BOX 9267, AUSTIN, TEXAS 78766-9990 USA. (512) 836-0801, TELEX 77-6413

TEXAS NUCLEAR
A SUBSIDIARY OF RAMSEY ENGINEERING

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December 20, 1984

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U.S. N.R.C.
LIC. FEE MGMT. BRANCH

U. S. Nuclear Regulatory Commission
Region IV
Material Radiation Protection Section
611 Ryan Plaza Drive, Suite 1000
Arlington, TX 76011

Ref: License No. 42-01485-04
Expiration Date: January 31, 1985

Gentlemen:

The purpose of this letter is to request renewal of NRC License No. 42-01485-04 due to expire on January 31, 1985.

Our existing license and supporting documentation dated January 5, 1980, the Texas Nuclear Service Guide and Instructions dated December, 1979, and letter dated June 24, 1981, continue to reflect our current operating procedures and safety program. We wish to continue operations under this license and supporting documentation.

Enclosed is our license renewal fee in the amount of $930.

If you have any questions or require any additional information, please let me know.

Sincerely,

TEXAS NUCLEAR CORPORATION

Doris C. Bryan

Doris C. Bryan
Manager
Licensing & Regulatory Affairs

DCB/lmv
Enclosure

RECEIVED BY LFMB
Date 1/3/85
Log Jan 1 IV
By Brown
Orig. To
Action Compl 1/29/85

Applicant 008757 + 1B
Check No.
Amount Fee $930
Type of Fee Renewal
Date Check Rec'd. 1/3/85
Received By Brown
3N $930

Texas Nuclear
Applicant 009349
Check No.
$120 / 3P
Renewal
1/28/85
Brown

Log Jan. IV
Remitter Tex. Inc.
Check No. 025834
Amount $350
Fee Category 1K
Type of Fee APP
Date Check Rec'd. 7/13/87
Date Completed 7/13/87
By: S. Kimberly

see May 29, 1987 ltr.

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REG4 LIC30
42-01485-04 PDR

# APPENDIX I

1. POLICY STATEMENT
2. ORGANIZATION AND RESPONSIBILITIES
3. RESUMES
4. FACILITIES AND EQUIPMENT
5. USE OF RADIOACTIVE MATERIAL OFF-SITE

# POLICY STATEMENT

It is the policy of Texas Nuclear, Austin, Texas, to conduct its manufacturing and advanced research activities in such a manner that personnel exposures to radiation are kept at the lowest level reasonably achievable consistent with its operations.

The Radiological Health and Safety Manual of Texas Nuclear reflects the company policy in matters involving radiation protection and sets forth basic radiation protection standards and procedures. The purpose of the manual is:

a. To assure adequate protection for employees from all types of radiation exposure. This protection will comply with appropriate State and Federal regulations concerning permissible levels of radiation exposure and extend to reflect the general operating philosophy that personnel exposures should be maintained as far below any specified limits as practicable.
b. To provide for the purchase, use, control, and distribution of radioactive materials, radiation producing devices, and associated radiation facilities.
c. To insure that the necessary personnel are properly trained regarding radiological health and safety procedures.

d. To provide the organization and administrative guidelines that are necessary to assure a comprehensive program of radiological safety.

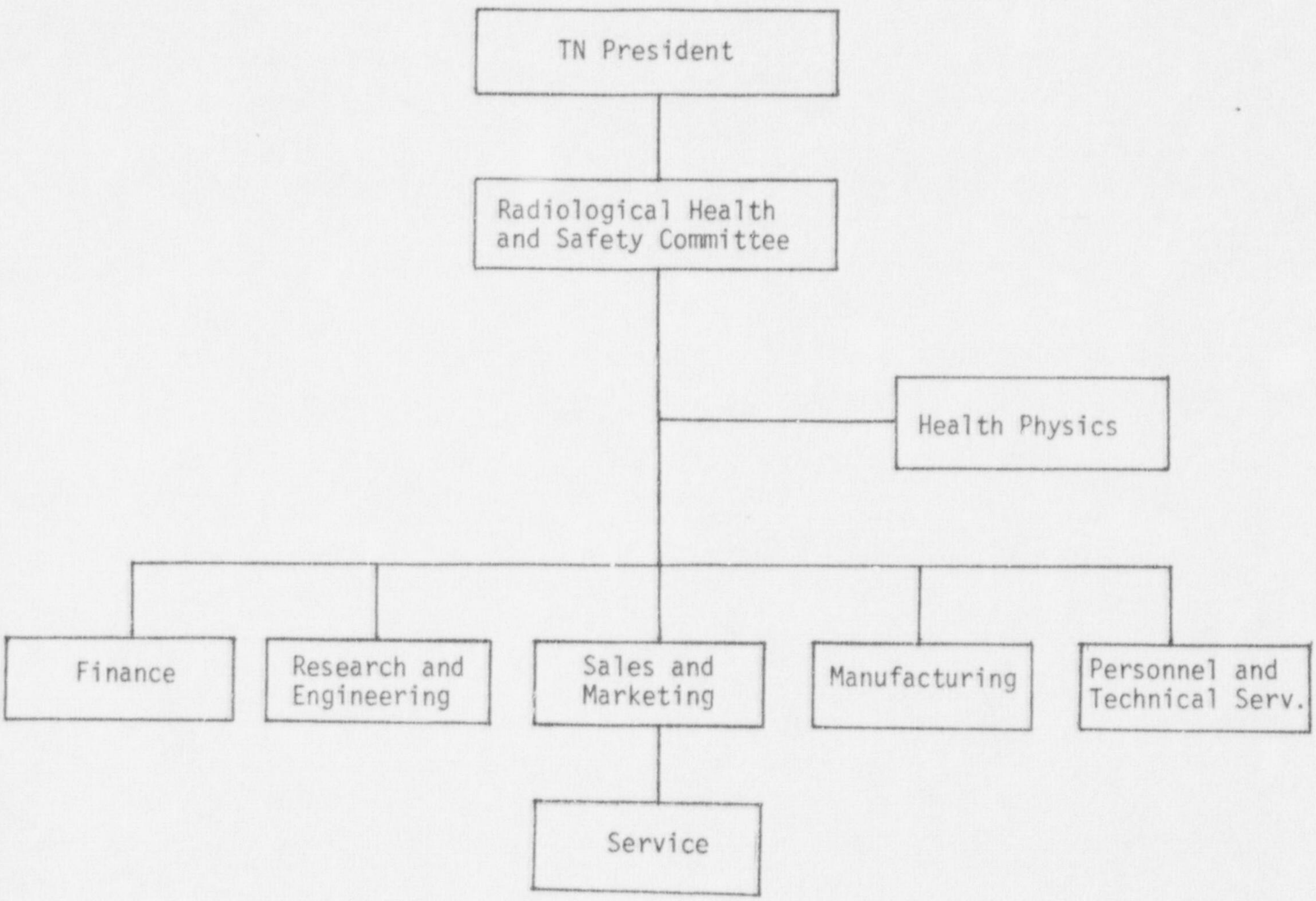
This manual is applicable and binding in its entirety to all Texas Nuclear employees who are engaged in, but not limited to, the procurement, utilization, storage, or disposal of radioactive material, radiation producing devices, and associated facilities.

Each supervisor shall be directly responsible for determining that each of his employees is familiar with the manual, and assure their compliance with the standards and procedures it contains. Any deviation from these standards and procedures requires the prior approval of the RHSC.

The policies and procedures contained in this Manual have been written to provide a minimum amount of restriction commensurate with safety of personnel and facilities. This Manual has been prepared by Health Physics which has staff responsibility for radiation safety. Policy and procedures are formulated through the RHSC. Inquiries relative to these procedures should be directed to Health Physics.

ORGANIZATION AND RESPONSIBILITIES

In establishing a radiological health program, there must first be developed a conceptual framework followed by the creation of an administrative organization to formulate policies and plans of action. The administrative organization can be described as follows:



A. Radiological Health and Safety Committee

The Radiological Health and Safety Committee, (RHSC), appointed by and acting for the President of Texas Nuclear, has the broad responsibility for establishing and approving the policies and practices for the safe use of radioisotopes and sources of radiation at Texas Nuclear, Austin, Texas.

1. The Committee shall consist of a chairman and at least three members with significant experience in the fields of radiation physics and dosimetry. Health Physics will be an ex officio member.
2. The RHSC shall meet any time a full member deems it necessary, but no less than once per year.
3. The proceedings of each meeting shall be maintained on file in the Health Physics office.
4. The duties of the individual membership will be assigned by the chairman as necessary.
5. Responsibilities of RHSC:
   (a) Establishes procedures and rules to govern the acquisition, transportation, handling, installation, use, storage, and disposal of radioactive materials, radiation producing devices, and associated radiation facilities at Texas Nuclear. The RHSC shall be guided by the rules and regulations set forth by appropriate State and Federal agencies, including but not limited to, the State of Texas Bureau of Radiation Control , U. S. Nuclear Regulatory Commission, U. S. Department of Health, Education, and Welfare, U. S. Department of Transportation, and other Agreement States. In the event that any practice or procedure approved by this committee conflicts with applicable State or Federal rule or regulation, the procedure is hereby amended to comply.

(b) Coordinates activities of all segments of Texas Nuclear concerning the procurement, handling, use, and disposal of radioactive materials, radiation producing devices, and associated radiation facilities.

(c) Determines qualifications necessary for personnel who desire to use radiation producing equipment or materials within Texas Nuclear or under Texas Nuclear authorization.

(d) Approves such instructional material as needed for the safe use of sources of radiation and for compliance with the regulations regarding use of such sources.

(e) Establishes and periodically reviews procedures for the acquisition of radioactive materials and/or for use of radiation producing devices.

(f) Approves the issuance of all reports and notifications required by Federal, State, City, and Texas Nuclear regulations.

(g) Acts as an advisory board to all sections in matters of radiation safety.

(h) Periodically performs a formal audit to determine the effectiveness of the total radiological health program and to insure that all personnel exposures are being maintained as low as practicable.

B. Health Physics Section

The Health Physics Section (HP) will operate as an advisory and enforcement arm of the RHSC.

1. Responsibilities of HP

(a) Has full-time responsibility for the safe utilization of radioactive materials and radiation producing devices with authority to halt unsafe radiological operations until the operations can be reviewed and corrected by the RHSC and the supervisor of the operation.

(b) Assures strict compliance with regulations and procedures established by the RHSC that govern the acquisition, transportation, handling, installation, use, storage, and disposal of radioactive materials, radiation producing devices and associated radiation facilities.

(c) Provides for the proper sto age of all radioactive materials and assures that these are routinely tested for leaks and other possible defects.

(d) Maintains all accountability records, personnel radiation exposure records, and other records as required by governmental agencies.

(e) Advises and assists all employees using or considering the use of radioactive material or radiation producing equipment in matters pertaining to the procurement, use and disposal of radioactive material, and to safety and training of personnel.

(f) Approves or disapproves all transfers of radioactive materials and radiation producing devices with regard to safety only - not use. Issues periodic lists giving location and movement of radioactive materials.

(g) Assists in the instruction of radiological safety programs as required.

(h) Assures that proper protection and adequate monitoring equipment are available for all persons working with radioactive materials or radiation producing devices or in the confines of an area marked as being potentially hazardous due to radiation.

(i) Assures that all personnel have been instructed in the handling and the operation of radioactive material and equipment prior to working in an area marked potentially hazardous due to radiation.

(j) Is responsible for providing properly calibrated monitoring equipment in conformance with established practices.

(k) Prepares and maintains appropriate manuals of rules and regulations governing the operation and use of radioactive materials, radiation producing devices, and associated radiation facilities.

(l) Maintains an up-to-date file of Federal, State, City, and company regulations pertinent to radiological safety.

(m) Serves any other function as required by the RHSC to maintain or upgrade the radiological safety program.

C. Individual

Employees of Texas Nuclear are individually responsible for the following:

1. Keeping their own exposures to radiation as low as reasonably achievable, and specifically below the exposure levels stated in this manual.
2. Wearing the prescribed monitoring equipment in controlled areas.
3. Using prescribed techniques and facilities in operations involving radioactive materials and/or radiation producing devices.
4. Be knowledgeable of and observe established company procedures and regulations.
5. Notifying the Health Physicist, or in his absence a member of the RHSC, promptly of any unusual occurrence involving radioactive materials and/or radiation producing devices.

The employee is a valuable link in the communication chain necessary to maintain radiation exposures as low as practicable consistent with necessary operations. The employee is best able to evaluate the workability of operating procedures that govern his actions, and supply information and suggestions for improvement. This communication is actively solicited and each employee should notify his supervisor or Health Physics directly any time questions or suggestions for improvement of the radiation protection program occur.

# PERSONNEL EXPOSURE

1. Policy

   It is the policy at Texas Nuclear to avoid all unnecessary radiation exposures; to keep personnel exposure at the lowest practicable level consistent with operations and to insure that no indiviual exceeds the recommended dose limits.

2. Radiation Units and Dose Determinations

   The organization which selects and defines the units and quantities of radiation is the International Commission on Radiological Units and Measurements (ICRU). The current definitions are found in ICRU Report 19 (1971).

   Units of Measurement of Ionizing Radiation:

   a. roentgen (R) - ionization in air due to X or $\gamma$ radiation (exposure)
   b. rad - energy absorbed from radiation in any material (absorbed dose)
   c. rem - relating effectiveness of different radiations in producing biological damage, to the quantity of radiation or absorbed dose and including irradiation conditions (dose equivalent)

   a. Roentgen: The quantity of X or $\gamma$ radiation which will produce 1 esu of total charge of one sign (+ or -) in 1 cc of air at STP. Energy absorption corresponding to this is approximately 83 ergs per gram of air.

$$1 \text{ R} = 2.58 \times 10^{-4} \text{ Ckg}^{-1}$$

b. Rad (Radiation Absorbed Dose): 1 rad represents an energy absorption from any type of radiation of 100 ergs per gm in any medium.

$$1 \text{ rad} = 10^{-2} \text{ J kg}^{-1}$$

c. Rem (Dose Equivalent): The rem is the quantity of radiation of any type which relates biological effectiveness. The dose equivalent is:

$$DE(\text{rem}) = \text{absorbed dose (rad)} \times QF \times N$$

where

QF (Quality Factor): QF is used in radiation protection work to relate the effectiveness of different types of radiation in producing biological damage.

N(Modifying factor): is the product of other modifying factors describing the irradiation conditions.

3. External Whole Body Exposure

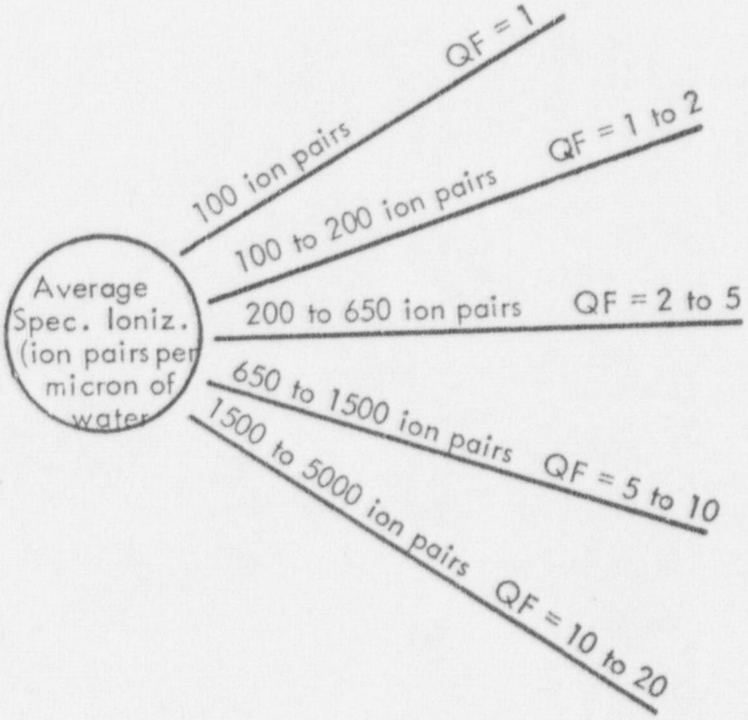
The dose to the whole body, head, trunk, active blood-forming organs or gonads, accumulated at any age shall not exceed 5 rems multiplied by the number of years beyond age 18. In addition, the dose in any 13 consecutive weeks shall not exceed 3 rems. Thus the accumulated maximum permissible whole body dose is 5(N-18) rems where N is the age in years and is greater than 18.

Quality Factors

The product of absorbed dose and a suitable quality factor expresses the irradiation in terms of a common scale for all ionizing radiations.

| Radiation | Dose in Rad | x | QF | = | Dose in Rem |
|---|---|---|---|---|---|
| $\gamma$ | 0.4 | x | 1 | = | 0.4 |
| $n_{th}$ (neutrons thermal) | 0.3 | x | 2.5 | = | 0.75 |
| $n_f$ (neutrons fast) | 0.2 | x | 10 | = | 2.0 |
| | 0.9 Rad | | | | 3.15 Rem |

| Energy & Type of Radiation | QF |
|---|---|
| X | 1 |
| $\gamma$ | 1 |
| 1.0 Mev $\beta$ | 1 |
| 0.1 Mev $\beta$ | 1.08 |
| $n_{th}$ | 2.5 |
| 1.0 Mev Proton | 8.5 |
| 0.1 Mev Proton | 10 |
| $n_f$ (1-10) Mev) | 10 |
| 5 Mev $\alpha$ | 15 |
| 1 Mev $\alpha$ | 20 |



4. Radiation Protection Guides

The concept of a "Radiation Protection Guide (RPG)" has been adopted. The Radiation Protection Guide is defined as, "the radiation dose which should not be exceeded without careful consideration of the reasons for doing so; every effort should be made to encourage the maintenance of radiation doses as far below this guide as practicable." The import of this definition is to focus on the concept of an acceptable risk. The term "maximum permissible dose" is often misunderstood. In order to convey the meaning that there can be no level of exposure without proper thought about the reasons for permitting the exposure, we have adopted this term.

| Occupational Exposure | Condition | Dose (rem) |
|---|---|---|
| 1. Whole body, head and trunk, blood-forming organs, gonads, lens of the eye | Accumulated dose<br>13 weeks | 5(N-18);N=age>18 years<br>3 |
| 2. Skin, thyroid and other organs | Year<br>13 weeks | 15<br>5 |
| 3. Hands, feet, and ankles | Year<br>13 weeks | 75<br>25 |
| 4. Bone | Body burden | 0.1 μgm $^{226}Ra$ or its equivalent |
| 5. Forearms | Year<br>13 weeks | 30<br>10 |
| **Population** | | |
| 1. Individual | Year | 0.5 (whole body) |

5. Radiation Dose Limits for Pregnant Women

Based upon the most current recommendations of the NCRP and the recognized principle that human embryo and fetus are much more sensitive to radiation than the adult, we will limit personnel exposure of women during the entire gestation period so that the mother does not exceed 0.5 rem whole body. We will attempt at all times to do this without the necessity of transfer to other jobs. Personnel are requested to notify their superviso as soon as pregnancy is known or suspected.

TEXAS NUCLEAR CORPORATION

RADIOLOGICAL HEALTH & SAFETY COMMITTEE

J. Thomas Prud'homme, Chairman
J. D. Henderson, Member
J. D. Hall, Member
John B. Nelson, Member
Richard Hernandez, Member
James Hardin, Member
Joe Gallagher, Member
Tom L. Erb, Alternate
Troy Johnson, Alternate
William G. Hendrick, Ex Officio

J. Thomas Prud'homme
President

B.S., Physics, Spring Hill College, 1951
M.A., Physics, The University of Texas, 1953
Ph.D., Physics, The University of Texas, 1957

Dr. Prud'homme helped establish Texas Nuclear in 1956, and served as Senior Research Scientist until 1959 when he was appointed Director of Research. In 1961 he became Vice President, Engineering and Manufacturing and in 1967 he was made Vice President, Engineering and Research. In May of 1968 he was promoted to the position of General Manager, Texas Nuclear Division and Vice President of Nuclear-Chicago, and in 1973 he was made President of Texas Nuclear.

Dr. Prud'homme has been responsible for the development of charged particle (positive and negative) and electron accelerator systems including ion optics systems, ion sources and high voltage assemblies. He has been involved in the development of a high output duo-plasmatron ion source for production of negative helium ions.

Dr. Prud'homme served as co-Principal Investigator from 1961 to 1963 for a major program of neutron-induced Gamma-Ray Production Cross Section Measurements supported by The Division of Research, U. S. Atomic Energy Commission.

Among Dr. Prud'homme's fields of specialization are neutron and gamma-ray spectroscopy, nuclear cross section measurements, nuclear structure, and design and development of various time-of-flight systems. He has been instrumental in development of fast neutron activation and analysis systems and methods. His duties included supervision of engineering and production of nuclear instrumentation. He works actively with research personnel in all phases of nuclear applications.

Dr. Prud'homme was employed by The University of Texas as a Teaching Fellow in mathematics and physics from 1955 to 1956, and as a Teaching Assistant from 1952 to 1955. During the summer of 1955, he was employed by Magnolia Petroleum Company of Dallas, Texas, where he worked on the development of neutron and gamma-ray oil well logging techniques. He has approximately 22 publications.

Jerry D. Henderson
Vice President, Research and Engineering

Education: B.S., Physics, The University of Texas at Austin, 1954. Ph.D., Physics, The University of Texas, 1959.

Experience: Post doctoral Fellow, Nuclear Physics, The University of Texas at Austin, Austin, Texas, 1959-1961. Senior Research Scientist, Texas Nuclear, 1961-1962. Manager of Technical Planning, Texas Nuclear, 1962-1967. Director of Engineering, Texas Nuclear, 1967-1973.

Fields of Experience: As a Research Scientist and Postdoctoral Fellow at The University of Texas at Austin Nuclear Physics Laboratory, Dr. Henderson conducted research on energy levels in light nuclei using charged particle reactions, and assisted in laboratory administration.

Since joining Texas Nuclear, Dr. Henderson has served in the Research Division, in market and product planning, and in Engineering. He has had particular interest in the specification and design of instrumentation for dosimetry and the characterization of radiation fields. He currently serves as Vice President of Research and Engineering with responsibility for planning and development of Texas Nuclear products.

Honors: B.S. with high honors; Convair-Ft. Worth graduate scholarship.

Honorary Societies: Phi Beta Kappa, Sigma Pi Sigma.

Publications: Co-authored three papers in nuclear physics.

James D. Hall
Chief Engineer, Product Design

Education: B.S., Electrical Engineering, University of Texas, 1951; Ph.D., Physics, University of Texas, 1962.

Experience: Technical Representative, General Electric Co. of Schenectady, New York, 1951-1956. Research Scientist, The University of Texas, Austin, Texas, 1958-1961. Senior Engineer, Texas Nuclear Corporation, Austin, Texas, 1961-Present.

Fields of Experience: At General Electric, Dr. Hall worked in shop engineering for jet engine assembly where duties were mainly to facilitate engine assembly with minor design and procedure changes and as a technical representative to the Air Force for jet engines.

From 1958 to 1961, Dr. Hall held the position of Research Scientist at The University of Texas, where he conducted experimental research on electron-positron pairmomentum distributions and lifetimes. At Texas Nuclear, Dr. Hall has directed and participated in the design and development of electronic instruments for production including radiation monitoring devices, low noise pulse amplifiers, digital analyzers, and pulsing systems for particle accelerators. He has also been responsible for the design of a few specialized instruments developed under government contract, such as a neutron-gamma ray spectrometer, gamma-ray checkpoint detector, high intensity radiation survey probe, and high energy proton flux measurement systems.

Honors: Tau Beta Pi, Sigma Pi Sigma

Publications: Three publications in the field of Nuclear Physics.

John B. Nelson
Vice President Sales and Marketing

Education: Ph.D., Physics, The University of Texas at Austin, Austin, Texas, 1963. B.S., Physics, St. Marys University, San Antonio, Texas, 1959.

Experience: Sales Manager, Senior Group Leader, Principal Staff Scientist, Senior Research Scientist, Texas Nuclear, 1966-Present. Assistant Professor of Physics, The University of Texas at Austin, 1965-1966. Visiting Scientist, Center de Recherches Nuclearires, Strasbourg, France, 1964-1965. Research Scientist, Nuclear Physics Laboratory, The University of Texas at Austin, 1960-1964.

Fields of Experience: Dr. Nelson, as Vice President Sales and Marketing, is responsible for Domestic and International sales of Texas Nuclear Division products. Dr. Nelson also has experience in Analytical Applications, and Instrumentation at Texas Nuclear. His principal activities range from basic research in analytical techniques and dosimetry to applied problems in activation analysis, instrumentation, health physics, X-ray fluorescence studies and radioactive tracer techniques. His duties as Senior Group Leader included participation in the research programs under his direction.

Dr. Nelson has carried out experimental work in the fields of charged particle spectroscopy and radiation dosimetry. He was principal investigator of programs sponsored by the School of Aerospace Medicine to provide physics support for their primate irradiation experiments. At The University of Texas at Austin, Dr. Nelson was an Assistant Professor of Physics and concurrently held the position of Research Scientist in the Nuclear Physics Laboratory. Experiments were carried out to measure the correlation of the 2I + 1 rule with total cross section. While a Visiting Scientist at the Centre de Recherches Nuclearires, Strasbourg, France, he participated in a study to determine the multipolarity of various nuclear levels from the observation of internal pairs in a beta-ray spectrometer, a search for new excited levels in several light nuclei using a Buechner spectrometer and a study of the $Zn^{90}$ (d,p) $Zn^{91}$ stripping reaction at bombarding energies below the Coulomb barrier.

Technical Societies: American Physical Society, American Association of Physicist in Medicine, American Association for the Advancement of Science.

Honors: Sigma Pi Sigma

Publications: Author or co-author of more than 20 papers in the field of nuclear physics, dosimetry, and related areas.

Richard Hernandez
Test Department Supervisor

Education - 1964-1966 Assoc. of Applied Science - DeVry Institute of Technology, Chicago, Illinois. Major in Electronics Engineering.

Experience - 1977 to present, Test Department Supervisor at Texas Nuclear Corp. 1975-1977 Leadman with supervisory responsibilities. 1972-1975 Systems Technician II. 1968-1972 Systems Technician I. 1966-1968 Test Technician II.

Fields of Experience - Currently, the technical and administrative supervisor over the Test Department. This requires a thorough understanding of electronics, industrial gauge construction detail, industrial gauge application work, both theoretical and applied, and electronics circuits from a design as well as a functional standpoint. Responsible for electronic testing and functional application of industrial gauges plus overall responsibility for handling a wide variety of radioactive materials used in gauging applications.

Is also responsible for testing and calibration of the entire Texas Nuclear line of radiation survey instruments which requires basic understanding of the radiation principles by which these meters work, their problems and capabilities.

Experience includes several years in the installation and field application of industrial gauging devices in all facets of industry.

Has supervised for a number of years the source loading area, requiring familiarity with source loading procedures, source handling procedures, as well as the training of new personnel in source loading.

James L. Hardin
Service Engineer

B.S. Physics, Southwestern University
Georgetown, Texas 1952

Texas Nuclear 4-1-74 to 6-24-77

Counter Shop Supervisor

Built and tested bismuth counters, neutron detectors, and ion chambers.

Service Supervisor

Did field installation and checkout of Cs-137, Co-60, and neutron sources.

AC Company, New Iberia, LA July, 1977 thru March 1978

Radiation Safety Officer and Manager, Nuclear Instrumentation Dept.

Installed and maintained nuclear density gauges in oil field.

Texas Nuclear April, 1978 to present

Graduated TN radiation Safety Course

Service Manager, Field Service Supervisor,
Service Engineer

MAX J. "JOE" GALLAGHER
11404 THORNY BROOK TRAIL
AUSTIN, TEXAS 78750

(512) 258-2971

## EMPLOYMENT HISTORY

### AUSTRON, INC.
### AUSTIN, TEXAS

Dec 1974 to present

VICE PRESIDENT MANUFACTURING: Responsible for the entire manufacturing effort for a mid sized, high technology, electronics company engaged in building navigation timing, and computer peripheral products for government and commercial customers. I coordinate the activities of subordinate managers who in turn supervise approximately fifty people performing fabrication, assembly, testing, inspection, materials management and manufacturing engineering functions.

Some specific accomplishments include:

- Doubling the number of end items shipped while increasing the number of employees by only 25 percent.
- Guiding the company from an informal inspection system to a MIL-Q9858 quality program.
- Established a Material Requirements Planning (MRP) system for inventory control replacing an obsolete order point method.
- Implemented a production scheduling and control system for capacity planning and priority control.
- Incorporated a number of progressive and forward looking personnel policies allowing us to better compete in a tight labor market.

### DISPLAYTEK CORPORATION
### DALLAS, TEXAS

April 1973 to Aug 1974

WAFER PROCESSING MANAGER: Responsible for the integrated circuit chip out put from semiconductor "front end" facility. This included production scheduling, inventory control, capital equipment acquisition and supervision of twenty people.

## TEXAS INSTRUMENTS, INC.
## DALLAS, TEXAS

May 1967
to Apr 1973

SENIOR DESIGN ENGINEER: Participated in several radar and missile test equipment design projects.

Worked on virtually every facet of a project including proposal writing, systems engineering, detailed circuit design (analog and digital), production, qualification testing, and field installation.

## US ARMY MISSILE COMMAND
## REDSTONE ARSENAL, ALABAMA

Sept 1964
to May 1967

While on duty as a Captain in the US ARMY, I was assigned as project engineer in charge of Laboratory Product Verification testing of the REDEYE missile.

## EDUCATION

Received an MS in Industrial Administration in summer of 1974 from the University of Dallas.

Received a BS in Electrical Engineering from Oklahoma State University in 1963.

## AWARDS AND ORGANIZATIONS

US ARMY Commendation Medal in 1967.
Member SIGMA IOTA EPSILON - National honorary business fraternity.
Charter member of the Austin Chapter of the AMERICAN PRODUCTION AND INVENTORY CONTROL SOCIETY.
Taught several management courses for ST. EDWARDS UNIVERSITY in Austin.
Member of the AMERICAN INSTITUTE OF INDUSTRIAL ENGINEERS.

## PERSONAL DATA

Married
Age 40
Three Children
Active in childrens' activities such as Optismist Club Soccer (coach) YMCA Indian Guides and swimming.

## REFERENCES

Will be furnished upon request.

Tom Lee Erb
Chief Engineer, Process Measurements

Education: B.S., Georgia Institute of Technology, 1963

Experience:

1965 to Present - Texas Nuclear - Applications development and equipment design including portable and fixed neutron moisture gauges, portable and fixed neutron asphalt content gauges, portable and fixed gamma ray density gauges, gamma ray level gauges, and gamma ray belt weigh scales. Work included detailed design of radiation geometries for function and safety as well as associated instrumentation. Configure and perform experiments at the plant and in the field in support of equipment development. Instrumentation design and some field support of neutron activation analysis equipment.

1960 - 1965 - Georgia Institute of Technology Research Station and Research Reactor, Research Assistant - Designed instrumentation and related equipment for background and fallout monitoring, low level counting, subcritical assembly experiments, reactor experiments, fission product monitoring in water and waste water, safety interlocks for 50KCi hot cell, high level x-ray facility interlocks, and other radiation related experiments.

Troy K. Johnson
Service Manager

Education: Texas A & M, MBA - Organization and Administration; University of Texas at Austin, BBA - Industrial Management; Officer Candidate School; Southeastern Signal School; National Radio Institute.

Experience: 1983-present, Service Manager, Texas Nuclear; 1981-1983, MAPICS Project Manager, Texas Nuclear; 1979-1981, Production & Inventory Control Manager, Texas Nuclear; 1977-1979, Production Manager, Texas Nuclear; 1976-1977 Quality Engineer, Eagle Signal; 1974-1975 Plant Manager, Austin Industries, Inc.; 1973-1974 Quality Assurance Engineer, Rockwell International Corp.; 1967-1971 Quality Engineer, Texas Nuclear; 1963-1965 Engineer Aide II, Texas Highway Department.

As Service Manager duties involve management of in-house, Field and Repair Parts service operations; Customer Service activities; Marketing administrative support and customer applications support.

As MAPICS Project Manager, responsibilities involved specification, procurement, installation, setup, initial data loading, personnel training procedure development and general implementation for the various hardware and software components of an IBM MAPICS manufacturing management system.

Fields of Experience: As Production & Inventory Control Manager for Texas Nuclear, responsibilities involved generating plans for production scheduling; maintenance of an accurate inventory control system which included generating procedures and systems and initiating the conversion of the manual system to a computerized system; supervision of all Production Schedulers, Inventory Clerks, Stock Clerks and Shipping and Receiving Personnel.

As Production Manager, responsibilities involved management of production departments and production operations, equipment procurement and maintenance, development of production procedures and systems, production cost control aid management of sub-contract operations.

While employed with Austin Industries, Inc. as Plant Manager, was responsible for all aspects of plant operations. This included production control and scheduling, inventory control, all personnel functions, plant and equipment maintenance, serve new product design, production engineering and some sales/marketing.

As Quality Assurance Engineer with Rockwell International, Corp. was assigned to the corporate new product development team and performed Q.E. design reviews of the new product; reviewed, helped specify, evaluated and made final acceptance on a series of highly specialized custom machine tools and testing and inspection machines.

Other areas of experience include the inspection of mechanical parts and assemblies for Texas Nuclear products; preparing operating and capital expenditure budgets, various quality control standards, inspection and records procedures and the performance of various supervisory functions.

Active member of Society of Manufacturing Engineers and American Society for Quality Control and more than 10 years with the Military Service.

William G. Hendrick
Health Physicist

Education: B.S., Physics, Roanoke College, Salem, Virginia, 1963.
M.S., Physics, University of Tennessee, Knoxville, Tennessee, 1968.

Experience: Health Physicist/Senior Research Scientist, Texas Nuclear, 1968-Present. Chief Health Physicist, Space Radiation Effects Laboratory, Newport News, Virginia, 1965-1968. Health Physics Fellow, University of Tennessee and Oak Ridge National Laboratory 1963-1965. Instructor, Mathematics, Roanoke College, 1963. Laboratory Assistant, Physics, Roanoke College, 1961-1963.

Fields of Experience: Mr. Hendrick is responsible for the entire radiation safety program of Texas Nuclear. His duties include the development of procedures for personnel safety and material control, licensing for both the company and customers, facility design, instrumentation studies and personnel training. Additionally, he assists in associated Health Physics areas, e.g. source and shield design, dosimetry, instrumentation, and provides monitoring and supervision over all measures essential for the protection of persons and property from radiation.

From 1966 to 1968, Mr. Hendrick was at the Space Radiation Effects Laboratory, where he had the overall responsibility for the radiation safety program. He established an isotope counting facility, assisted in experimental shield design, coordinated experimenters' requirements with the laboratory and served as an ex officio member of the Radiation Safety Committee of NASA, Langley.

From 1963 to 1965, Mr. Hendrick attended the University of Tennessee on a Special Health Physics Fellowship awarded by the Atomic Energy Commission. He attended graduate courses in Health Physics and on-the-job training at Oak Ridge National Laboratory. While at ORNL, he did experimental research on low energy electron interactions with selected organic molecules.

Prior to 1963, Mr. Hendrick attended Roanoke College, Salem, Virginia, where for two years he worked as a laboratory assistant. His duties involved instrument repair, calibration, control of radioactive sources and assistance with the nuclear physics laboratories.

Technical Societies: American Association of Physics Teachers; Health Physics Society.

Honors: AEC Fellowship; Sigma Phi; Sigma Pi Sigma.

Publications: Two papers on electron attachment with organic molecules and three technical reports on accelerator monitoring.

9. FACILITIES AND EQUIPMENT

The following two drawings display the facilities at Texas Nuclear. The areas marked are those that we control most closely due to the presence of radioactive materials. These areas contain both active and passive personnel monitoring devices and area survey devices. Many of these areas contain sophisticated counting systems that are primarily used in R & D efforts, but are available to Health Physics.

Support Instruments, Calibration and Verification:

Following is a list of rdiation detection instrumentation and their specifications indicating portable survey instrumentation available at Texas Nuclear. These instruments are either already distributed or are available from Health Physics.

Additionally, there is support instrumentation available which can only be utilized through Health Physics and any proposed use of said instrumentation is to be cleared through the Health Physics Department.

Instruments must be calibrated when needed and this is primarily a function which is either done by Health Physics. There is an instrument calibration procedure contained which discusses in general what must be done to calibrate an instrument and what accuracy specifications that instrument must meet. However, each individual using a portable survey meter is responsbile for seeing that it is properly operating and within calibration. If any questions arise in this area, the instrument is to be brought to Health Physics and its status and use clarified. Any survey instrument not operating properly or known not to be calibrated based upon performance is to be turned in to Health Physics.

The most widely used instruments at Texas Nuclear are those for detecting X and gamma radiations and used around gauging devices either in-house or in the field. This is typically our Model 2652. Because of the wide operating use of this instrument, we have developed a verification procedure which is also included in this section. Verification of an instrument's operating precision is simply a method of reassuring one that the instrument is responding properly to a broad range of gamma ray energies. One accomplishes this by carefully using the Ra-226 check source supplied with each instruments, its known and recorded two-point readings and distance from the detector. This simple procedure will verify the instrument calibration and will do it on all ranges if necessary.

Following the Instrument Verification Procedure we have included a sketch of the Health Physics counting area and descriptive information titled "Laboratory Counting Instrumentation."


TN BLDG I

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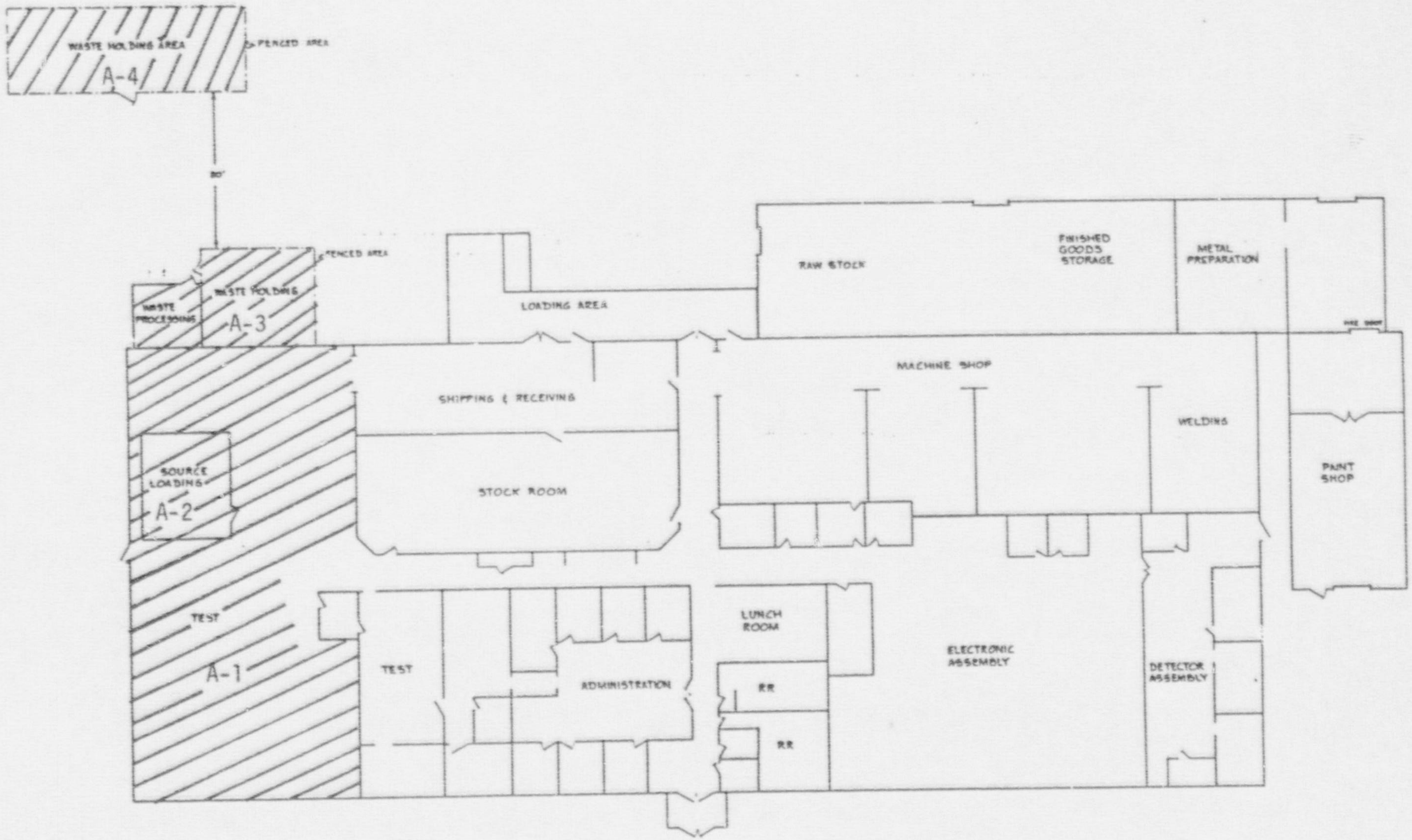



TEXAS NUCLEAR
BUILDING 2

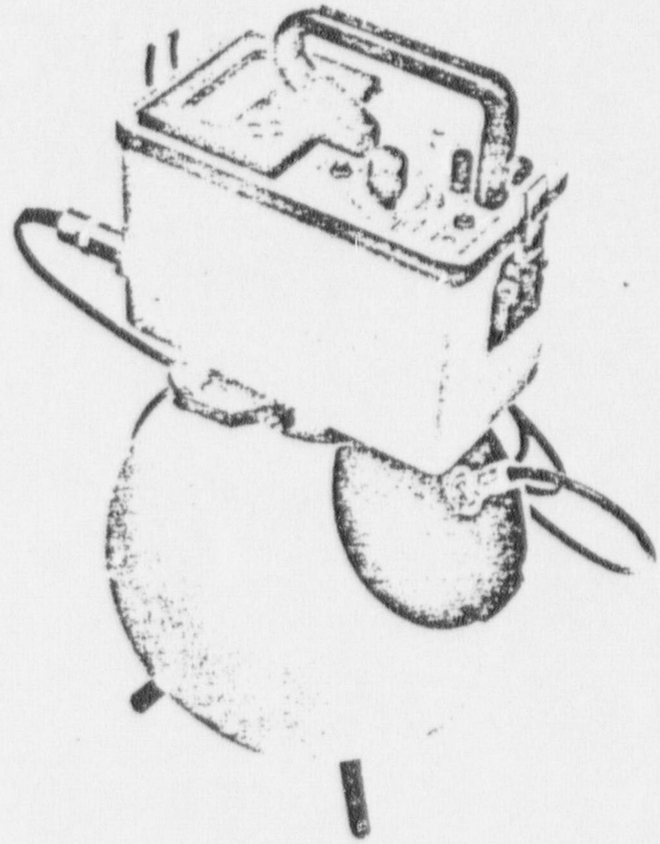
## IONIZING RADIATION SUMMARY

| Radiation | Alpha ($\alpha$) | Beta ($\beta$) | Gamma-X-Ray ($\gamma$-X) | Neutron (n) |
|---|---|---|---|---|
| Type | $He^{++}$ atom | $e^-$, $e^+$ (electron) | Electromagnetic | Particle |
| Charge | 2 Positive | 1 Negative or 1 Positive | None | None |
| Mass | 4 amu | .00055 amu | No rest mass | 1 amu |
| Source | Nucleus | Nucleus | $\gamma$-nucleus<br>X-orbital $e^-$'s | nucleus |
| Energy | ~4 to 10 MeV | 0.2 to 3 MeV | $\gamma$-0.3 to 2.7 MeV<br>X-0.05 to .25 MeV | Thermal 0.025-0.1 eV<br>slow 0.1 to 200 eV<br>intermediate .2 KeV to 0.1 MeV fast > 0.1 MeV |
| Hazard | Internal | Internal and External | External | External |
| Detection | ZnS screen<br>Gas counter | G-M Tube<br>ionization chamber | ion chamber<br>G-M tube<br>scintillation counter | $BF_3$ Tube<br>Gas counter<br>collision with nuclei |
| Q.F. | 10-20 | 1 | 1 | Thermal 2.5<br>fast 10 |
| | a) emitted with discrete energy | a) emitted with a continuous energy spectrum up to E max. | | |

## RADIATION DETECTION INSTRUMENTATION

| Model | Number Available | Radiation Detected | Sensitivity Range | Window Thickness | Use |
|---|---|---|---|---|---|
| TN Model 2651 GM Counter | 6 | $\beta$, $\gamma$ | 0.1 to 100 mR/h | 30 $mg/cm^2$ | Survey |
| TN Model 2652 GM counter | 28 | $\alpha,\beta,\gamma$ | 0.1 to 100 mR/h | ∼2 $mg/cm^2$ | Survey |
| TN Model 2671 Neutron | 1 | Neutron | 25 to 25,000 $n/cm^2$- sec | 0.01 eV to 14 MeV | Survey |
| Eberline PRS-2P/NRD BF3 | 2 | Neutron | 0.2 mrem/h to 10 rem/h | 0.01 eV to 14 MeV | Dosimeter |
| TN Model 9120 Log Series | 5 | $\beta,\gamma$ | 0.02 to 200 mR/h | 30 $mg/cm^2$ | Survey |
| TN Model 9121 Log Series | 3 | $\gamma$ | 0.2 to 2000 mR/h | 36 $mg/cm^2$ | Survey |
| TN Model 9122 Log Series | | $\gamma$ | 2 to 20,000 mR/h | 90 $mg/cm^2$ | Survey |
| TNC Model 9160 Tritium Monitor | 2 | $\alpha,\beta$ | 20 $\mu$Ci of $H^3/m^3$ to 100,000 $\mu$Ci | Flow thru | Monitoring |
| TN Model 2595 Ionization | 5 | $\alpha,\beta,\gamma$ | 0 to 1000 mR/h (Rate) 0 - 10 mR (Integrate) | ∼1 $mg/cm^2$ | Dosimeter |
| N-CC Model 2596 Ionization | 3 | $\alpha,\beta,\gamma$ | 0 to 1000 R/h (Rate) 0 to 10 R (Integrate) | ∼1 $mg/cm^2$ | Dosimeter |

# "RASCAL"
# Portable Neutron Rem Counter
# Model PRS-2P/NRD



- DIGITAL RATEMETER-SCALER
- MEASURES NEUTRON DOSE EQUIVALENT FROM 0.2 mrem/hr TO 10 rem/hr
- THERMAL THROUGH FAST NEUTRONS
- $BF_3$ TUBE GIVES HIGH GAMMA REJECTION
- DETACHABLE DETECTOR
- ENERGY SPECTRUM INFORMATION (OPTIONAL 3-INCH SPHERE)
- LIGHTED LIQUID CRYSTAL DISPLAY
- HIGH VOLTAGE DISPLAYED ON READOUT
- BATTERY CHECK CONDITION
- BUILT-IN SPEAKER

eberline

PRS-2P

# SUPPORT INSTRUMENTATION

There is certain instrumentation available at Texas Nuclear only from Health Physics which can be used to support dosimetry functions.

1. Sets of pocket dosimeters. Most of these are for X and gamma radiation operating over the 0 to 200 mR range.

2. Ion chamber calibration device designed to calibrate the Cutie Pie high and low range chambers.

3. Free field calibration range with 1.5 curies Co-60.

4. Fast plastic scintillator that will not only measure energy of charged particles but also number of charged particles if the numbers do not exceed about one million per second.

5. Victoreen R-meter set with nine different probes.

6. Free air ion chamber.

7. Extrapolation chamber.

8. Neutron activation foil sets.

9. Several high resolution X and gamma detectors which can be combined with readout for spectrum analysis. These are computer based systems which allow not only stripping but have peak identification at a 2 sigma level.

## INSTRUMENT CALIBRATION

There are in general three terms used to describe certain actions that must be taken prior to using portable detection instruments.

1. Check the instrument operation.
2. Verify the instrument calibration.
3. Calibrate the instrument.

All instruments will be checked prior to use and a calibration sticker should be on the instrument. If the measurements need to be made with precision greater than $\pm$ 20%, the instrument may have to be recalibrated. However, in general a functioning instrument that is verified to still be in calibration by radiation readings to $\pm$ 20%, measures quite well and reliably.

All portable instruments used for X and gamma radiation survey work have check sources with them, and for the X and gamma survey instruments, which are the widest used, there is a Verification Procedure following which can be used to verify that the instruments is still in calibration. Verification of an instrument calibration is the minimum someone would do prior to taking an instrument into the field.

Calibration is required anytime an instrument is repaired or any time its readings differ from those expected using certain selected sources or check sources by more than 20% of the expected value. Calibration will be done by Health Physics. It will generally be done on a free field range using the appropriate sources and our quality requirements are to calibrate to ± 6% of the expected value and have agreement to ± 10% range to range. Error for integrating dosimeters would typically be somewhat greater than the error for rate meters.

Details for calibrating individual instruments are available. However, in general what is done is that in the free field range certain points are measured with standard instruments that typically can be calibrated to ± 3% by outside firms like NBS. Then a combination of mapping the radiation field with the standard instrument, distance and supplied attentuation plates can reproduce almost any radiation intensity desired. In calibration we generally do not attempt to compensate for the scatter field that exists around most gauging devices. That is, we primarily will calibrate at the energy of the source; i.e., Cs-137 or Co-60, and you would then expect over-response of most GM survey meters when measuring gauges where the source is contained in a massive lead and steel shield.

There are standards on instrument calibration when those instruments are being used to measure diagnostic or therapeutic devices where exposures to humans is a primary function of the device. These standards require things like two points on every scale and ± 10% at every point. Only those ion chambers maintained by Health Physics will be calibrated to this standard. Generally, our 2652's will be calibrated to six points plus we check scale overlap for ranging. This should be more than adequate to professionally do gauge survey and installation work.

Texas Nuclear
December 1979

# FIELD VERIFICATION OF RADIATION INSTRUMENTATION CALIBRATION

This procedure is applicable to the most commonly used field survey instrument at Texas Nuclear, namely the end window GM tube Model 2652. This instrument is used by all service personnel in the installation of devices containing gamma emitting isotopes.

The instrument properties, its physical construction, the effects of shock, sound, vibrations, switching transients, etc. are well known. The characteristics that need to be checked and verified in the field prior to making radiation surveys and leak tests are precision, that is reproducibility of repeated measurements, accuracy, sensitivity and its linearity.

Tests for these items should be repeated routinely, particularly because instruments in travel are subjected to such physical abuse. This precision calibration should be completed prior to or soon after going on any job site for the installation of gauging devices. This periodic recalibration is distinctly different from the in-house calibration. The in-house calibration should be performed any time the instrument is in for maintenance or repair or any time the instrument readings differ from those established by this procedure by more than $\pm$ 20%.

At the time the primary instrument calibration is completed, a Ra-226 check source is assigned and read on that instrument. The two widely different (e.g., 50 mR/h side I and 1.5 mR/h side II) readings are recorded in the instrument backplate where the source is stored.

The field calibration procedure then is as follows:

1. Remove the instrument to a relatively low background area.

2. The equipment necessary would be the instrument itself, the check source supplied and a small 6" pocket steel ruler.

3. Set the instrument on a flat surface, check the battery and adjust if necessary. Remove the end cap, measure and record the background radiation.

4. Place the highest reading side of the check source on the meter probe. One does not have to be very careful on the newer models since the screen protects the probe. For old models with an unprotected end window, one is cautioned to exercise care to keep from destroying the tube. With the highest reading side down on the end window and positioned symmetrically with the probe, verify that the instrument is reading the same as that stamped inside the back cover $\pm$ 20%.

5. By using the pocket steel ruler as a brace, move the source approximately 1/4" above the end window and you should have a reading on the highest scale that is also verifiable on the 30 mR/h scale. A typical example would be that the check source reads 50 mR/h in contact with the meter probe, and at 1/4" or so away it should drop to 25 mR/h, which is verifiable on the 30 mR/h full scale.

6. Move the source until it is approximately an inch away, and one will have a reading of less than 10 mR/h which means you can verify the instrument calibration on the 100 mR/h scale, the 30 mR/h scale and now the 10 mR/h scale. Reading scale to scale should be within ± 10%.

7. At approximately 2" away on the 10 mR/h scale another reading is produced which could be verified on the 3 mR/h scale.

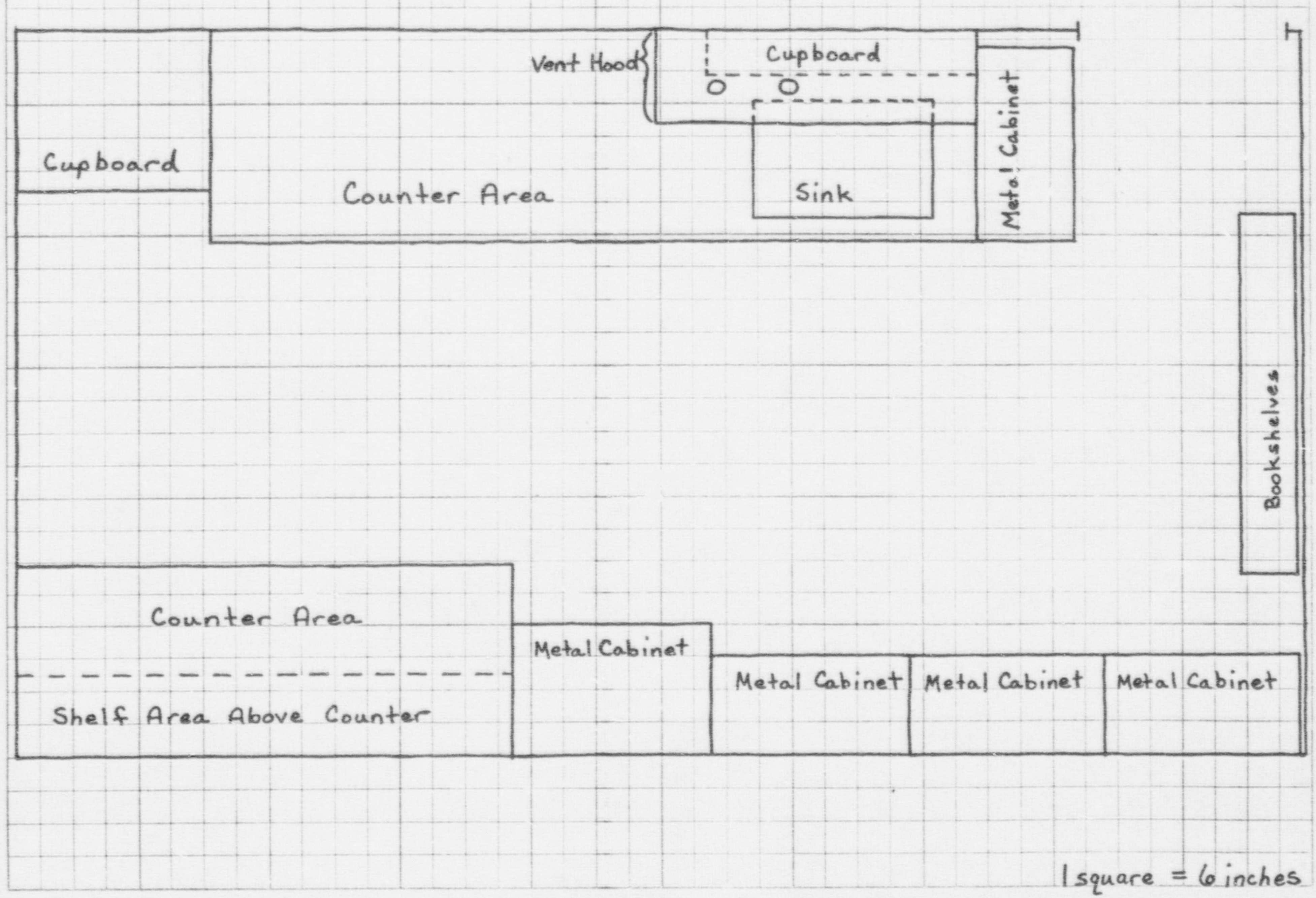
8. Turn the source over and place the lower reading side in direct contact with the meter probe. Verify that this reading is the same as that stamped inside the instrument. This reading should be approximately mid-range on the 3 mR/h scale. The lower side of the source can also be used to verify the instrument to the 10 mR/h scale.

9. Slight separation of about one inch will allow readings on the 1 mR/h scale that are verifiable on the 0.3 mR/h scale. Separation of about 3 inches will allow you to get down onto the 0.1 mR/h scale.

10. The leak test standard, that is the certified 0.005 microcurie standard should produce another check source reading on the 1 mR/h or 3 mR/h scales.

11. This procedure performed routinely prior to entering customer job sites, or very soon thereafter on installation work, will allow one to have confidence in the accuracy of the meter readings taken during survey and leak test work. Without this detailed calibration of the instrument on all scales questionable readings could be obtained.

13. In the performance of this calibration verification work, if the instrument readings deviate by more than ± 20% from those expected, that is those readings taken at the time the instrument and source were calibrated, the instrument must be removed from service and brought back or returned to Texas Nuclear for repair and re-calibration.


Vent Hood
Cupboard
Metal Cabinet
Cupboard
Counter Area
Sink
Bookshelves
Counter Area
Metal Cabinet
Metal Cabinet
Metal Cabinet
Metal Cabinet
Shelf Area Above Counter
1 square = 6 inches

# LABORATORY COUNTING INSTRUMENTATION

## System I - Gamma Counting

Channel A. Detector 3 x 3 NaI(Tl)
Composed of Canberra Model 2013 amplifier, Model 2030 single channel analyzer, and Model 1772 counter/timer.

Channel B. Detector 3 x 3 NaI(Tl)
Composed of Canberra Model 816A amplifier, Model 2030 single channel analyzer, and Model 1772 counter/timer.

HV Power Supply for Channels A & B.
Model 2K-10 Power Designs.

## System II - Proportional Counting

Detector Reuter-Stokes thin window (1.4 mg Be) proportional tube 2 1/2" diameter held in a graded shield.
Electronics composed of Canberra Model 2012 amplifier, Model 2030 single channel analyzer, and Model 2071 dual counter/timer.
HV Power Supply 3KV Model 3002.

## System III - Charged Particle Counting

Detector Ortec silicon surface barrier. Active area 100 mm sq. Depletion depth at 300 volts will count 4.0 MeV protons, 200 KeV beta particles, and greater than 10 MeV alpha particles.
Composed of Canberra 7400 A vacuum chamber, Model 2004 pre-amplifier, Model 2015A amplifier/timing single channel analyzer and Model 2071 dual counter/timer.
HV Power Supply is Model 3012.

## System IV - Coincidence Counting

Detector 2 matched 3 x 3 NaI(Tl)
Composed of two Model 816A amplifiers, two Model 2030 single channel analyzers, Model 2071 dual counter/timer including either a Canberra Model 1441 or EG&G Model C-102B fast coincidence units.

## System V - Beta Screening

Detector GM Tube
1-2 mg/cm$^2$ window, power supply and Model 1772 counter/timer.

System VI - Shielded Thin NaI(Tl)

Composed of Model 2015A amplifier/timing single channel analyzer, Model 2071 dual counter/timer with a Model 3102 HV power supply.

System VII - High Resolution Gamma Counting

Detector ORTEC High-Purity Germanium Coaxial with efficiency 25.8% @ 1.33 MeV; resolution 1.89 KeV @ 1.33 MeV; diameter 50.7 mm; length 64.3 mm.

Electronics standard ORTEC Nim Modules, including pile-up rejection. Tracor Northern TN-1750 multi-channel analyzer with 4096 channels.

Computer Data General NOVA-4X with extended memory and in-house peak search and integration routines.

Other Supporting Components

1. Multi-channel analyzer Canberra Series 30 with 2048 channels.
2. Thin Beryllium window, NaI(Tl) detector.
3. Texas Nuclear low-noise pre-amplifier and amplifier system.
4. An array of 25 NBS or Radiochemical Centre standard calibration sources of different isotopes.
5. Model 1454 linear gate and stretcher.
6. Model 1480 linear rate meter.
7. Model 1455 logic shaper.
8. Various reference standard delay units.
9. Tektronix Model 2215.
10. An assortment of general support detectors, pre-amplifiers, custom shaping circuits, etc.

# USE OF RADIOACTIVE MATERIAL OFF-SITE

This section details the procedures for obtaining authorization to use radioactive materials at locations other than Texas Nuclear. For operational convenience, the control is divided into the following categories based upon the potential hazard involved:

A. Radioactive material in normal form.
B. Radioactive material in special form and large quantities.
C. Radioactive material in special form and contained in a device for demonstration purposes.
D. Radioactive material as small check or calibration sources.

This type of work can be divided into five general areas for discussion:

(1) Planning
(2) Equipment
(3) Authorization
(4) Execution
(5) Emergency

The individuals responsible for off-site work should keep in mind that their work must be done with safety as a paramount objective. This must be accomplished, in general, without the back-up routinely provided by the personnel and facilities of the home office.

## A. Radioactive Material in Normal Form

The use of significant quantities of radioactive material in normal form off-site contains the potential for a most serious accident.

### Planning

Planning must be done in greater detail than is necessary for the same project done at the plant. This is due mainly to the lack of back-up that can be made immediately available. A detailed project analysis must be prepared for submission to the Radiological Health and Safety Committee.

This project analysis must detail all phases of the operation in which the isotopes are to be used. This must include, but not be limited to:

(a) Isotopes to be used and amounts
(b) Procurement and transportation to the site, including routes to be traveled, if applicable
(c) Environmental conditions at the job-site
(d) Any additional preparation on handling of the isotopes
(e) Methods of detection
(f) Project equipment
(g) Emergency equipment
(h) Method of determining isotope concentration at the time of release, if any transfer is involved.

Equipment

The large amount of equipment necessary to do the work is not the concern of this section except that much of it may be useful in the event of an emergency.

Some equipment is necessary to be on every job-site where isotopes are used. This equipment must include the following:

(a) Portable instruments capable of detecting the isotope being used with suitable standards to check their accuracy.

(b) One NaI (Tl) scintillation counter with scaler system for swipe testing.

(c) Emergency kit, one for every two people. (Emergency Procedure)

(d) Personnel monitoring to include at least film badge and 200 mR pocket chambers.

(e) Associated radiation users supplies.

(f) One copy of Texas Nuclear Emergency Procedures.

These items and their use are detailed in the following sections. All radiation monitoring instruments to be used off-site must be listed on the following form, number HP-RP-001.

Authorization

The Radiological Health and Safety Committee must have given prior approval before any significant quantity of radioactive isotope in normal form is used for off-site applications. The form, "Application for Isotope Usage Off-site", number HP-RP-002, must be completed and signed before starting the project. The Committee will request any additional information necessary to evaluate the application, and will specify additional equipment, conditions of personnel as necessary to assure that personnel and equipment are protected and all applicable local, State and Federal regulations are complied with.

Additionally, the user must complete and submit the "TN Source Control-Transportation" form, number HP-RP-003. A copy must be sent to Health Physics for comments and inclusion in the formal off-site proposal. These forms are available in the Health Physics office.

If approval is granted, the user will be responsible for assuring that:

(a) All radioactive materials are handled in accordance with the "Texas Nuclear Radiological Safety Manual."

(b) All such materials are properly labeled.

(c) All materials are transported and stored as specified.

The Health Physics office will aid any user with handling or storage problems and will advise on transportation requirements. The responsibility of complying with safe handling and storage procedures off-site will remain with the user.

RADIATION MONITORING EQUIPMENT

| | | | |
|---|---|---|---|
| Model Number | | | |
| Manufacturer and Serial Number | | | |
| Types of Radiation Measured | | | |
| Ranges Measured | | | |
| Period of Calibration | | | |
| | | | |
| Model Number | | | |
| Manufacturer and Serial Number | | | |
| Types of Radiation Measured | | | |
| Ranges Measured | | | |
| Period of Calibration | | | |
| | | | |
| Model Number | | | |
| Manufacturer and Serial Number | | | |
| Types of Radiation Measured | | | |
| Ranges Measured | | | |
| Period of Calibration | | | |
| | | | |

# APPLICATION FOR ISOTOPE USAGE OFF-SITE

Proposal Title

| Start Date | Completion Date |
|---|---|
| Project Leader | Other Personnel |

Job Description

| Isotopes | Form | Amount | Type of Radiation |
|---|---|---|---|
| | | | |
| | | | |

| Protective Equipment | Use | Type |
|---|---|---|
| | | |
| | | |
| | | |
| | | |

Transfer Concentrations

Method of Determination

RHSC Conditions (Additional)

Applicant (Signature)

Radiological Health and Safety Committee

# TEXAS NUCLEAR SOURCE CONTROL: TRANSPORTATION REQUEST

Date: ____________________

(1) User's Name: ____________________

Location of Use: ____________________

Complete Address: ____________________

____________________ Telephone: ____________________

(2) Date of isotope arrival at off-site location ____________________

Duration isotope will be at off-site location ____________________

(3) Isotopic composition: ____________________

Physical state: ____________________

Strength (State units and type of radiation precisely): ____________________

____________________

Dimensions: ____________________

(4) Size of container: ____________________

Weight: ____________________

(5) Activity at container surface: ____________________

Activity 12 inches from container: ____________________

Comments: ____________________

____________________

(6) Planned use of source: ____________________

(7) Where do you plan to store source? ____________________

____________________

Exactly what shielding will you provide in the storage area:

____________________

(8) Do you foresee any special problems? ____________________

____________________

(9) Mode of transportation: ____________________

(10) Describe packaging: ____________________

____________________

## Execution

This section contains the following:

(a) Brief of the applicable regulations and exposure guidelines.

(b) Rules of operation as established by Texas Nuclear.

(c) General rules for working around radiation.

In general, the regulations as set forth in Part 21, Texas Regulations for Control of Radiation, will be followed. Recommendations set forth in other publications will be used in addition. In case of any conflict between sources, the one specifying the lower maximum exposure level will be used. The following paragraphs summarize the pertinent guides under which we operate.

## Exposure of Individuals

The basic permissible weekly whole body dose for exposure to any ionizing radiation for an indefinite period of time is 100 mrem. On a quarterly basis (12-14 weeks) it is as follows:

| | Rems per Calendar Quarter |
|---|---|
| 1. Whole body, head and trunk; active blood-primary organs; lens of eyes; or gonads | 1 1/4 |
| 2. Hands, feet and ankles | 18 3/4 |
| 3. Skin of whole body | 5 |

These values constitute the Maximum Permissible Dose (MPD) and are governed primarily by the susceptibility of the vital organs of the body to ionizing radiation. In certain cases, an individual may receive a whole body dose not to exceed 3 rems per calendar quarter. In cases of special circumstance, where the above quarterly rates of exposure to radiation may be exceeded, application must first be made to Health Physics for authorization. Individual exposures must be maintained as far below these levels as practicable.

Uncontrolled Areas

Unless specifically authroized by Health Physics, no radiation fields shall be generated or materials transferred, stored or used in such a manner as to potentially expose non-radiation workers to:

1. Radiation levels of more than 2 mrem/hr in any one hour, or
2. Radiation levels of more than 100 mrem/wk.

The Health Physics Department may upon application authorize a higher radiation level if it is demonstrated that such levels are necessary for completion of the work and they will not cause any individual to receive a radiation dose in excess of 10% of the limits established in this section. These individuals, not employed by Texas Nuclear, must be notified of their potential exposure prior to the work beginning. Any objections must be resolved prior to starting.

Release of Radioactive Materials

In general, no radioactive materials may be released into the environment in any concentrations greater than those specified in the original application for the off-site work. If a release of greater concentrations is necessary, prior approval must be obtained from the Radiological Health and Safety Committee through Health Physics.

Posting

When radiation fields exceed prescribed levels, these areas will be posted with appropriate radiation signs. These signs will indicate the nature of the radiation, date of posting, radiation level at a specified distance, and any other appropriate data. A contaminated area will be posted immediately as a restricted area and will remain posted until cleared by Health Physics. Contamination is discussed in more detail under "Emergencies".

General Rules

1. Film badges and pocket chambers should be worn by all personnel working off-site.
2. Working areas should be monitored frequently for possible contamination. If any area is suspect perform a wipe test.
3. Radiation survey instruments should be checked daily to assure their operating conditions.
4. No food is to be stored, prepared, or eaten in areas where radioisotopes are utilized.
5. No smoking will be allowed in areas where unsealed sources are being used.
6. No work with loose radioactive materials should be done by a person having a break in his skin.
7. Radioactive materials should never be handled with the bare hands.
8. Appropriate handling equipment should be readily available on all job sites.
9. All liquid isotopes should be stored in non-breakable containers.

10. Forceps or remote handling tools should be used when indicated. Rubber or plastic gloves should be worn and should be washed before removing from the hands. After removal of the gloves, the hands should be washed and monitored.

11. A specially labeled can lined with a waterproof disposable sack should be provided for disposal of radioactive waste.

12. All containers of radioactive material should be appropriately labeled if practical. These labels may indicate the date of assay and the kind and quantity of radioactive material, and have the standard yellow and magenta radioactivity symbol.

13. Containers of radioactive solutions shall be kept closed except when in actual use.

14. Pipetting of radioactive solutions by mouth shall not be permitted.

15. Radioactive sources shall be stored, when not in use, in a suitable location with means to prevent unauthorized access. Adequate shielding must be provided and "Radioactive Materials" signs posted. It is rare for unauthorized access to become a problem; however, the risk must not be taken lightly.

## Hazard Evaluation

A physical survey including swipes of all working surfaces, environmental samples if applicable, survey of all equipment and working areas and product samples if applicable, must be completed prior to leaving any job site. Copies of this data must be prepared for submission to the Radiological Health and Safety Committee. No movable, contaminated material will be left at any job site, but will be packaged and returned to Texas Nuclear. Any material or equipment so contaminated shall be properly labeled with a contamination tag giving:

1. Type and level of radiation (mrem/hr) at a specified distance;
2. Extent of contamination on surfaces.

EMERGENCY

The in-house Emergency Procedures are directly applicable, and a copy should be available at all times. The Accident Detail Form, number HP-RP-004, will aid in reporting the accident and should be referred to.

B. Radioactive Material in Special Form and Large Quantity

The use of radioactive material in special form but large quantities off-site contains as the primary hazard external radiation exposure. Special form sources are extremely rugged and the probability of the release of significant amounts of radioactive material is small.

An application for isotope usage off-site, HP-RP-002, must be completed and submitted to Health Physics. Health Physics will determine whether the planned usage necessitates submission to the RHSC before approval is given.

The equipment necessary will include:

a. Portable instrumentation capable of detecting the emitted radiation.

These instruments must be calibrated within the previous thirty (30) days prior to being taken off-site.

b. Personnel monitoring will include the film badge and any other dosimeters deemed appropriate.

The user must complete and submit Transportation Form HP-RP-003 to Health Physics. The user will be responsible for assuring that the radioactive materials are handled safely and according to prescribed procedures; and all storage containers are properly labeled and that all materials are transported and stored as agreed upon. The user must carry a copy of this procedure with him and be familiar with its requirements as they pertain to his particular off-site usage.

Radioactive Material in Special Form and Contained in a Device for Demonstration Purposes

Personnel needing to use radioactive material in devices for demonstration purposes will submit their needs and plans for such demonstration to Health Physics. Health Physics will notify appropriate regulatory agencies if necessary, and insure that shipping containers are adequate and properly labeled. All devices used for demonstration purposes will be leak tested within 6 months prior to leaving the plant site. Only personnel authorized can perform demonstrations.

Demonstrations off-site are subject to particular control by regulatory agencies and the user will be briefed on these requirements by Health Physics prior to his demonstration. The one requirement for which there is no exception is that radioactive material taken off-site for demonstration will never be outside the direct control of the individual unless said material is properly packaged, labeled and placed in the hands of a common carrier for delivery to an authorized recipient.

1. <u>Guides for Sales Demonstrations</u>

   a. Notify Health Physics prior to a demonstration with the following information:

      1. Date of demonstration
      2. Location - city and state
      3. Company name and address if possible
      4. Where you could be contacted - (rep, hotel, etc.)

      If special conditions exist, we will make you aware of them at that time.

   b. The indivdual should always have:

      1. Suitable carrying case if appropriate
      2. Copy of license
      3. Current leak test certificate
      4. Current Shippers' Certificate

   c. You cannot send units to customer sites, warehouses, or reps, unless the rep has a license to possess it, much in advance of your arrival. Common carriers can hold shipments for short times. Anyone other than Texas Nuclear employees receiving it must be instructed not to open the packaging.

   d. You cannot cross international borders.

   e. Radioactive material can never be carried in the passenger compartment of an aircraft.

f. Units containing radioactive material can never be left unattended. They can be temporarily stored but they cannot be left in an operable condition without your presence.

g. Familiarize yourself with the particular radiation safety characteristics of each source you may be demonstrating.

h. There are no circumstances under which you will be authorized to remove a source from a unit.

Radioactive Material As a Small Check or Calibration Source

The use of small check and calibration sources off-site is subject to license restrictions and approval must be obtained from Health Physics prior to removing any radioactive material from the plant site.

# EMERGENCY PROCEDURES

Emergency procedures are to be instituted at the time of a radiation accident or contamination event. Generally, radiation accidents are in two categories; accidental release of radioactive material, or excessive exposure to radiation, or both. The objective of these radiological emergency procedures is to obtain immediate control of the situation, prevent the spreading of contamination and minimize any damage to personnel and property.

## Contamination

When any accident occurs involving the release of radioactive materials (contamination), the individual(s) involved should first try to estimate the hazard caused by the accident and evacuate any persons likely to be contaminated. Special attention should be paid to the possibility of contaminated wounds. Personnel safety is the first responsibility. Loss or damage to materials or equipment, under emergency conditions, is a secondary consideration.

One should try to prevent the spread of contamination by cutting off room ventilation fans, sealing windows, applying absorbers, such as paper or sand, to the contaminated area, and roping off or barricading the area, if these can be done quickly and with reasonable safety. The area should be isolated as quickly as possible and each entrance or exit to the area marked with a warning sign indicating the hazard. An inventory of people in the area must be started and maintained.

The Health Physicist should be notified immediately of the incident; if he cannot be reached, a member of the Radiological Helath and Safety Committee must be notified. However, because of the importance of immediate action, the precautions mentioned above should be taken, if possible, by those on the spot. No one should be admitted to the contaminated area except authorized emergency personnel, and they should be protected by special clothing and masks. Anti-contamination clothing, respirators, tape, etc., is contained in every emergency kit and are available from Health Physics.

Unless an individual has sustained an injury requiring immediate medical attention, he should not be allowed to leave the area until cleared by the personnel manning a check station, where they are monitored for contamination. All entrances and exits of people must be accounted for and documented.

Emergency telephone numbers, giving the office and home telephone numbers of the Health Physicist, members of the Radiological Health and Safety Committee, and Texas State Department of Health are given below:

| | Daytime | Nights & Week-ends |
|---|---|---|
| W. Hendrick | (512) 836-0801 ext. 310 | (512) 345-0585 |
| J. D. Henderson | (512) 836-0801 ext. 320 | (512) 452-4618 |
| Bureau of Radiation Control | (512) 835-7000 | (512) 478-7460 |

Additional information on contacting regulatory agencies other than Texas is contained in the back of this section.

If any material comes in contact with the clothes or body:

a. Clothing should be discarded in a suitable container. Under no circumstances should the clothing be so carelessly handled as to spread the contamination further.

b. Contaminated skin areas should be decontaminated as outlined below. Any contaminated cuts or abrasions should be flushed immediately with large quantities of water.

c. All other persons who were working in the vicinity of a contaminated area should be monitored.

No area decontamination procedures should be started until the situation is evaluated by Health Physics.

Personnel should decontaminate themselves as quickly as possible, using methods outlined below.

Personnel Decontamination

Thorough washing with soap and water and rinsing with large quantities of water is the best general decontamination method for the hands and other parts of the body, regardless of the nature of the radioactive contaminant. If, however, the contamination is well localized, it is recommended that the area be washed off and cleaned with small swabs and later, if necessary, use a general washing. Spread of contamination to other skin areas is thus avoided.

If the contamination is widespread, a general washing or shower should be taken and other more specific measures should be followed.

1. For general handwashing: The hands should be washed for two to three minutes in tepid water using a mild soap, and paying special attention to the finger folds, outer edges of the hands, and fingernails. Rinse thoroughly and repeat a maximum of four times. If the required degree of decontamination is not reached, proceed with No. 2.

2. Using a soft brush, wash and rinse three times. Use only light pressure so as not to abrade the skin and increase the possibility of internal contamination. Rinse thoroughly and monitor. If the desired level is not reached after several trials, chemical decontamination may be attempted as outlined in No. 3.

3. Use a paste of titanium dioxide applied liberally and worked in over small contaminated areas for a minimum of two minutes. Use water sparingly, only enough to keep the paste moist. Rinse with warm water and follow with soap, brush, and water, being extremely cautious to remove all paste about the nails. Monitor. Repeat process if necessary. If the contamination is still apparent, cover the areas with absorbent cloth and await additional instructions from Health Physics.

Any wounds, cuts, or bruises received while working with, in, or near radioactive materials should be flushed with water immediately. Any such accidents should be referred to Health Physics immediately. The following table summarizes the permissible skin contamination limits where one may stop decontamination proceedings for the time being.

Maximum Permissible Contamination Limits for Skin Surfaces

| Surface | Direct Survey | | Transferable (Smear) |
|---|---|---|---|
| | $\alpha$ (d/m/100 cm$^2$) | $\beta,\gamma$ (mrad/hr) | $\alpha$ $\beta,\gamma$ (d/m/100 cm$^2$) |
| General body | 150 | 0.06 | None detectable |
| Hands | 150 | 0.3 | None detectable |

## Contaminated Materials

Contaminated materials which can be disposed of should be placed in suitable dry active waste (DAW) or liquid active waste (LAW) containers. If possible DAW and LAW should not be mixed.

Health Physics will aid in the problem of evaluating contaminated equipment. In the event that it is not practical to decontaminate the equipment, it will be handled as DAW. In some cases, it may be possible to store such equipment for future use when radiation levels have decayed to acceptable levels. Equipment should be stored in an isolated area, properly marked and shielded.

The following methods can be used to decontaminate equipment.

Equipment may be washed with a hot, strong detergent solution and rinsed, the procedure repeated until the desired activity removal is obtained. Chemicals that may be used include chronic acid, nitric acid, ammonium citrate, trisodium phosphate, and ammonium bifluoride. In selecting decontamination materials, the nature of the surface and extent of contamination must be considered. For all practical purposes, decontamination effectiveness of a solution is considered complete at the end of the second repetition of any one process. If the desired level is not reached at this time, other methods should be considered. Tide has been found to be very effective for many contaminates. The following table summarizes the permissible contamination limits on items.

| Direct Survey | | Transferable (Smear) | |
|---|---|---|---|
| $\alpha$ (d/m/100 cm$^2$) | $\beta,\gamma$ (mrad/hr) | $\alpha$ (d/m/100 cm$^2$) | $\beta,\gamma$ (d/m/100 cm$^2$) |
| <300 | <0.05 | <30 | <200 |

In the case of area contamination, the method of decontamination will depend upon the nature of the surface. These methods include vacuuming, physical removal of surfaces, covering of short-lived materials with impervious materials, detergents, and chemicals. Where practical, areas which are contaminated will be isolated until radioactive decay permits safe entry. The following table, taken from "Radiological Emergency Operations, TID-24919, USAEC, summarizes many surface decontamination methods.

Anti-Contamination Clothing

Anti-contamination clothing is worn to prevent radioactive materials from reaching the body and to prevent the spread of contamination to clear areas. Disposable plastic coveralls, heavy cotton twill hoods, plastic boots, and rubber gloves complete the anti-contamination suit.

When dressing, all button or zipper seams, vents and other holes should be covered with masking tape. All junctions between the boots, the gloves and the coveralls should also be taped.

# Summary of Surface Decontamination Methods

| METHOD | SURFACES | ACTION | TECHNIQUE | ADVANTAGES | DISADVANTAGES |
|---|---|---|---|---|---|
| VACUUM CLEANING | Dry contaminated surfaces. | Removal of contaminated dust by suction. | Use conventional vacuum technique with efficient filter. | Good on dry porous surfaces. Avoids water reactions. | All dust must be filtered out of exhaust. Machine is contaminated. |
| WATER | All nonporous surfaces (metal, paint, plastic, etc.). Not suitable for porous materials, such as wood, concrete, canvas, etc. | Solution and erosion. | Use gross decontamination employing water shot from high pressure hoses. Work from top to bottom to avoid recontamination; from upwind to avoid spray; 15 to 20 feet from the surface is the optimum operating distance. Vertical surface should be hosed at an incident angle of 30 to 45 degrees. Determine cleaning rate experimentally if possible. Otherwise, use a rate of 4 square feet per minute. | All water equipment may be utilized. Allows operation to be carried out from a distance. Contamination may be reduced by 50%. Water solutions of other decontaminating agents may utilize water equipment. | Drainage must be controlled. Porous materials will absorb contaminants. Oiled surfaces cannot be decontaminated. Not applicable on dry contaminated surfaces (use vacuum). Spray will be contaminated. |
| STEAM | Nonporous surfaces (especially painted or oiled surfaces). | Solution and erosion. | Work from top to bottom and from upwind. Clean surface at a rate of 4 square feet per minute. The cleaning efficiency of steam may be greatly increased by using detergents. | Steam reduces contamination by approximately 90% on painted surfaces. | Steam subject to same limitations as water. Spray hazard makes the wearing of waterproof outfits necessary |
| DETERGENTS | Nonporous surfaces (especially industrial film). | Emulsifying agent. Wetting agent. | Rub surface for 1 minute and wipe with dry rag. Use clean surface of the rag for each application. A powered rotary brush (with pressure feed) is more efficient. Moist application is all that is desired. Solution should not be allowed to drip onto other surfaces. Solution may be applied from a distance with a pressure proportioner. | Dissolves industrial film which holds contamination. Contamination may be reduced by 90%. | May require contact with surface. Mild method not efficient on long-standing contamination. |
| COMPLEXING AGENTS<br>OXALATES<br>CARBONATES<br>CITRATES | Nonporous surfaces (especially unweathered surfaces; i.e., no rust or calcareous growth). | Forms soluble complexes with contaminated material. | Solution should contain 3% (by weight) of agent. Spray surface w[illegible] solution. Keep surface moist for 30 minutes by spraying with solution periodically. After allotted time, flush material off with water. Agents may be used on vertical and overhead surfaces by employing mechanical foam. | Holds contamination in solution. Contamination (unweathered surfaces) reduced 75% in 4 minutes. Easily stored, carbonates and citrates are non-toxic, non-corrosive. | Requires application from 5 to 30 minutes. Little penetrating power; of small value on weathered surfaces. |
| ORGANIC SOLVENTS | Nonporous surfaces (greasy or waxed surfaces, paint or plastic finishes, etc.). | Solution of organic materials (oil, paint, etc.). | Entire unit may be immersed in solvent. Also may be applied by standard wiping procedures. (See Detergents.) | Quick dissolving action. Recovery of solvent possible by distillation. | Requires good ventilation and fire precautions. Toxic to personnel. Material bulky. |
| INORGANIC ACIDS | Metal surfaces, especially those with porous deposits (i.e., rust or calcareous growth). Circulatory pipe systems. | Strong dissolving power on metals and porous deposits. | Dip-bath technique is advisable for movable items. Acid should be kept at a concentration of from 1 to 2 Normal (9 to 18% hydrochloric, 3 to 6% sulfuric acid). Reaction time on weathered surfaces should be 1 hour. Pipe systems, 2 to 4 hours. Afterwards, surface should be neutralized and rinsed. | Corrosive action on metal and porous deposits. Corrosive action may be moderated by addition of corrosion inhibitors to solution. | Good ventilation required because of toxicity and explosive gases. Acid mixtures should not be heated. Possibility of excessive corrosion if used without inhibitors. Sulfuric acid not effective on calcareous deposits. |
| ACID MIXTURES<br>HYDROCHLORIC<br>SULPHURIC<br>ACETIC ACID<br>CITRIC ACID<br>ACETATES<br>CITRATES | Nonporous surfaces (especially those having porous deposits). Circulatory pipe systems. | Dissolving action. | Applied in same manner as inorganic acids. Mixture consists of: 0.1 gal. hydrochloric, 0.2 lb. sodium acetate, 1.0 gal. of water. | Dissolving action may reduce contamination 90% in 1 hour (unweathered surfaces). | Weathered surfaces may require prolonged treatment. |
| CAUSTICS<br>LYE (SODIUM HYDROXIDE)<br>CALCIUM HYDROXIDE<br>POTASSIUM HYDROXIDE | Painted surfaces (horizontal). | Dissolving power softens paint (harsh method). | Lye paint-removal mixture: 10 gal. water, 4 lb. lye, 6 lb. boiler compound, 0.75 lb. cornstarch. Allow lye paint-remover solution to remain on surface until paint is softened to the point where it may be washed off with water. Remove remaining paint with long-handled scrapers. | Minimum contact with contaminated surfaces. Easily stored. | Personnel danger (painful burns). Reaction slow; thus, it is not efficient on vertical surfaces or overheads. Should not be used on aluminum or magnesium. Method is difficult on vertical or overhead surfaces. |
| TRI SODIUM PHOSPHATE | Painted surfaces (vertical, overhead). | Dissolving power (mild method). | Hot 10% solution applied by standard wiping technique. (See Detergents.) One-minute rub. | Reduces activity to tolerance in one or two applications. | Destructive effect on paint. Not to be used on aluminum or magnesium. |
| ABRASION | Nonporous surfaces. | Surface removal. | Use conventional procedures, but keep surface damp to avoid dust hazard. | Activity may be reduced to as low a level as may be desired. | Impracticable for porous surfaces because of surface penetration by moisture |
| WET SANDBLASTING | Nonporous surfaces. | | Wet sandblasting is most practical on large surface areas. Collect used abrasive. | | Contamination spread over area must be recovered. |
| VACUUM BLASTING | Porous and nonporous surfaces. | Abrasion with controlled removal by vacuum suction. | Hold tool flush to surface to prevent escape of contamination. | Controlled disposal. | Contamination of equipment. |

An ultra-filter respirator (Type H) is satisfactory in low concentration areas. The seal between the face and the mask should be tested before entering the contaminated area. Unnecessary movement of the respirator in the area should be avoided. In general, this type of filter can be used safely around most solid form beta or gamma emitters. Alpha emitters in concentrations greater than 800 d/m per cubic meter require a different respirator.

Fire Involving Radioactive Materials

The object of this section is to minimize the risk to personnel due to radioactive materials in the event of a fire. The three basic hazards in such cases are inhalation of radioactive materials, exposure to harmful external radiations and contamination.

Since it is not feasible to assay the radioactive contamination of the atmosphere at any point during a fire, respiratory protection is necessary. Accordingly, full face, self-contained breathing apparatus must be worn by all personnel when working in the fumes of such a fire.

Personnel knowledgeable about the radioactive materials must keep firemen informed of the location of all quantities of radioactive materials large enough to constitute a hazard.

They must also assist firemen with measurements, advice on conditions around the materials and additional safety precautions, if necessary. No unauthorized personnel should be allowed in the area until the condition of the materials is established or the area has been cleared by making appropriate measurements.

Records, Reports, and Notifications

As a licensee of both the State of Texas and the Nuclear Regulatory Commission, certain classes of incidents must be reported. Pertinent conditions are:

Any incident involving radioactive materials which caused or threatens to cause:

a. Exposure of the whole body of any individual to 25 rems or more; exposure to the skin of the body of 150 rems or more; exposure to the extremities of 375 rems or more;

b. Release of radioactive materials in concentrations which, if averaged over 24 hours, exceeds 5000 times the limits specified in 21-A, Table II of Texas Regulations;

c. Property damage in excess of $200,000;

must be reported by telephone or telegraph immediately.

Other classes of incidents occur at lower levels than the above and require reporting times of from 24 hours to 30 days. This class of incident will not usually be reported by people in the field, but will be reported by the home office.

In reporting an incident either to the home office or a regulatory agency, the following form will be of assistance and should be filled out as nearly completely as possible so that information can be passed in an orderly fashion.

# ACCIDENT DETAIL AND REPORTING

Home Office Telephone (512) 836-0801, Ext. 310

(Tell operator you have an emergency and ask her to stay on the line)

Information:

Name ______________________ Location ______________________

Type of Emergency ______________________

Officials contacted ______________________
(Name) (Phone)

______________________

______________________

Medical assistance needed ______________________

Radioactive materials involved ______________________

Telephone calling from ______________________

Telephone where you can be reached ______________________

What happened ______________________

When ______________________ Who is involved ______________________

What has been done ______________________

______________________

What is the greatest hazard ______________________

______________________

What assistance is required ______________________

______________________

What are the next steps ______________________

______________________

What help is available to you ______________________

Additional details ______________________

______________________

______________________

## EMERGENCY EQUIPMENT

The basic objective in carrying emergency equipment for off-site use of radioactive materials is to be able to monitor and control any radiological accident. Prompt response to an accident with proper equipment is most important in minimizing exposure and damage.

For our purposes, the following items are minimal and are an expanded listing of those items previously mentioned.

1. Portable survey instrumentation including one high (at least 1000R) range chamber.
2. Swipe counting equipment, usually NaI (Tl), but could be gas proportional sealed tube depending on the isotope.
3. Personnel monitoring devices including pocket chambers and chargers.
4. Emergency Kit

   Containing: Anti-contamination clothing
   Respirators - H-type filters
   Sample bioassay kits
   Radiation rope and warning signs
   Masking tape
   Filter paper (Whatman No. 1)
   Plastic bags
   Swabs and containers
5. Small tool kit (replacement batteries)
6. First Aid Kit
7. Contaminated waste container

Any additional equipment specified by the Radiological Health and Safety Committee.

# LICENSING AGENCIES IN AGREEMENT STATES AS OF MARCH 1984

## ALABAMA

Alabama Dept. of Public Health
Div. of Radiological Health
State Office Building
Montgomery, Alabama 36130
Phone: 205/261-5315

## ARIZONA

Arizona Radiation Regulatory Agency
925 S. 52nd Street, Suite #2
Tempe, Arizona 85281
Phone: 602/255-4845

## ARKANSAS

Arkansas Dept. of Health
Radiological Health Section
4815 West Markham Street
Little Rock, Arkansas 72201
Phone: 501/661-2000

## CALIFORNIA

California Dept. of Health
Radiologic Health Section
744 P Street
Sacramento, California 95814
Phone: 916/445-0931

## COLORADO

Colorado Department of Health
Radiation Hygiene Section
4210 East 11th Avenue
Denver, Colorado 80220
Phone: 303/320-8333

## FLORIDA

Florida Department of HRS
Radiological Health Services
1317 Winewood Boulevard
Building 1, Room 108
Tallahassee, Florida 32301
Phone: 904/487-2437

## GEORGIA

Georgia Department of Human Resources
Radiological Health Unit
47 Trinity Avenue, S.W.
Atlanta, Georgia 30334
Phone: 404/894-5795

## IDAHO

Radiation Control Section
Division of Environment, Licensing and Inspection
Dept. of Health and Welfare
Statehouse
Boise, Idaho 83720
Phone: 208/334-4107

## KANSAS

Kansas Department of Health and Environment
Bureau of Radiation Control
Topeka, Kansas 66620
Phone: 913/862-9360

## KENTUCKY

Radiation Control Branch
Department for Human Resources
275 East Main Street
Frankfort, Kentucky 40621
Phone: 502/564-3700

## LOUISIANA

Louisiana Department of Natural Resources
Ofc. of Environmental Affairs
Nuclear Energy Division
P.O. Box 14690
Baton Rouge, Louisiana 70898
Phone: 504/925-4518

## MARYLAND

Department of Health and Mental Hygiene
Division of Radiation Control
201 West Preston Street
Baltimore, Maryland 21201
Phone: 301/383-2744

# LICENSING AGENCIES IN AGREEMENT STATES AS OF MARCH 1984

## MISSISSIPPI

Mississippi State Board
of Health
Div. of Radiological Health
P.O. Box 1700
Jackson, Mississippi 39205
Phone: 601/354-6612

## NEBRASKA

Nebraska Department of Health
Div. of Radiological Health
P.O. Box 95007
Lincoln, Nebraska 68509
Phone: 402/471-2168

## NEVADA

Nev. Dept. of Human Resources
Div. of Health, Radiological
Health
Consumer Health Protection
505 East King Street
Carson City, Nevada 89710
Phone: 702/885-4750

## NEW HAMPSHIRE

New Hampshire State Radiation
Control Agency
61 South Spring Street
Concord, New Hampshire 03300
Phone: 603/225-6611

## NEW MEXICO

New Mexico Environmental
Improvement Division
Radiation Protection Bureau
P.O. Box 968
Santa Fe, New Mexico 87503
Phone: 505/984-0020

## NEW YORK

New York Dept. of Labor
Div. of Safety and Health
Radiological Health Unit
Two World Trade Center
New York, New York 10047
Phone: 212/488-7790

## NORTH CAROLINA

North Carolina Department of
Human Resources
Radiation Protection Branch
Division of Facility Services
P.O. Box 12200
Raleigh, North Carolina 27605
Phone: 919/733-4283

## NORTH DAKOTA

North Dakota Dept. of Health
Environmental Health Section,
Environmental Engineering
1200 Missouri Avenue
Bismarck, North Dakota 58501
Phone: 701/224-2348

## OREGON

Oregon Department of
Human Resources
Health Divsion
Radiation Control Section
P.O. Box 231
Portland, Oregon 97207
Phone: 503/229-5797

## RHODE ISLAND

Rhode Island Radiation
Control Agency
206 Cannon Building
75 Davis Street
Providence, Rhode Island 02908
Phone: 401/277-2438

## LICENSING AGENCIES IN AGREEMENT STATES AS OF MARCH 1984

### SOUTH CAROLINA

South Carolina Dept. of Health
and Environmental Control
Div. of Radioactive Material
Licensing and Compliance
2600 Bull Street
Columbia, South Carolina 29201
Phone: 803/758-5548

### TENNESSEE

Tennessee Department of Public Health
Division of Radiological Health
TERRA Building
150 9th Avenue North
Nashville, TN 37203
Phone: 615/741-7812

### TEXAS

Texas Department of Health
Bureau of Radiation Control
Division of Licensing,
Registration, and Standards
1100 West 49th Street
Austin, Texas 78756
Phone: 512/835-7000

### UTAH

Bureau of Radiation Control
Utah State Department of Health
150 W. North Temple
P.O. Box 2500
Salt Lake City, Utah 84110
Phone: 801/533-6734

### WASHINGTON

Washington State Department of
Social and Health Services
Radiation Control Program
Mail Stop 4-1
Airdustrial Park
Olympia, Washington 98504
Phone: 206/753-3463

### NRC HEADQUARTERS

Division of Fuel Cycle
and Material Safety
Office of Nuclear Safety
and Safeguards
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555
Phone: 301/427-4228

### CONNECTICUT, DELAWARE, MAINE, MASSACHUSETTS, NEW JERSEY, PENNSYLVANIA, VERMONT, WASHINGTON D.C.

U.S. Nuclear Regulatory Commission
Region I
Nuclear Material Section B
631 Park Avenue
King of Prussia, Pennsylvania 19406
Phone: 215/337-5000

### VIRGINIA, WEST VIRGINIA, PUERTO RICO, VIRGIN ISLANDS

U.S. Nuclear Regulatory Commission
Region II
Material Radiation Protection Section
101 Marietta Street, Suite 2900
Atlanta, Georgia 30303
Phone: 404/221-4503

### ILLINOIS, INDIANA, IOWA, MICHIGAN, MINNESOTA, MISSOURI, OHIO, WISCONSIN

U.S. Nuclear Regulatory Commission
Region III
Material Licensing Section
799 Roosevelt Road
Glen Ellyn, Illinois 60137
Phone: 312/790-5500

### MONTANA, OKLAHOMA, SOUTH DAKOTA, WYOMING

U.S. Nuclear Regulatory Commission
Region IV
Material Radiation Protection Section
611 Ryan Plaza Drive
Suite 1000
Arlington, Texas 76011
Phone: 817/860-8100

### ALASKA, HAWAII, GUAM

U.S. Nuclear Regulatory Commission
Region V
Material Radiation Protection Section
1450 Maria Lane, Suite 210
Walnut Creek, California 94596
Phone: 415/943-3763

U.S. ATOMIC ENERGY COMMISSION

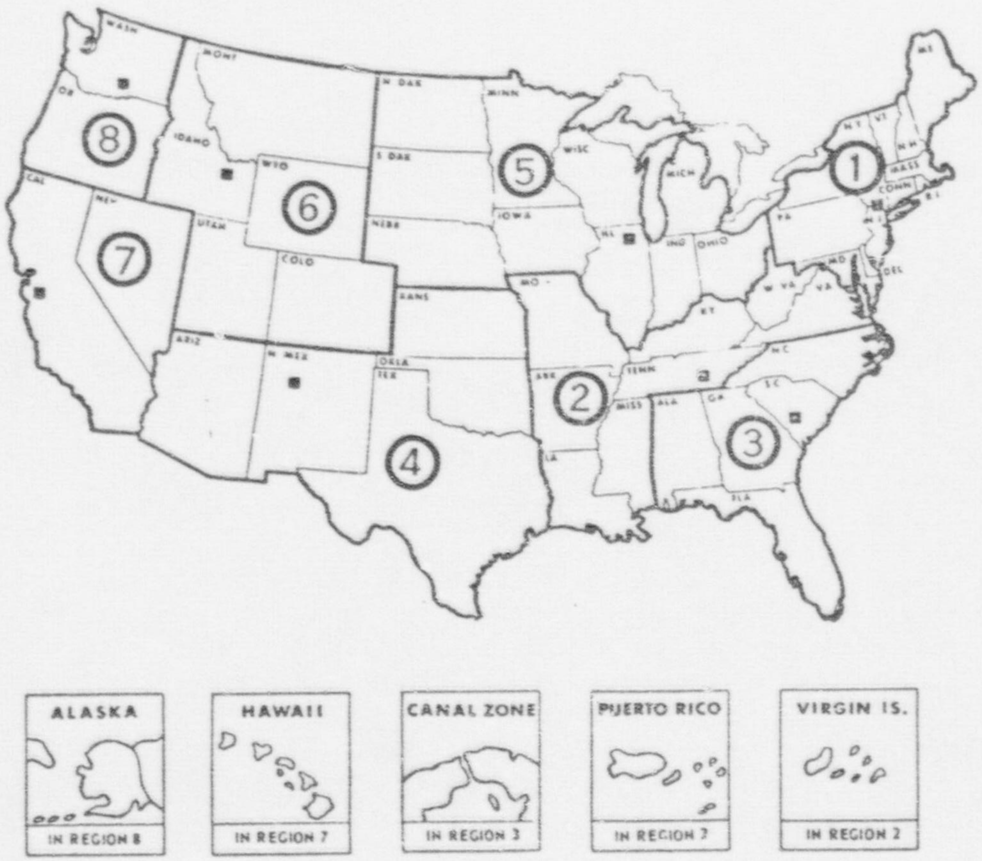
# REGIONAL COORDINATING OFFICES

FOR

# RADIOLOGICAL ASSISTANCE

AND

# GEOGRAPHICAL AREAS OF RESPONSIBILITY




| | REGIONAL COORDINATING OFFICE | POST OFFICE ADDRESS | TELEPHONE for ASSISTANCE | DDD AREA CODE |
|---|---|---|---|---|
| 1 | BROOKHAVEN AREA OFFICE | UPTON, L. I. NEW YORK 11973 | 924-6262 | 516 |
| 2 | OAK RIDGE OPERATIONS OFFICE | P. O. BOX E OAK RIDGE TENNESSEE 37830 | 483-8611, Ext. 3-4510 | 615 |
| 3 | SAVANNAH RIVER OPERATIONS OFFICE | P. O. BOX A AIKEN, S.C. 29801 | N. AUGUSTA, S.C. 824-6331, Ext. 3333 | 803 |
| 4 | ALBUQUERQUE OPERATIONS OFFICE | P. O. BOX 5400 ALBUQUERQUE, NEW MEXICO 87115 | 264-4667 | 505 |
| 5 | CHICAGO OPERATIONS OFFICE | 9800 S. CASS AVE. ARGONNE, ILLINOIS 60439 | 739-7711 Ext. 2111 duty hrs. Ext. 4451 off hrs. | 312 |
| 6 | IDAHO OPERATIONS OFFICE | P. O. BOX 2108 IDAHO FALLS, IDAHO 83401 | 526-0111 Ext. 1515 | 208 |
| 7 | SAN FRANCISCO OPERATIONS OFFICE | 2111 BANCROFT WAY BERKELEY, CALIFORNIA 94704 | 841-5121 Ext. 664 duty hrs. 841-9244 off hrs. | 415 |
| 8 | RICHLAND OPERATIONS OFFICE | P. O. BOX 550 RICHLAND, WASHINGTON 99352 | 942-7381 | 509 |