the words "CAUTION - RADIOACTIVE MATERIALS" or "CAUTION - RADIATION AREA", whichever is applicable.

b. Use of signs -- Radiation warning signs shall be used in the following instances.

(1) Radiation area. (Specifically, any area where the survey meter reading exceeds 2 mr/hr.)

(2) Rooms or areas where radioactive materials are stored in quantities exceeding those specified in 10 C.F.R. or applicable State regulations.

(3) Containers in which radioactive materials are stored.

(4) Vehicles transporting radioactive material.

(5) Packages used for shipping radioactive material.

IV. PROCEDURES FOR HANDLING RADIOACTIVE SOURCES

Reference NDT's User's Manual (Section 3) for information regarding this training.

V. TESTS AND CERTIFICATES

See following pages for test and example of certificate.

TEST

A grade of 70 must be achieved in order to pass this test. This test must be completed before the employee can progress onto the further levels.

1.) Give 5 atomic elements that do not have to be of radioactive nature.

_____

_____

_____

_____

_____

2.) Name the fundamental particles of the atomic structure.

_____

_____

_____

3.) Give a brief definition of atomic weights. _____

_____

4.) Give a definition of an isotope. _____

_____

5.) What is the most common method used to radiate stable material for use.

_____

6.) Give a brief definition of decay of radioactive material. _____

_____

_____

7.) What is a curie. _____

_____

8.) Give a definition for half value layers. _____

_____

9.) What are the three factors a person should know about radioactive material protection?

_____

_____

_____

10.) Define microcurie, millicurie, and picocurie. _____

_____

_____

_____

11.) Define the term half-life. _____

_____

12.) What is a beta particle? _____

_____

13.) What is ionization? _____

_____

14.) Define the term Rad. _____

15.) Define the term Rem. _____

16.) On a survey meter, what does MR/HR mean? _____

_____

17.) What is the allowable radiation exposure to the whole body in one year? In one quarter?

_____ PER YEAR _____ PER QUARTER

18.) Name three ways to monitor personnel for radiation exposure?

_____ _____ _____

19.) What is the most common type of sensing device used for nuclear detection?

_____

20.) What item is required by law for each individual working with radioactive material to have on his person at all times?

21.) How often should a survey meter be calibrated, and how should this calibration procedure be conducted.

22.) How often must a sealed source of radioactive material be tested for leakage?

23.) What does the term "bank account" mean? Give formula.

24.) Who must be contacted in the case of an emergency involving radioactive material?

25.) Who is your Radiation Safety Officer and what is his function?

AMERICAN TUBULAR INSPECTION, INC.

This is to certify that

has on this date successfully completed training
in Radio Active Handling Fundamentals

Level _____

_____
Radiation Safety Officer

_____ _____
Date Instructor

AMERICAN TUBULAR INSP, INC.

This is to certify that

Level

TABLE OF CONTENTS

SECTION 2: RADIATION SAFETY PROCEDURES

AMERICAN TUBULAR INSPECTION, INC.

OPENING STATEMENT:

This manual outlines procedures pertaining to the use and handling of radioactive sources. It is the intent of American Tubular Inspection to comply in every way possible with State and Federal regulations for control of radiation. The objective of these procedures is to minimize safety problems and non-compliance problems, to minimize hazards to employees and the general public, and to prevent radiation incidents. Although our operations are such that the levels of radiation provide a low risk of exposure, we will follow procedures and practices that will maintain doses to individuals as low as is reasonably achievable.

To insure compliance with all regulations, a safety committee will be formed, consisting of:

George L. Andrews, Corporate Radiation Protection Officer
Kent T. Seeley, Operator
Keith E. Moon, Consultant

The function of this safety committee will be to regularly review the status of American Tubular Inspection's safety procedures and policy and to be made aware of any discrepancies which exist in these programs and to insure that all company personnel are committed to a safe and proficient safety program. A copy of these procedures will be given to each named user concerned with the handling of radioactive materials. It is the responsibility of every radiation user to have a working knowledge of these procedures. If any doubts exists in regard to these procedures or the safety conditions relating to the use of the pipe inspection unit, the Radiation Safety Officer should be contacted immediately. Violation of the conditions and procedures set forth in the following instructions shall be just ca se for punitive action.

In the event of any emergency involving a radioactive source, the Radiation Safety Officer will notify:

U. S. NUCLEAR REGULATORY COMMISSION
REGION IV - OFFICE OF INSPECTION & EQUIPMENT
611 RYAN PLAZA DRIVE, SUITE 1000
ARLINGTON, TEXAS 76012

TELEPHONE: (817) 860-8100 334-2841

RADIATION SAFETY PROCEDURES

I. RADIATION SAFETY OFFICER'S MANAGEMENT RESPONSIBILITY

A. The Radiation Safety Officer (R.S.O.) is responsible for the over-all radiation program. These duties consist of:

1. Maintaining proper radiation safety records and personnel files.
2. To provide an on-going training program for qualification of radiation personnel.
3. Providing monthly checks on all radiation personnel to insure that no excessive exposures are received by employees (not to exceed 1.25 Rems per calendar quarter or no more than 5.0 Rems per calendar year.)
4. Maintaining a personnel monitoring device.
5. Making sure vehicles/units and facilities are surveyed monthly to determine contamination levels, if any.
6. To insure that all transportation of radioactive materials is done in compliance with D.O.T. regulations (49 CFR).

B. The Radiation Safety Officer is committed to make every effort to comply with State and Federal regulations for control of radiation and to report any deficiency or area of non-compliance to the radiation safety committee.

II. RECORDS MANAGEMENT

A. A source utilization log will be kept on each tubing wall caliper that is used. (Ref: Figure #1)

B. A record of source receiving and transfer will be kept in the master radiation files.

C. Vehicle/unit and/or facility inspection survey reports will be made monthly. (Ref: Figure #2)

D. Personnel exposure records will be maintained on a monthly basis.

E. Leak test reports will be made every six months.

III. TRAINING AND QUALIFICATIONS OF PERSONNEL

A. Any person named as radiation personnel (users) on the license must be an employee of the company who has sufficient training and experience to operate inspection equipment and who has received sufficient on-the-job training in operating the equipment and in the safe use of radioactive materials.

B. All operations involving the use of radioactive materials will be performed by or under the personal supervision of a user named on the license or added by amendment.

C. Before an employee is allowed to operate any equipment containing radioactive material, he will be instructed in its use, and in the related safety procedures, by the Radiation Safety Officer and/or the qualified user in charge of the operation in progress or to be encountered.

IV. RADIATION SAFETY AND MONITORING DEVICES

A. TLD Badges: (Thermoluminescent Dosimeter)

1. A TLD badge will be assigned by name and number to each employee working with radioactive materials. Under NO circumstances will an employee be permitted to use a TLD badge other than his own.

2. The Radiation Safety Officer will be responsible for the distribution of the TLD badges and the procedures governing their use. Care should be taken to prevent exposure of TLD badges to environmental conditions which involve excessive heat or moisture as such exposure will impair the ability of the badges to measure radiation dosage.

3. TLD badges will be worn attached to the body clothing (body trunk area) during all operations which involve possible exposure to radiation.

4. TLD badges will be returned to the Radiation Safety Officer, or his designated representative, at the end of the control period for the badge.

5. TLD badge reports will be kept up-to-date by the Radiation Safety Officer. These reports will become a part of each employee's personnel record by means of an individual exposure report which will be maintained on a quarterly basis by the R.S.O. Each person to whom a TLD badge is assigned will be informed of his total radiation exposure upon request or within thirty (30) days after termination.

B. Survey Meters:

1. A radiation survey meter shall be carried on each vehicle used for transportation of radioactive materials. Survey meters used shall be sensitive to gamma radiation.

2. One or more operable radiation survey meters will be kept at the base facility as a spare and for emergency use.

3. A calibration check shall be performed on each radiation survey meter at six months intervals and after repair. The calibration check shall consist of testing the survey meter at two points other than zero, on each scale using a radiation source of known output. The calibration will be performed by a State or Federally approved survey meter calibration service company. A written record of this calibration will be kept by the R.S.O. in the master radiation files.

C. Leak/wipe tests for Sealed Sources:

1. A leak/wipe test shall be performed on each sealed radiation source at six months intervals. Leak/wipe tests will be performed by the Radiation Safety Officer or other authorized user.

✓ 2. Leak/wipe tests will be performed through the use of kits according to accompanying instructions. The kits will be supplied by one of the following:

Nuclear Sources & Services, Inc., Houston, Texas
Gulf Nuclear, Houston, Texas
Eberline Instruments, Santa Fe, New Mexico
or Any other State or Federal approved company for service, maintenance, and repair of sources.

3. Leak/wipe test reports will provide removable activity data in units of microcuries.

4. All results of leak/wipe tests will be retained for review by regulatory agents.

V. STORING, SECURING, AND TRANSPORTING RADIOACTIVE MATERIAL

A. Source Storage:

1. When not in use all sealed radiation sources shall be kept locked in their source holder.

2. Each source holder shall be posted with warning labels. (See NDT's Users Manual - Item I: Device Labeling)

3. Detailed radiation surveys will be performed on the source holder at the following times:

(a) When a new source is first received.
(b) At any time a source holder is transferred to another licensee.
(c) At the time of each quarterly source inventory. A written record shall be made of the results of each survey.

B. Vehicle/Unit Surveys:

1. Detailed radiation surveys will be made on the exterior of each vehicle/unit used for transportation of radioactive material at the following times:

(a) Prior to transporting any radioactive material. (Ref: Figure #1)
(b) Once each month. (Ref: Figure #2 - Monthly Vehicle Survey)
(c) When a new radiation source is first carried in the vehicle.
(d) After any change in the construction of the source holder or its position in the vehicle.

2. Areas around a vehicle containing radioactive material are to be considered as unrestricted areas, thus, the radiation dose rate in these areas must not exceed 2 mr/hr. If the radiation dose rate at the outer surface of a vehicle/unit is found to exceed 2 mr/hr, the radiation source must be relocated or shielded so that the dose rate is reduced to 2 mr/hr or less.

VI. EMERGENCY PROCEDURES

A. In the event of an emergency arising from malfunction of source holder device, mechanical damage, or damage to vehicle/unit:

1. Area should be immediately surveyed with an operable radiation survey meter and the area of danger secured.
2. Warning signs and barriers should be erected, if possible, at the 2 mr/hr line or a minimum of 15 feet from location of source holder.
3. The Radiation Safety Officer should be notified immediately but area must not be left unattended.
4. Proper investigation authorities must be notified.

B. In the event of a fire:

1. Notify all personnel in the area immediately.
2. Attempt to put out all fires if radiation hazard is not immediately lpresent.
3. Notify the Fire Department and the Radiation Safety Officer.
4. Govern the fire fighting activities by the restrictions of the Radiation Safety Officer.
5. Do not resume work until approved by the Radiation Safety Officer.
6. Monitor the area and all persons involved in combating the emergency.
7. Prepare a complete history of the accident and give the details in the Emergency Procedures Report (Ref: Figure #3)

FOR FURTHER INSTRUCTIONS TAILORED SPECIFICALLY FOR THE LICENSED SOURCE, REFERENCE THE ENCLOSED USERS MANUAL PROVIDED BY NDT SYSTEMS.

UNDER NO CIRCUMSTANCES WILL A COMPANY EMPLOYEE REMOVE A SEALED SOURCE OR RADIOACTIVE MATERIAL FROM ITS SOURCE HOLDER.

SEALED SOURCES OF RADIOACTIVE MATERIALS WILL BE RETURNED TO THE MANUFACTURER FOR DISPOSAL IN COMPLIANCE WITH DEPARTMENT OF TRANSPORTATION REGULATIONS.

SOURCE USE LOG
AND
TRANSPORTATION SURVEY FORM

DATE: _____

CUSTOMER NAME: _____

LOCATION: _____

SURVEY METER IDENTIFICATION:

Manufacturer: _____

Model No.: _____

Serial No.: _____

Before Job Reading

_____ mr/hr
(left)

X

_____ mr/hr (rear) X | Inspection Unit | X _____ mr/hr (front)

X

_____ mr/hr
(right)

X - Denotes Posting with Radioactive Warning Signs

After Job Reading

_____ mr/hr
(left)

X

_____ mr/hr (rear) X | Inspection Unit | X _____ mr/hr (front)

X

_____ mr/hr
(right)

Source Serial No.: _____

Isotope: _____ Signature: _____
Operator

MONTHLY UNIT SURVEY

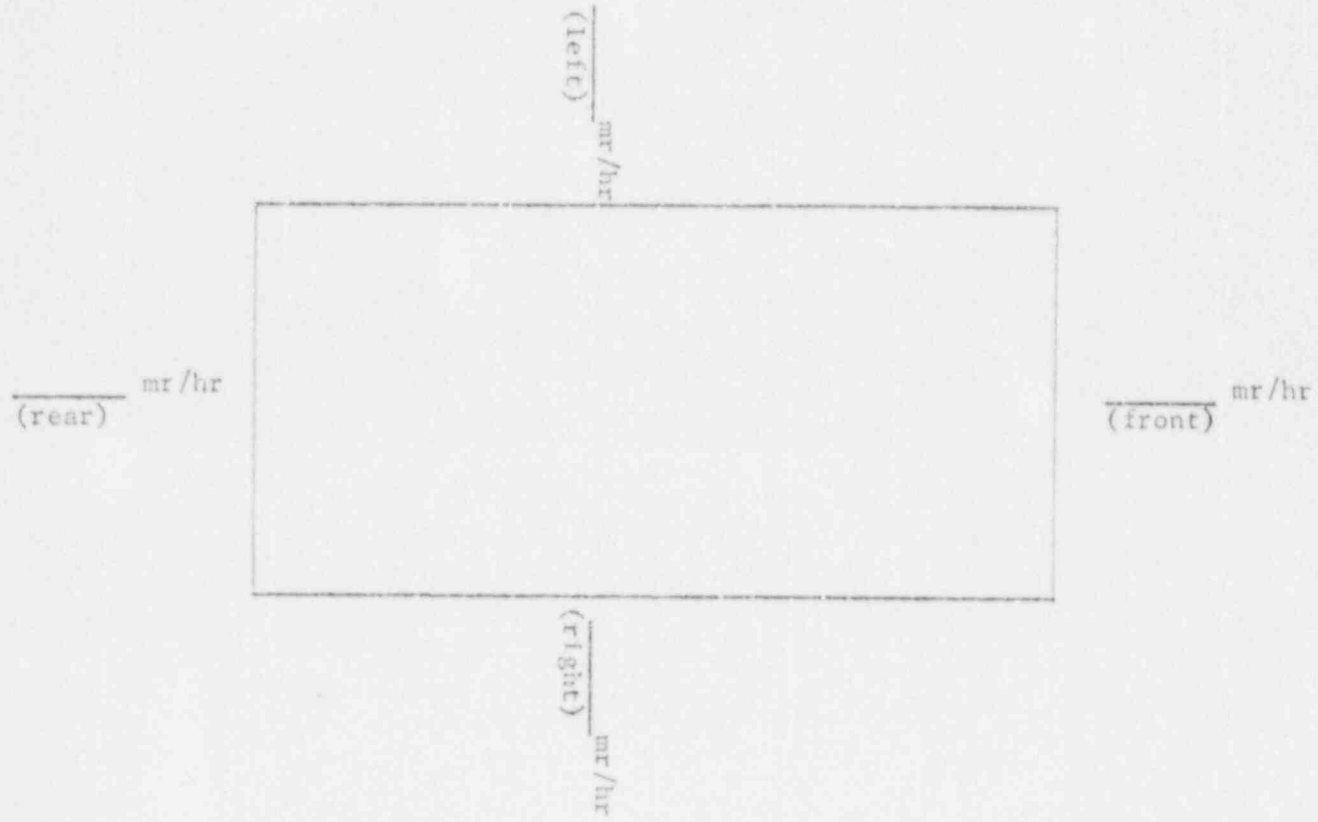
DATE: _____

SURVEY METER IDENTIFICATION:

Manufacturer: _____

Model No.: _____

Serial No.: _____



Source Serial No.: _____

Isotope: _____

Signature: _____

A. EMERGENCY PROCEDURES REPORT

1. Customer: _____

2. Customer's Supervisor: _____

3. Company Supervisor: _____

4. Cause of Emergency: _____

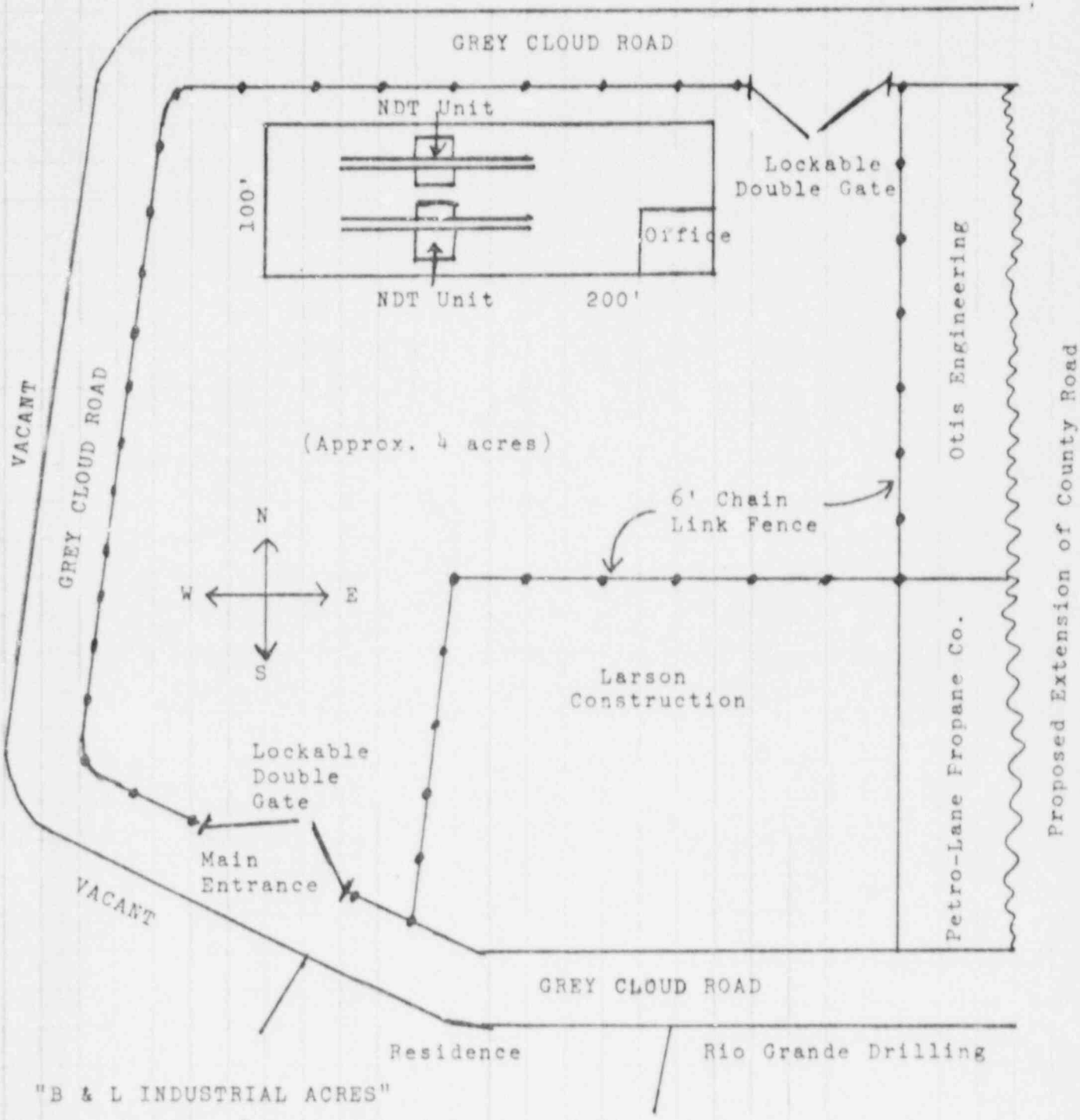
5. Source or Isotope: _____

6. Quantity of Isotope (curies) believed to have been spilled:

7. Safety precautions immediately enacted: _____

Figure #4

FACILITY DRAWING



"B & L INDUSTRIAL ACRES"
Approximately 8 miles NW of Casper, Wy.

AMERICAN TUBULAR INSPECTION, INC.
7340 West Grey Cloud Road
P. O. Box 1748
Casper, Wyoming

NDT SYSTEMS, INC. MODEL 13640 and 13640 B

TUBE WALL CALIPER

USER'S MANUAL

Section 3

C O N T E N T S

A. IDENTIFICATION
NDT Model 13640, 13640 B
Tube Wall Caliper

B. PROPOSED USE
For distribution to authorized recipients for use as a tubing or pipe wall thickness gauge. Each unit will be utilized under the terms of a specific license. The Model 13640 and 13640 B may be utilized as a complete pipe inspection system, permanently mounted at the use site or in a mobile trailer or van. The unit is designed for use as a fixed or rotating head gauge at ambient temperatures and pressures.

C. RADIOACTIVE SOURCES
Cesium 137-Up to 1500 mCi
3M Model 4F6S or 4F6H
All sources are USASI rated-46535 (Certified for well logging)

D. DETAILS OF CONSTRUCTION
The source holder is solid heavy metal (Tungsten)camera utilizing a heavy metal slide from the open to closed position. Due to the extended collimation, one small well-defined beam is emitted from the Model 13640 and two small well-defined beams are emitted from the Model 13640 B. The source is secured by a tungsten plug and a bolted cover. The cover bolts are equipped with a security seal

The "OPEN" and "SHUT" positions are plainly labeled. The OPEN/SHUT slide is equipped with an eye for locking in the closed position.

(Refer to Drawing of Model 13640 or 13640 B)

E. RADIATION PROFILES
Radiation profiles of the Model 13640 and 13640 B camera and total sys- with a 1.5 curie C_s-137 source are shown in Figures 1,2,3, & 4.

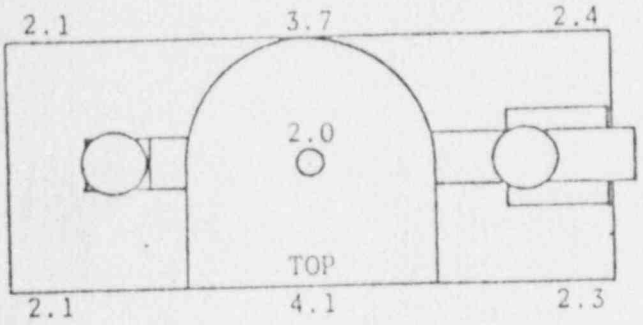
All profiles were measured with a Ludlum Model 2 geiger counter with a 44-6 gamma probe.

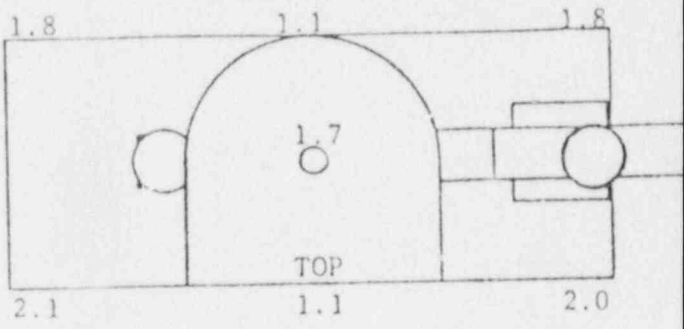
When the source camera is mounted with the detector assembly, radiation levels are less than 2.0 mr/hr on all outside surfaces of the unit in both the "OPEN and "SHUT" position.

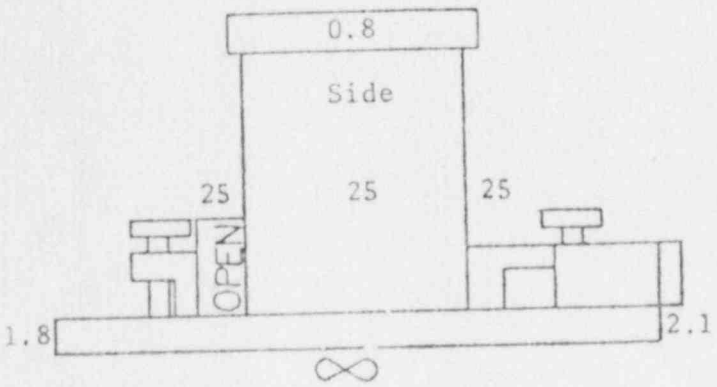
F. INSTALLATION
The Model 13640 or 13640 B may be mounted as a stationary or rotating unit at a fixed location or in a mobile trailer or van.

The device as mounted in a mobile trailer or van exhibits less than 2.0 mr/hr radiation level during operation and less than 2.0 mr/hr radiation level in the storage position on all outside surfaces of the unit.

RADIATION LEVEL PROFILES







OPEN

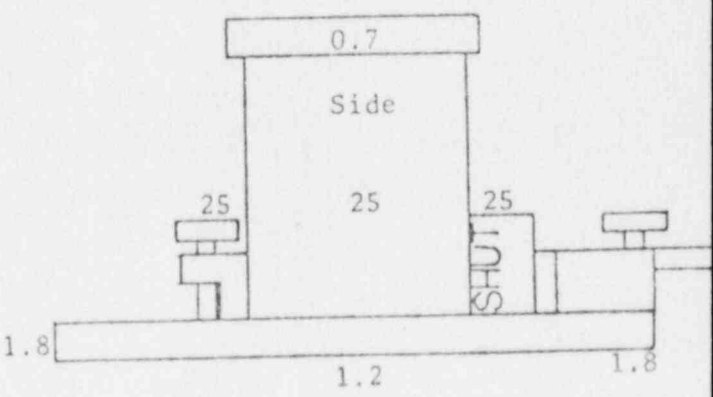


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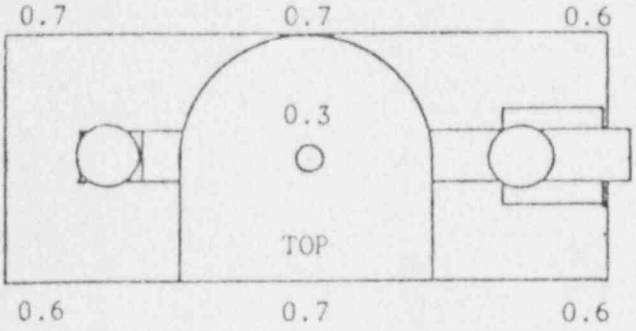
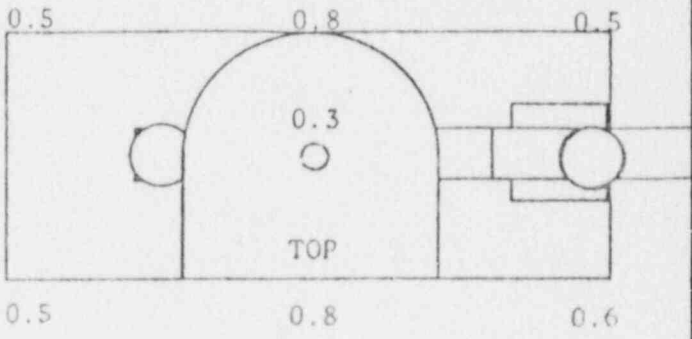
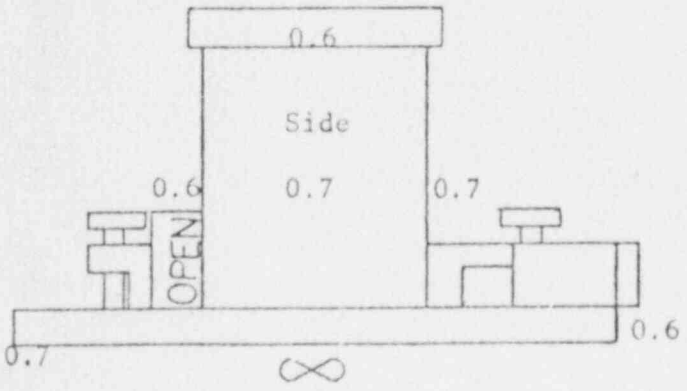
Figure 1
Surface Readings (MR/HR)
Model 13640
1500 Mci C_s-137

RADIATION LEVEL PROFILES







OPEN

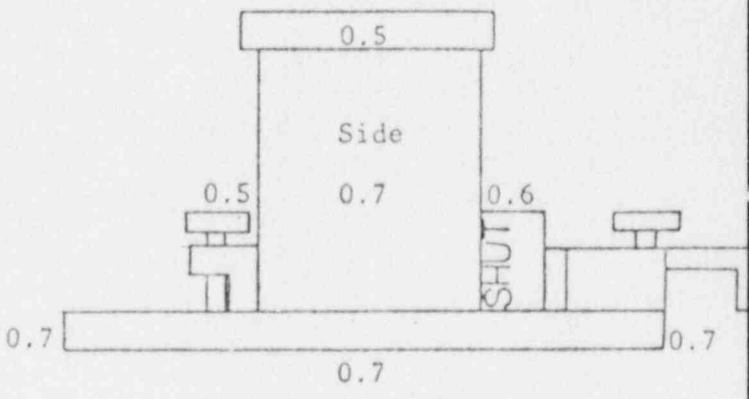


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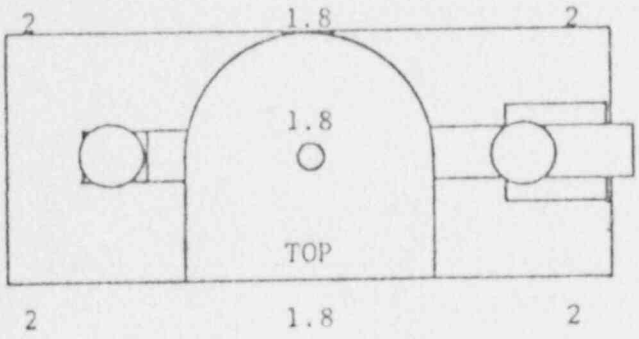
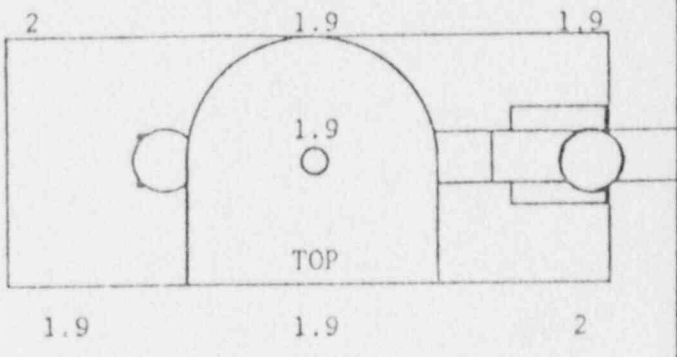
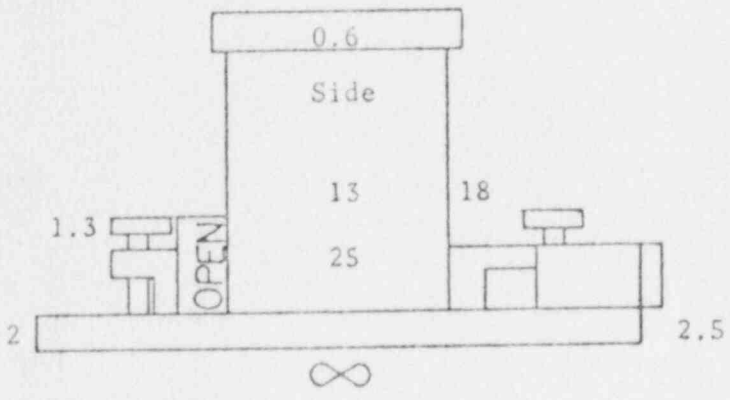
Figure 2
Twelve Inches From Surface Readings (MR/HR)
Model 13640
1500 Mci Cs-137

RADIATION LEVEL PROFILES







OPEN

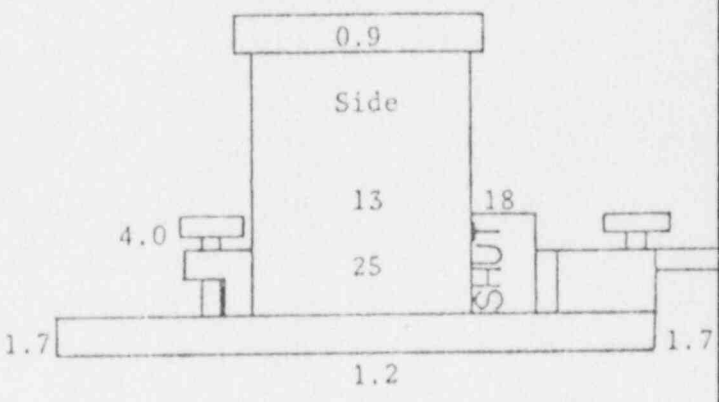


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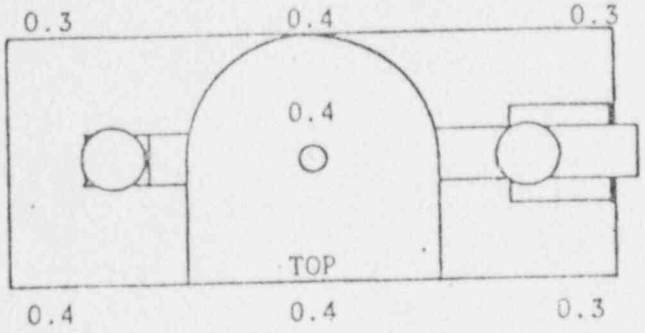
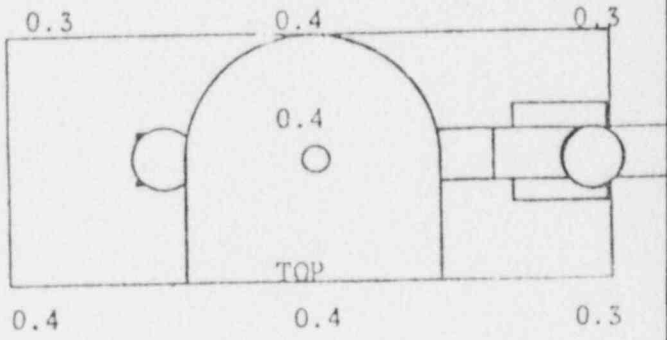
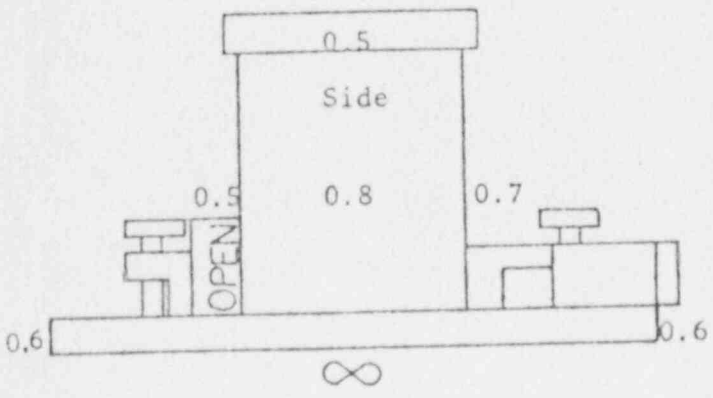
Figure 3
Surface Readings (MR/HR)
Model 13640B
1500 Mci Cs-137

RADIATION LEVEL PROFILES







OPEN

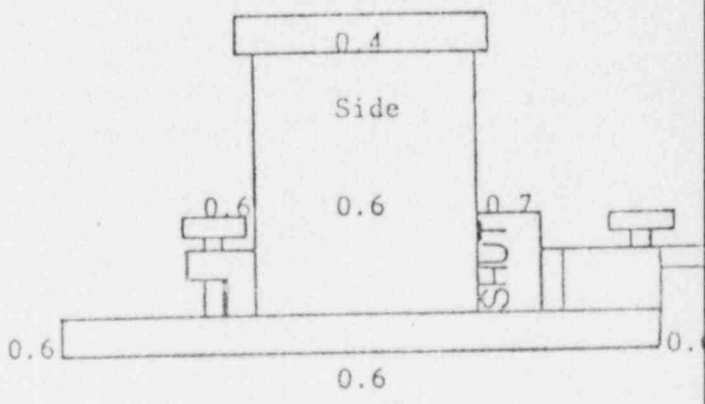


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Figure 4
Twelve Inches From Surface Readings (MR/HR)
Model 13640 B
1500 Mci Cs-137

G. PROTOTYPE TESTING

The radioactive sources have been tested and certified for use in oil well logging (ASASI 46535). The shield is of tungston heavy metal to avoid loss of shielding in case of fire due to the high melting point of greater than 6000°F.

The "OPEN" - "SHUT" mechanism has been tested and has withstood drops and jars without accidental opening or jamming.

Workers have been utilizing the unit in a laboratory enviroment for 3-4 months without excessive exposures.

Since the unit may be utilized in a rotational enviroment up to 60 RPM stress calculations were made to assure its integrity while rotating. The calculations showed that the stresses were within reason and the design adequate.

H. QUALITY CONTROL

Quality control checks prior to delivery of completed units to customers shall include:

1. A survey of each camera after loading with a 1.5 curie Cs-137 source. The survey of the camera must match closely the initial camera survey which is a part of the device evaluation. A copy of each survey will be retained as a quality control record.

2. Each camera will be fabricated as per NDT Systems, Inc., camera drawings, and will be assembled and tested for shielding and shutter operation prior to source loading for any mechanical deficiencies.

3. Each sealed source shall be wipe tested prior to placing in a camera for shipment to a customer.

1. Two labels as shown will be attached to the side of the source holder.

NOTICE

1. The receipt, possession, use, and transfer of this device, Model No. 13640 or 13640 B

   Serial No. _____ are subject to a specific license or the equivalent and the regulations of the U.S. NRC or a State with which the NRC has entered into an agreement for the exercise of regulatory authority.
2. Abandonment or disposal prohibited unless transferred to persons specifically licensed by NRC or an Agreement State.
3. Operation prohibited if there is indication of failure of, or damage to, containment of radioactive material.

   Notify NSSI- Houston, TX.

   Phone (713) 641-0391 Immediately.
4. Installation, dismantling, relocation, repair, or testing shall be performed by persons specifically licensed by NRC or an Agreement State.
5. Device shall be tested for leakage of radioactive material and proper functioning of the on-off mechanism and indicator at intervals not to exceed six months.
6. Removal of this label is prohibited.
7. Operation prohibited if there is indication of failure or damage to shielding source containment or on-off mechanism.
8. Loss, theft, or transfer of this device to another licensee, and failure or damage to shielding, source containment or on-off mechanism must be reported to NRC or Agreement State.
9. Do not place hands or fingers in the air gap.

NOTIFY CIVIL AUTHORITIES IF FOUND

CAUTION

1500 MCS C_s 137

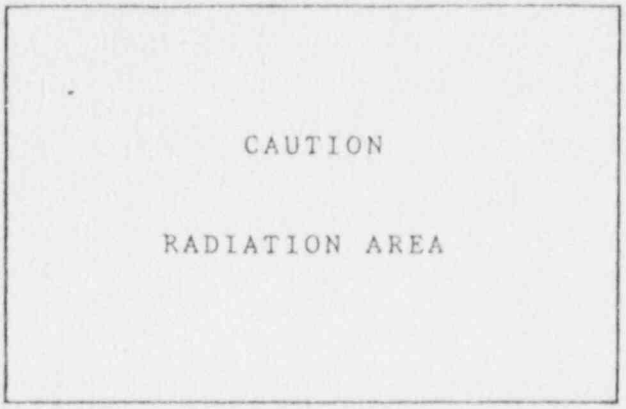
RADIOACTIVE MATERIAL

DATED

SERIAL

WARNINGS: Under no circumstances is the source holder to be disassembled, modified, application altered, or signs changed other than its specified use. Locking mechanics should be used to deter removal by unauthorized personnel.

2. Labels as shown will be attached to the instrument housing.



WARNINGS: Under No Circumstances is the source holder to be disassembled, modified, application altered, or signs changed other than its specified use. Locking mechanics should be used to deter possible removal by unauthorized personnel.

J. PIPE WALL THICKNESS GAUGE

1. NDT MODEL 13640

PURPOSE

The NDT Model 13640 Pipe Wall Thickness Gauge measures variations in pipe wall thickness by utilizing a non-contact method.

By NDT customer supplied mechanical means the pipe is fed into the gauging device which constitutes a nuclear source and a detector system. The absorption of radiation, as the pipe passes through, is directly proportional to wall thickness or any variation in that thickness. The system is presently designed to accomodate pipe size from 1" to 17" OD, but can be increased by enlargement of the cylinder through which the pipe passes.

SYSTEM OUTLINE

The pipe wall thickness gauge consists of three basic components, a source in special source housing, one electronic detector, a mechanical device for rotating the source-detector around the pipe in order to scan the circumference and an electronic processing unit with digital and analog readout. Provisions are made for attaching a chart recorder to display the continuous detected radiation in analog form. In this section each of the three components will be described.

(1) SOURCE & SOURCE HOUSING

The source housing is designed to contain and shield 1500 millicuries of Cesium 137. The isotope, double-encapsulated, is located in a heavy metal source housing. By means of a movable shutter the source housing can be placed in an open position, thus allowing one narrow beam of radiation to pass through the beam port and impinge on the pipe wall.

Each source housing has an Isodose Chart (See Figure 1 & 2) which represents the gamma dose rate at noted distances from the surface of the source housing. A lock and key is provided to prevent unauthorized opening of the source. Once the source shutter has been placed in the "OPEN" position, and locked open, the source will emit radiation at a constant rate depending upon the half-life of the isotope.

(2) DETECTOR

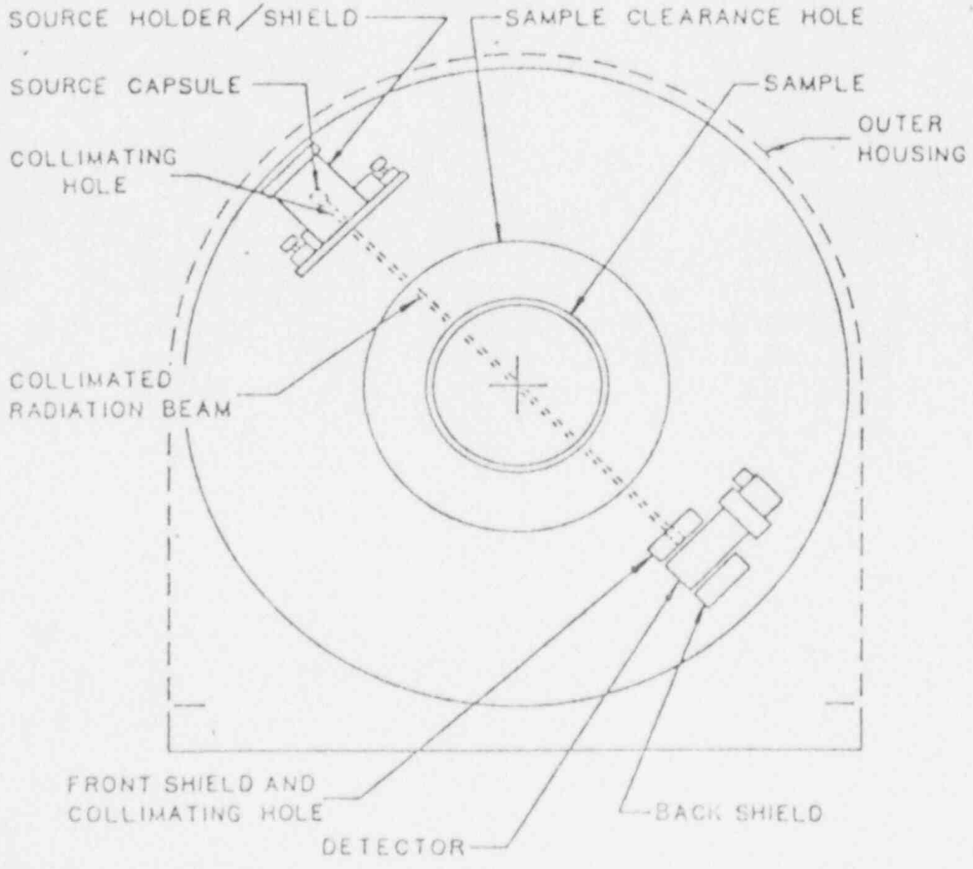
The nuclear detector comprises a scintillator (NaI) plus photomultiplier tube, amplifier and lead counter balance and beam shield. The (NaI) scintillator receives gamma energy and through physical properties, converts the incident radiation into visible light pulses.

The photomultiplier converts these signals to electrical pulses. The amplifier increases the electrical pulse amplitude so that it can be transmitted to the electronic processing unit.

The detector is located directly in front of the source beam and is mounted in such a manner that it is always facing the pipe surface at the pont of impingement of the radiation beam. The radiation intensity at the detector is related directly to the wall thickness of the pipe being surveyed.

(3) MECHANICAL SYSTEM

The total gauging system operates on the basis of passing a nonrotating pipe through a circular opening and scanning the wall thickness by rotating the source-detector system. This provides a helical curve approximately 8 to 12 inches apart (dependent on pipe speed through gauge), and gives good coverage of the scanned area. The source-detector system is mounted on a rotating drum. The system is driven by motor drive belts. The motor speed can be varied as desired. The total system is mounted on a rigid frame and bolted into place for installation. Since the source and source housing as well as the detector system is rotating, the signal from the scintillation detector is transferred to stationary system by means of a carbon brush commutator. All electrical signals to the gauging device are transferred through the commutator and are fed into the electronic unit.



PURPOSE

The NDT Model 13640 B Wall Thickness Gauge measures variations in pipe wall thickness by utilizing a non contact method.

By NDT customer supplied mechanical means the pipe is fed into the gauging device which constitutes a nuclear source and a detector system. The absorption of radiation, as the pipe passes through, is directly proportional to wall thickness or any variation in that thickness. The system is presently designed to accomodate pipe size from 1" to 17" OD, but can be increased by enlargement of the cylinder through which the pipe passes.

SYSTEM OUTLINE

The pipe wall thickness gauge consists of five (5) basic components, a source in special source housing, two electronic detectors, a mechanical device for rotating the source-detector around the pipe in order to scan the circumference and an electronic processing unit with digital and analog readout. Provisions are made for attaching a chart recorder to display the continuous detected radiation in analog form. In this section each of the five (5) components will be described.

(1) SOURCE & SOURCE HOUSING

The source housing is designed to contain and shield 1500 millicuries of Cesium 137. The isotope, double-encapsulated, is located in a heavy metal source housing. By means of a movable shutter the source housing can be placed in an open position, thus allowing two narrow beams of radiation to pass through the beam ports and impinge on the pipe wall.

Each source housing has an Isodose Chart (See Figure 3 & 4) which represents the gamma dose rate at noted distances from the surface of the source housing. A lock and key is provided to prevent unauthorized opening or closing of the source. Once the source shutter has been placed in the "OPEN" position, and locked open, the source will emit radiation at a constant rate depending upon the half life of the isotope.

(2) DETECTORS

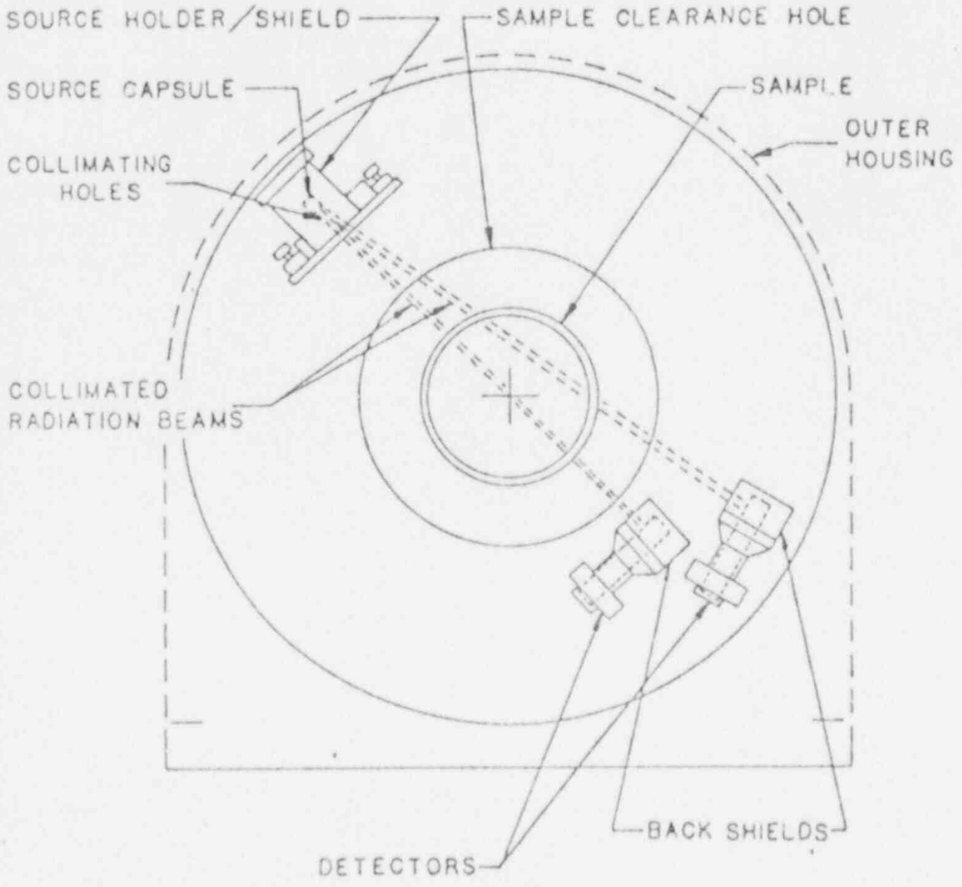
Each nuclear detector comproses a scintillator (NaI)plus photo multiplier tube, amplifier and lead counter balance and beam shield. The (NaI)scintillator receives gamma energy and through physical properties, converts the incident radiation into visible light pulses.

The photomultiplier converts these signals to electrical pulses. The amplifier increases the electrical pulse amplitude so that it can be transmitted to the electronic processing unit.

The detector systems are located directly in fromt of the source beams and are mounted in such a manner that they are always facing the pipe surface at the point of impingement of the radiation beam. The radiation intensity at the detector is related directly to the wall thickness of the pipe being surveyed.

(3) MECHANICAL SYSTEM

The total gauging system operates on the basis of passing a nonrotating pipe through a circular opening and scanning the wall thickness by rotating the source-detectors system. This provides a helical curve approximately 8 to 12 inches apart (dependent on pipe speed through gauge), and gives good coverage of the scanned area. The source-detectors systems is mounted on a rotating drum. The system is driven by motor drive belts. The motor speed can be varied as desired. The total system is mounted on a rigid frame and bolted into place for installation. Since the source and source housing as well as the detector system is rotating, the signal from the scintillation detector is transferred to a stationary system by means of a carbon brush commutator. All electrical signals to the gauging device are transferred through the commutator and are fed into the electronic processing unit.



K. SERVICING

Repair and maintenance work involving the source will be performed by Nuclear Sources & Services, Inc., personnel only. NDT Systems, Inc., will be limited to warranty repair of the mechanical and electronic portions of the system.

NUCLEAR SOURCES & SERVICES, INC.
P.O. Box 14023
5711 Etheridge St.
Houston, TX. 77021
713-641-0391 (24 Hour Telephone)

NDT SYSTEMS, INC.
P.O. Box 4999
119 E. 52nd St.
Odessa, TX, 79760
915-362-0378

L. ELECTRONIC MAINTENANCE

If it is determined that electronic failure in the interstage or detector has occured, proceed as follows for replacement of components:

1. Open outer housing.

2. Move source holder to "SHUT" position and lock.

3. Place geiger counter on the side of detector which is toward source holder. Reading must be less than 2.0 mr/hr indicating source is in "SHUT" position. If higher reading is obtained, terminate procedure and follow emergency procedure.

4. Disconnnect interstage unit and connect in new interstage.

5. Place test sample in sample hole, move source to "OPEN" position, replace outer housing and determine if problem is resolved.

6. If interstage replacement did not resolve problem, then open outer housing, move source holder to "SHUT" position and lock. Then replace detector. (Do not open source holder without detector mounted securely.)

7. Move source holder to "OPEN" position and close outer housing before testing to determine if repair is complete.

M. INSTRUCTIONS FOR SHIPMENT AND TRANSPORTATION

Special rules apply to transportation and shipment of radioactive materials. If any transportation of the source holder or complete device is contemplated, all packages or vehicles must comply with rules and regulations published by U.S. Department of Transportation, 46 C.F.R. Part 146, 49 C.F.R. Parts 173-179, and 14 C.F.R. Part 103.

In the event of damage or malfunction to the source holder, do not transport until the device has been inspected by an individual licensed to load the source holder and certified as safe for transportation.

For routine transportation, move source holder to "SHUT" position and lock. Remove source holder from source holder support (7 bolts). Take geiger counter and confirm radiation profile. Pack source holder so slide is protected. Label shipment in compliance with cited regulations and ship to licensed destination.

Prior to transporting any radioactive material, a "Transportation" form must be completed and appropriate placards placed on the vehicle. A sample form is attached.

TRANSPORTATION OF SOURCES

DATE & TIME: LOADED _____

TRANSPORTED _____

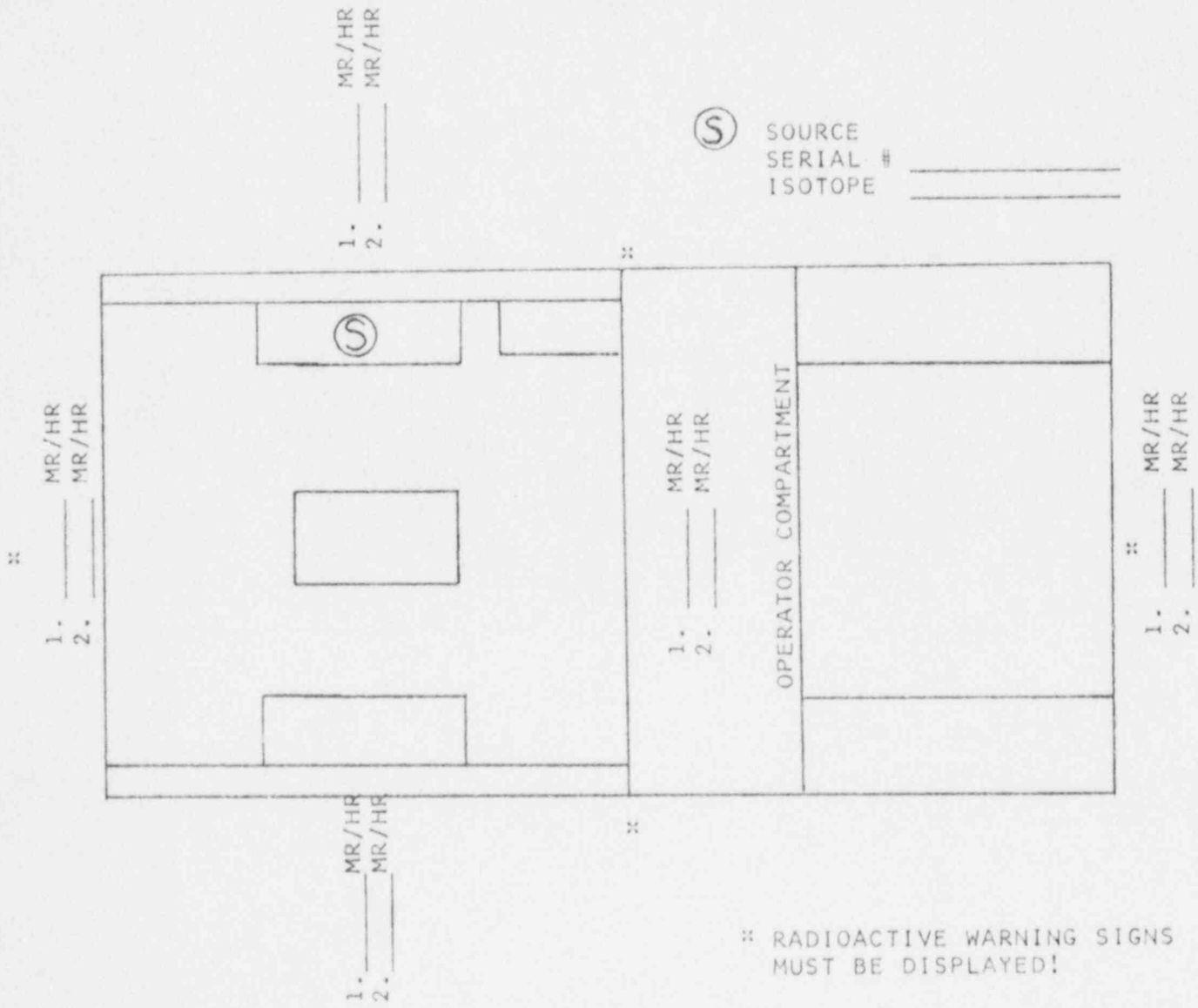
UNLOADED _____

DRIVER _____ FILM BADGE NO. _____

VEHICLE: MAKE _____ MODEL _____ LICENSE # _____

DESTINATION _____

SURVEYOR _____ SURVEY METER MODEL _____
SERIAL NO. _____



N. OPERATING PROCEDURES AND SURVEYS

1. Upon arrival at the job site, test procedures should be followed for the gauging system.

2. Using your G-M Survey Meter, determine the radiation dose rate by monitoring the gauge around the perimeter of the camera drum at the surface of the unit. This should be done while the source is in the "SHUT" position. Repeat the survey with the source in the "OPEN" position. CLOSE THE SOURCE AND RESURVEY THE UNIT. Check your readings against the "Isodose Chart" supplied in Figure 1,2,3 & 4 Radiation Fields. If values do not correspond with ± 20%, contact manufacturer at once.

3. Complete the assembly of all pipe transport mechanisms

4. Turn power switch on open outer housing and move the camera shutter to the "OPEN" position. (Warning-Do Not Place Any Part of Body in Sample Hole as Radiation Overexposure May Result.) Close outer housing.

5. Complete all electronic test checks.

6. Calibrate system using standard wall calibrator.

7. System is ready to measure pipewall thickness.

8. Upon completion of the pipe testing or at the end of each day, the reverse procedure is utilized.

   a. Open outer housing and close camera shutter and lock. Close outer housing.

   b. Turn off power.

   c. Check to see that source is off and survey surface of source head and assure that the unit is in the "SHUT" position.

   d. Lock the truck or trailer to assure that no unauthorized personnel may enter. (For mobile units only.)

9. Wipe test unit every six months. To wipe test:

   a. Obtain an approved wipe test kit or use one provided by NSSI.

   b. Survey the source holder with a calibrated geiger counter to assure that it is in the "SHUT" position.

   c. Follow instructions on kit and wipe the camera port.

   d. Monitor the swab and follow instructions on the kit or camera locking mechanism.

   e. Survey the wipe with the geiger counter. If levels are above 0.1 mr/hr notify NSSI immediately, and do not operate device.

ELECTRONIC DATA PROCESSING

All signals received from the survey unit are electronically converted to analog signals and displayed on a continuous recorder.

Adjustments of high voltage, gain signal discrimination, etc., are available at the console and at the detector.

BUYER ORIENTATION

Prior to delivery, or at the time of delivery, an NDT representative will provide a field test of the equipment which will serve an operator training period for the buyer and help insure that the buyer understands the "Operational Procedures" and the mechanics of the system. Nuclear Sources and Services Inc., offers a radiation training course to those who are completely unfamiliar with the basics of radiation monitoring and safety.

Each purchaser of an isotope thickness gauge will receive a minimum of one half day of operational experience in using the isotope system.

NDT will further advise the purchaser of the required surveys and leak tests to be performed periodically.

EMERGENCY PROCEDURE

In event of an emergency arising from malfunction of source holder device, mechanical damage, or damage to vehicle, the area should be immediately surveyed with an operable radiation survey meter and the area of damger secured. Warning signs and (if possible) personnel barriers should be executed at the 2 mr/hr line or a minimum of 15 feet from location of source holder. Notify Nuclear Sources & Services, Inc., immediately when accidents have occured involving radioactive materials.

NUCLEAR SOURCES & SERVICES, INC.
Houston, Texas
713-641-0391 (24 Hour Telephone)

SAFETY PRECAUTIONS

1. TOTAL MECHANICAL SYSTEM SHOULD BE LOCKED AT ALL TIMES WHEN NOT IN USE OR UNATTENDED TO PREVENT POSSIBLE ACCIDENTS TO PERSONNEL.

2. COVER FOR THE PIPE DRUM SHOULD BE PRESENT WHEN THE GAUGE IS NOT BEING UTILIZED FOR GAUGING PURPOSE.

3. TAKE CAREFUL NOTE OF ATTACHED "NOTICE PLATE" CONCERNING RULES AND REG ULATIONS FOR SAFETY PRECAUTIONS.

4. IN ALL OPERATING CASES, DOUBLE CHECK, SOURCE SHUTTER POSITION TO INSURE CORRECT MODE OF OPERATION.

5. IN CASE OF MALFUNCTION OF GAUGE, SOURCE OR SOURCE HOUSING ELECTRONIC DETECTOR, MOTOR DRIVE, ELECTRONIC PROCESSING UNIT OR ANY COMPONENT OF PIPE WALL THICKNESS GAUGE-SHUT DOWN OPERATION. IF PROBLEM IS NOT CORRECTED , CONTACT THE MANUFACTURER AT ONCE.

6. KEEP OPERATING AND CALIBRATED SURVEY INSTRUMENT AVAILABLE AT GAUGE SITE AT ALL TIMES.

7. CHECK ALL MECHANICAL MOUNT SCREWS DAILY OR PRIOR TO GAUGE USE TO INSURE SAFETY ASPECT OF FRAME.

8. ALL SERVICING OR MAINTENANCE OF THE SOURCE HOLDER WILL BE PERFORMED BY THE MANUFACTURER. ANY REPAIRS OR SERVICING WILL CONSTITUTE A RETURN OF THE UNIT OR A MANUFACTURER'S REPRESENTATIVE WILL REPAIR ON SITE.

RC FORM 41-3a
(10-78)

TEXAS DEPARTMENT OF HEALTH
RADIOACTIVE MATERIAL LICENSE

Supplementary Sheet

LICENSE NUMBER	AMENDMENT NUMBER
12-2031	15

IDT Systems, Inc.
ATTN: R. W. Leslie
P.O. Box 4999
Odessa, Texas 79760

In accordance with letter dated February 16, 1981, signed by Bob Leslie, License No. 12-2031 is hereby amended as follows:

To change Item 4, the expiration date, from March 31, 1981 to March 31, 1986.

RH:kjn

MAR 16 1981

Date

FOR THE TEXAS DEPARTMENT OF HEALTH

Joseph E. Gonella

Chief of Licensing
Radiation Control Branch

FORM 41-3
(4-76)

TEXAS DEPARTMENT OF HEALTH RESOURCES
RADIOACTIVE MATERIAL LICENSE

Pursuant to the Texas Radiation Control Act and Texas Department of Health Resources regulations on radiation, and in reliance on statemen representations heretofore made by the licensee, a license is hereby issued authorizing the licensee to receive, acquire, possess and transf radioactive material listed below; and to use such radioactive material for the purpose(s) and at the place(s) designated below. This license ject to all applicable rules, regualtions and orders of the Texas Department of Health Resources now or hereafter in effect and to a conditions specified below.

LICENSEE	This license issued pursuant to and in accordance with
Name: NDT Systems, Inc.	☐ APPLICATION ☒ LETTER ☐ 9-12-77
Address: P. O. Box 4999 Odessa, Texas 79760	Signed By: S. R. Moore Dated: 9-14-77
	3. License Number: 2-2031 — Amendment Number: 8
	PREVIOUS AMENDMENTS ARE VOID
	4. Expiration Date: March 31, 1981

RADIOACTIVE MATERIAL AUTHORIZED

5. Radioisotope	6. Form of Material	7. Maximum Activity *	8. Authorized Use
Cs-137	A. Sealed Sources (3M Co. Models 4F6H or 4F6S)	A. 10 sources of 3 Ci each. Total: 30 Ci.	A. through D. For receipt, storage, use and transfer to authorized recipients in Ludlum Instruments Model 3210, 3110 and Nuclear Sources Services, Inc., Model 1000 Tube Wall Calipers.
Cs-137	B. Sealed Sources (Gamma-tron Model GT-GHP)	B. 10 sources of 1 Ci each. Total: 10 Ci.	B. See A above.
Ir-192	C. Sealed Sources (NEN Model VL-1)	C. 10 sources of 5 Ci. each. Total: 50 Ci.	C. See A above.

☒ CONTINUED ON PAGE 2, IF CHECKED.

CONDITIONS

Radioactive materials shall be stored at the licensee's facility located at 119 East 52nd Street, Odessa, Texas.

. The licensee is authorized to use and demonstrate pipe wall thickness gauges throughout the State of Texas.

. The licensee shall comply with the provisions of Part 21, "Standards for Protection Against Radiation" and Part 41, "Licensing and Registration" of the Texas Regulations for Control of Radiation.

*uries mCi-Millicuries μCi-Microcuries

CONDITIONS CONTINUED ON PAGE 2

FORM 41-3
(4-76)

TEXAS DEPARTMENT OF HEALTH RESOURCES

RADIOACTIVE MATERIAL LICENSE

Supplementary Sheet

LICENSE NUMBER	AMENDMENT NO
2-2031	8

Radio-sotope	6. Form of Material	7. Maximum Activity	8. Authorized Use
Ir-192	D. Sealed Sources (Gamma-tron Model GI-GHP)	D. 10 sources of 1 Ci each. Total: 10 Ci.	D. See A on page 1
Cs-137	E. Sealed Sources (3M Co. Model 4F6H or 4F6S)	E. 10 sources of 3 Ci each. Total: 30 Ci.	E. For receipt, storage and distribution to authorized recipients in the licensee's Model 10333 Tube Wall Caliper specified in letter dated June 16, 1977.
Cs-137	F. Sealed Sources (3M Co. Model 4F6S or ~~6S6H~~) 4F6H	F. 10 sources of 1.5 Ci each. Total: 15 Ci.	F. For receipt, storage and distribution to authorized recipients in the licensee's Model 13640 Tube Wall Caliper specified in letters dated September 12, 1977 and September 14, 1977.

onditions Continued:

2. Radioactive material shall be used by, or under the supervision of, individuals designated by Carroll R. Thompson, the designated Radiation Safety Officer.

3. The licensee shall not open or remove sealed sources containing radioactive material form their respective source holders.

4. Sealed sources of radioactive material, Nickel 63 foil, and/or plated alpha emitting sources shall be tested for leakage and/or contamination in accordance with the provision of Section 41.73 of the Texas Regulations for Control of Radiation.

5. The licensee is authorized to distribute to persons specifically licensed to receive them, the pipe wall thickness gauges authorized by this license in accordance with procedures submitted June 4, 1976 and September 12, 1977.

TEXAS DEPARTMENT OF HEALTH RESOURCES

RADIOACTIVE MATERIAL LICENSE

Supplementary Sheet

LICENSE NUMBER	AMENDMENT NO.
2-2031	8

onditions Continued:

6. Except as specifically provided otherwise by this license, the licensee shall possess and use the radioactive material authorized by this license in accordance with statements, representations, and procedures contained in application dated February 17, 1975 and all correspondence amending the application which results in an amendment to the license.

FOR THE TEXAS DEPARTMENT OF HEALTH RESOURCES

OCT 14 1977

Joseph E. Gowell

Chief of Licensing
Radiation Control Branch

RC FORM 41-3a
(10-78)

TEXAS DEPARTMENT OF HEALTH
RADIOACTIVE MATERIAL LICENSE

Supplementary Sheet

LICENSE NUMBER	AMENDMENT NUMBER
12-2031	16

NDT Systems, Inc.
ATTN: R. W. Leslie
P.O. Box 4999
Odessa, Texas 79760

In accordance with letter dated November 18, 1981, signed by R. W. Leslie, License No. 12-2031 is hereby amended as follows:

To change Part D of Items 5, 6, 7 and 8 to read:

5. Radio-isotope	6. Form of Material	7. Maximum Activity	8. Authorized Use
D. Cs-137	D. Sealed Sources (3M Model 4F6H, 4F6S or GN Model CSV)	D. No single source to exceed 1.5 Ci.	D. Receipt, storage and distribution to authorized recipients in the licensee's Model 13640 or 13640B tube wall caliper.

PRH:kjn

DEC 09 1981
Date

FOR THE TEXAS DEPARTMENT OF HEALTH

Joseph C. Klinger

DEVICE

MANUFACTURER & DISTRIBUTOR:
NDT Systems, Inc.
Odessa, Texas

MODEL:
13640 Tube Wall Caliper

ISOTOPE:
Cesium 137 (3M Co. Model 4F6S or 4F6H)
Up to 1.5 curies

USE:
Measures wall thickness of pipes

DESCRIPTION:
This device has an exterior housing that is doughnut shaped with a center hole that will accomdate pipe sizes from 1 inch to 17 inches OD, but can be increased by enlargement of the cylinder through which the pipe passes. The housing is mounted on its edge so the pipe can pass through its center. The device can be used as a stationary or rotating unit at either a fixed location or in a mobile van.

Inside the housing, a tungsten source holder emits one collimated beam of radiation through the pipe to be inspected to detector on the other side of the housing with a beam stop behind it. The source holder and detectors are oppositely mounted on a frame inside the housing which rotates about the pipe as the pipe is conveyed through the device. Flaws in this section of pipe are detected by the variation in attenuation of the beam.

The source holder is made of a solid tungsten body with a tungsten slide shutter which aligns a beam collimation hole with the source when in operation. The shutter, which is plainly labeled "ON" or "OFF" can be locked in the desired position. The source is inaccessible to the user and cannot be removed unless four security wire seals are broken and the respective cover lugs removed.

RADIATION LEVELS:

When the device is in operation the radiation levels are less than 2.0 mr/h on all surfaces of the exterior housing except in the pencil-thin beam which is not accessible when a pipe is being inspected.

LABELING
The outer housing and the source holder are both labeled with the convention radioactive symbol. The source holder label also includes isotope, number of curies, date, serial number, and a warning to notify civil authorities if found.

RADIATION SAFETY INSTRUCTIONS:

The manufacturer provides, prior to delivery or at the time of delivery, a field test of the equipment which serves as an operator training period for the buyer and insures that the buyer understands the "Operational Procedures" and the mechanics of the system. The manufacturer also offers a radiation training course to those who are unfamiliar with the basics of radiation monitoring and safety. Repair and maintenance work involving the source or source mechanism is performed by Nuclear Sources and Services, Inc. of Houston, Texas.

LICENSING

Because the low levels of radiation, the State of Texas does not require personnel monitoring for operators of the device. A survey meter is required, however, for making surveys and to check the source holder prior to shipment, etc. Leak tests are required every six months. The manufacture can provide an approved leak test kit and furnishes instructions for leak testing.

Texas Department of Health

September 1977

O F F I C I A L U S E O N L Y

OFFICIAL USE ONLY

DEVICE

MANUFACTURER & DISTRIBUTOR:
NDT Systems, Inc.
P. O. Box 4999
Odessa, Texas 79760

MODEL:
13640B

ISOTOPE:
Cesium 137 (3M Co. Model 4F6S or 4F6H)
Up to 1.5 Curies

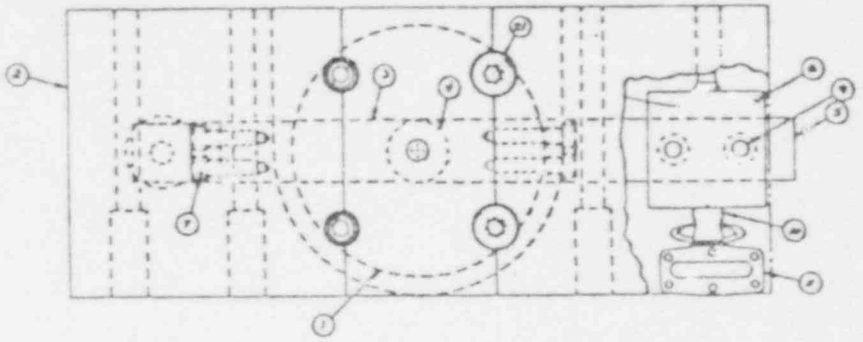
USE:
Measures wall thickness of pipes

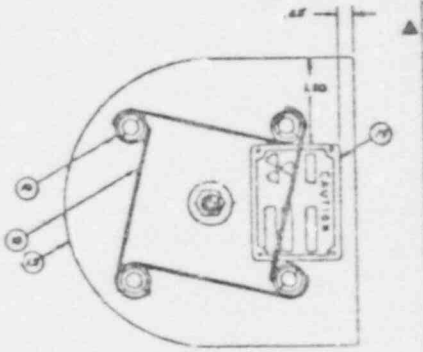
DESCRIPTION:
This model is a modification of the Model 13640. The modification incorporates the use of two pencil thin beams instead of one. One beam travels straight through the pipe and the other travels on a chord trojectoy through the pipe. Both beams have beam stops on the opposite side of the pipe to stop the beam behind the two detectors. The radiation levels are about the same as those for the Model 13640, and except for the change described, all other items concerning the Model 13640 also apply to the Model 13640B.

Texas Department of Health

O F F I C I A L U S E O N L Y

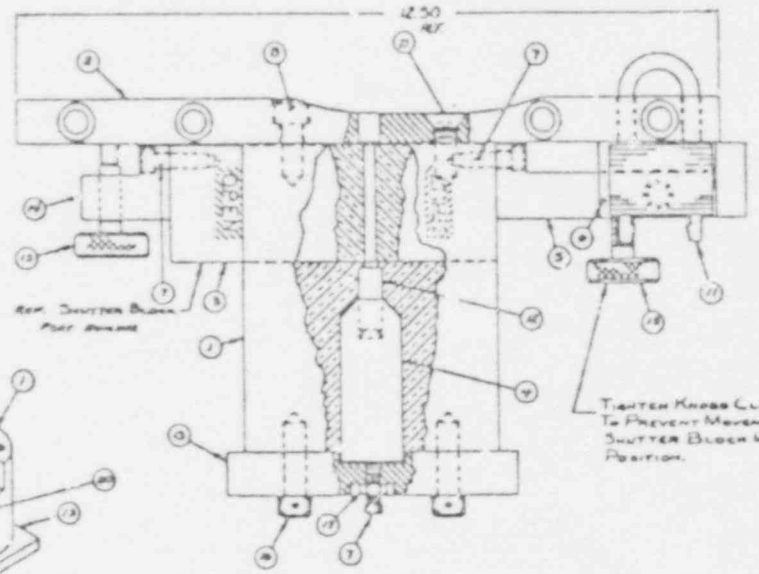
November 1977



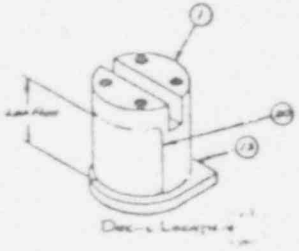


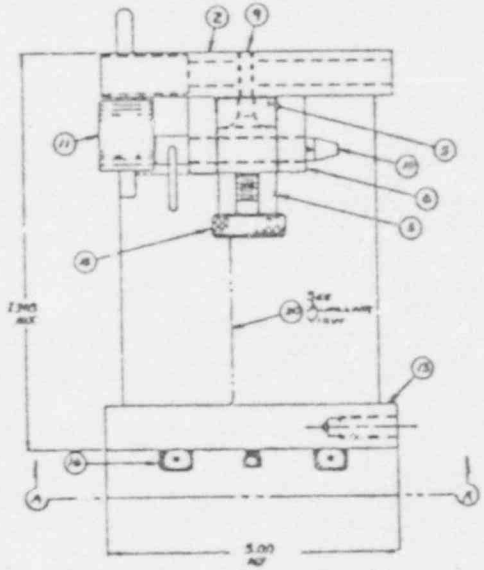
View A-A', Lockwire Detail
Lockwire As Shown After
Source Capsule Is Installed

ITEM	PART NO.	DESCRIPTION	QTY
1	13743	Body	1
2	4750	Plate Base	1
3	13747	Shutter Block	1
4	13704	Insert, Cork	1
5	13687	Block	1
6	13639	Yoke	1
7	3/4-20	Socket Hd. Cap Screw, 3/4-20 x [illegible]	2
8	1/4-20	Socket Hd. Cap Screw, 1/4-20 x [illegible]	2
9	1/4-20	Flat Head Cap Screw, 1/4-20 x [illegible]	2
10	10309	Pin, Detent	1
11	10374	Assy. Lock	1
12	14029	Source Capsule - 8 Curie	1
13	13749	Plate, Top	1
14	13635	Block	1
15	10371	Swivel Head Screw	1
16	13641	Set Screw, [illegible]	1
17	1/4-20	Thumb Nut, 1/4-20	1
18	——	Lockwire	AR
19	14079	Plate, Source Holder, I.D.	1
20	14080	Pigtail, Source Holder Plate	1
21	1/4-20	Flat Socket Screw, 1/4-20 x .75	2



Tighten Knobs Clockwise To Prevent Movement Of Shutter Block In "Open" Position.

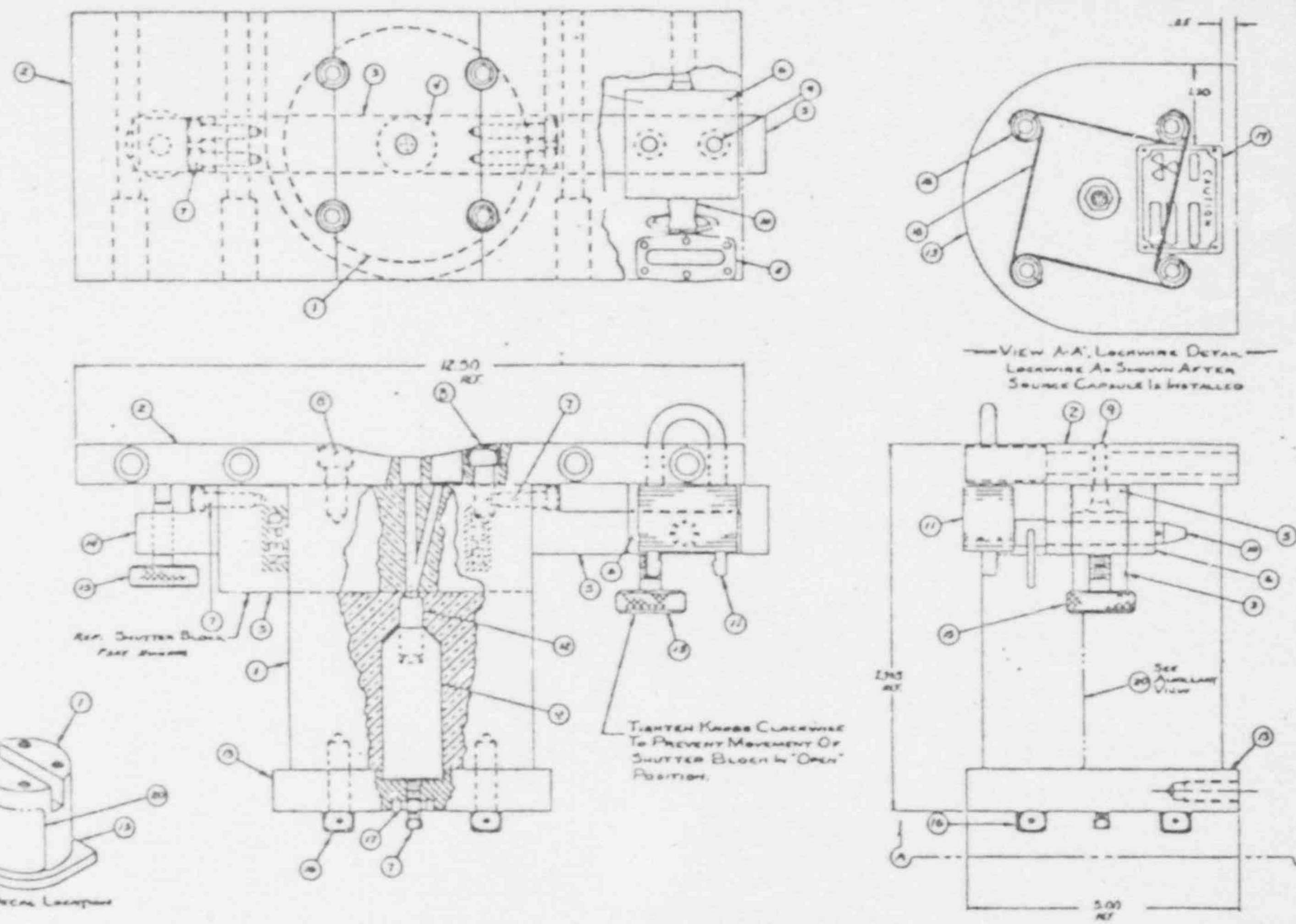




Operation Procedure

1) Remove Lock, Item 11, Locking Pin, Item 8, And Loosen Swivel Screw, Item 6.
2) Manually Move Shutter Block, Item 3, By Grasping Block. Item 9 Push "In" To Open Shutter, And Pull "Out" To Close Shutter.
3) After [illegible] Interacting Item, Reinsert Locking Pin, Install Lock, And Tighten Down Swivel Screw. (In Open Position Only), To Prevent Shutter Movement.
4) Shutter Condition Is Indicated At Sides Of Body (Open Or Shut).

	Assy, Source Mtr. Thru Wall System	NDT SYSTEMS INC. Odessa, Texas



1	13793	Body	1
2	13794	Plate, Base	1
3	13796	Shutter Block	1
4	13798	Insert, Cone	1
5	13627	Block	1
6	13639	Yoke	1
7	SHC6C5	Socket Head C Screw	5
8	SHC8C5	Socket Head C Screw	4
9	FSH10C5	Flat S Head C Screw	2
10	10569	Pin, Detent	1
11	10374	Assy. Lock	1
12	14029	Source Capsule - Ir Cyl	1
13	13797	Plate, Top	1
14	13635	Block	1
15	10371	Swivel Head Screw	2
16	13641	Socket Head C Screw - Drilled	4
17	JN4C5	Jam Nut	1
18	—	Lockwire	A/R
19	14079	Plate, Source Holder I.D.	1
20	14080	Decal, Source Holder Rage	1

13802

— OPERATION PROCEDURE —

1) Remove Lock, Item (11), Locking Pin, Item (10), And Loosen Swivel Screw, Item (15).
2) Manually Move Shutter Block, Item (3), By Grasping Block, Item (14). Push "In" To Open Shutter, And Pull "Out" To Close Shutter.
3) After Contacting Stop, Reinsert Locking Pin, Install Lock, And Tighten Down Swivel Screws (In Open Position Only), To Prevent Shutter Movement.
4) Shutter Condition Is Indicated At Sides Of Body (Open Or Shut).

Assy. Source Mtg. Thru Wall System

NDT SYSTEMS INC. ODESSA, TEXAS

13802

MICROFILM ON FILE

Amended Copy

Texas Department of Health

Safety Analysis Summary

DEVICE

MANUFACTURER & DISTRIBUTOR:
NDT Systems, Inc.
Odessa, Texas

MODEL:
13640 Tube
Wall Caliper

ISOTOPE:
Cesium 137 (3M Co. Model 4F6S or 4F6H or
Gulf Nuclear Model CSV)
Up to 1.5 Curies

USE:
Measure wall thickness of pipes

DESCRIPTION:
This device has an exterior housing that is doughnut shaped with a center hole that will accommodate pipe sizes from 1 inch to 17 inches OD, but can be increased by enlargement of the cylinder through which the pipe passes. The housing is mounted on its edge so the pipe can pass through its center. The device can be used as a stationary or rotating unit at either a fixed location or in a mobile van.

Inside the housing, a tungsten source holder emits one collimated beam of radiation through the pipe to be inspected to detectors on the other side of the housing with a beam stop behind it. The source holder and detectors are oppositely mounted on a frame inside the housing which rotates about the pipe as the pipe is conveyed through the device. Flaws in this section of pipe are detected by the variation in attenuation of the beam.

The source holder is made of a solid tungsten body with a tungsten slide shutter which aligns a beam collimation hole with the source when in operation. The shutter, which is plainly labeled "ON" or "OFF" can be locked in the desired position. The source is inaccessible to the user and cannot be removed unless four security wire seals are broken and the respective cover lugs removed.

RADIATION LEVELS:
When the device is in operation the radiation levels are less than 2.0 mr/h on all surfaces of the exterior housing except in the pencil-thin beam which is not accessible when a pipe is being inspected.

LABELING:
The outer housing and the source holder are both labeled with the conventional radioactive symbol. The source holder label also includes isotope, number of curies, date, serial number, and a warning to notify civil authorities if found.

RADIATION SAFETY INSTRUCTIONS:

The manufacturer provides, prior to delivery or at the time of delivery, a field test of the equipment which serves as an operator training period for the buyer and insures that the buyer understands the "Operational Procedures" and the mechanics of the system. The manufacturer also offers a radiation training course to those who are unfamiliar with the basics of radiation monitoring and safety. Repair and maintenance work involving the source or source mechanism is performed by Nuclear Sources and Services, Inc. of Houston, Texas.

LICENSING

Because the low levels of radiation, the State of Texas does not require personnel monitoring for operators of the device. A survey meter is required, however, for making surveys and to check the source holder prior to shipment, etc. Leak tests are required every six months. The manufacturer can provide an approved leak test kit and furnishes instructions for leak testing.

As amended November 1981

Date December 2, 1981 Reviewed by [signature]

Date December 9, 1981 Concurred by [signature]

Amended Copy

Texas Department of Health

Safety Analysis Summary

DEVICE

MANUFACTURER & DISTRIBUTOR:

NDI Systems, Inc.
P.O. Box 4999
Odessa, Texas 79760

MODEL:

13640B

ISOTOPE:

Cesium 137 (3M Co. Model 4F6S or 4F6H or Gulf Nuclear Model CSV)
Up to 1.5 Curies

USE:

Measures wall thickness of pipes

DESCRIPTION:

This model is a modification of the Model 13640. The modification incorporates the use of two pencil thin beams instead of one. One beam travels straight through the pipe and the other travels on the chord trajectory through the pipe. Both beams have beam stops on the opposite side of the pipe to stop the beam behind the two detectors. The radiation levels are about the same as those for the Model 13640, and except for the change described, all other items concerning the Model 13640 also apply to the Model 13640B.

As Amended
November 1981

Date December 2, 1981 Reviewed by [signature]

Date December 9, 1991 Concurred by [signature]

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

NOTE FOR: License 49-26867-01

FROM: Glenda Jackson
License Fee Management Branch

The $120 Renewal fee paid on 2/6/87 is the correct fee for the issuance of License 49-26867-01 in accordance with C. James Holloway's March 27, 1987 Memorandum to Files. The new license replaces License 42-19978-01.

Glenda Jackson

Glenda Jackson
License Fee Management Branch
Division of Accounting and Finance
Office of Administration and
Resources Management

MAR 27 1987

MEMORANDUM FOR: Files

FROM: C. James Holloway, Jr., Chief
License Fee Management Branch, RM/A

SUBJECT: FEE FOR NEW LICENSES ISSUED BY NMSS/ REGIONS FOR ADMINISTRATIVE REASONS

The NMSS materials license numbering system is designed to use a numerical state code as the first two digits of the license number. If a licensee moves to a different state, the Licensing staffs issue a new license in order to accommodate the state code appropriate for the new address, and the original license is terminated. If a licensee moves within a state, the existing license is amended. In both cases, an amendment fee is assessed in accordance with 10 CFR 170. An amendment fee is assessed when a new license is issued for the interstate move because

1. the Licensing staffs have informed us that the new licenses are issued to administratively maintain the correct state number designation for the licensee's new address, and

2. the technical review effort required to issue the new license for the interstate move is the same as that required to amend an existing license to reflect a licensee's intrastate move.

Therefore, the correct fee for the issuance of the new license is the appropriate amendment fee for the fee category or categories assigned to the original license, except as follows:

1. If the licensee requests an amendment to upgrade the scope of the licensed program in addition to a change of address, the appropriate application fee is required for the category being requested;

2. If the address change is for mailing purposes only and does not affect the authorized place of use, and if no other changes are requested, a fee is not required in accordance with William O. Miller's October 30, 1980 memorandum to Vandy Miller; and

~~8704280111~~
299

MAR 27 1987

3. If the licensee requests renewal in addition to the address change, the appropriate renewal fee(s) is required.

Jr.

C. James Holloway, Jr., Chief
License Fee Management Branch
Division of Accounting and Finance
Office of Resource Management

DISTRIBUTION:
License Fee File
GJackson, LFMB
MMessier, LFMB
CPhillips, LFMB
SKimberley, LFMB
RM/A R/F
LFMB R/F (2)
DN/GJ/Fee for NL

OFFICE:	RM/ALF	NMSS	OGC	(RM/ALF)
SURNAME:	GJackson:rej	VMiller	RSmith	CJHolloway
DATE:	3/18/87	3/20/87	3/ /87	3/ /87