70-398

UNITED STATES DEPARTMENT OF COMMERCE
National Institute of Standards and Technology
Gaithersburg, Maryland 20899

March 15, 1994

U S NUCLEAR REGULATORY COMMISSION
ATTN MICHAEL TOKAR SECTION LEADER
MAIL STOP 4E4
LICENSING SECTION NUMBER 2
LICENSING BRANCH
DIVISION OF FUEL CYCLE SAFETY
AND SAFEGUARDS NMSS
WASHINGTON DC 20555

Docket Number 70-398
License Number SNM-362

Gentlemen:

We request amendment to License No. SNM-362 to complete the accident evaluation submission that began with our submission of November 19, 1992 and continued with our October 14, 1993 submission. We also request amendment to the license to incorporate an updated information set on the NIST radiation safety oversight committee, and to update the references to CFR, Title 10, Part 20. The changes involve so many pages in the Materials License Document that a complete set of the document is enclosed for your review and information.

With respect to the accident evaluation, new paragraph I-1-9 is submitted for your review, and new paragraph II-12.11 describes the implementation of the planned control of nuclide possession limits. Also, Table I.1-1 has become Table I.1-1(a) and is modified in accord with the accident evaluation review that has been conducted.

For the changes in the committee structure, the name "Radiation Safety Committee" has been changed to "Ionizing Radiation Safety Committee" to describe more accurately the role of the committee in the NIST radiation safety program. The membership list has also been updated. These changes are reflected in index pages and on pages I-1-(2,3), I-2-(1-3), I-3-1, II-9-(2,3), II-11-(1,2), and II-12-(1,2). Committee membership is updated as shown on pages II-11-(2,3). References to 10CFR20 are recorded on pages I-3-1, I-4-1, II-12-(4-6), and II-13-2. In addition, page I-6/7/8-1, Chapter 8, indicates the updating of information relating to the emergency plan requirement license condition. The attachment index pages show the change from NBS to NIST.

Thank you for your attention to this request. Should you have questions about this matter, please contact Mr. T. Hobbs, Chief of the NIST Health Physics Group, Room C125, Bldg. 245, telephone 301-975-5800.

Sincerely,

L E Pevey

L. E. Pevey, Chief
Occupational Health and Safety Division
(Materials License Manager)

enclosures

NF17

MATERIALS LICENSE DOCUMENT

United States Department of Commerce
National Institute of Standards and Technology
Gaithersburg MARYLAND 20899

TABLE OF CONTENTS

INTRODUCTION

PART I - LICENSE CONDITIONS

PART I, cont'd.

PART II - SAFETY DEMONSTRATION

PART II, cont'd.

CHAPTER 12 - RADIATION PROTECTION PROCEDURES AND EQUIPMENT

CHAPTER 13 - OCCUPATIONAL RADIATION EXPOSURES

ATTACHMENTS

INTRODUCTION

This document is intended to serve as information as required by the Code of Federal Regulations for the licensing of operations involving byproduct materials, source materials, and special nuclear materials. In no manner, express or implied, does the information in this document apply to the license issued to the National Institute of Standards and Technology for operating the NIST Reactor.

This document and succeeding versions of this document, including corrections, amendments, and updates, and consequential conditions imposed on the National Institute of Standards and Technology by the U. S. Nuclear Regulatory Commission constitute a full and complete set of operational descriptions for licensable material receipt, acquisition, ownership, possession, use, and transfer, other than for the NIST Reactor.

Various publications were used as guidance for the preparation of this document, in addition to the guidance publications from the USNRC. Among these were ANSI N679-1976, Guide for Writing Operating Manuals for Radioactive Materials Packaging; ANSI N13.2-1969(R1982), Guide for Administrative Practices in Radiation Monitoring; ANSI/ANS-15.1-1982, The Development of Technical Specifications for Research Reactors; ANSI/ANS-15.12-1977, Design Objectives for and Monitoring of Systems Controlling Research Reactor Effluents; ANSI N13.6-1966(R1982), Practice for Occupational Radiation Exposure Records Systems; ANSI/ANS-15.11-1987, Radiological Control at Research Reactor Facilities; IAEA Safety Series No. 38, Radiation Protection Procedures; NCRP Report No. 59, Operational Radiation Safety Program; NCRP Report No. 71, Operational Radiation Safety-Training.

This document is in two parts. Part I contains the license conditions that are fixed and cannot be modified without specific permission from the U. S. Nuclear Regulatory Commission. Part II contains the safety demonstration information that may be changed as necessary to support and confirm full compliance with the conditions of the license. This manual will be reviewed and updated as required to reflect changing standards and regulations. A current copy of this document will be maintained in the NIST Health Physics office.

PART I - LICENSE CONDITIONS

CHAPTER 1 - STANDARD CONDITIONS AND SPECIAL AUTHORIZATIONS

1.1 Name

The agency is the National Institute of Standards and Technology.

1.2 Location

The mailing address is National Institute of Standards and Technology, Attn: Chief, Occupational Health and Safety Division, Room B124, Building 301, Gaithersburg, MD, 20899. The facility location and the shipping address are National Institute of Standards and Technology, Route I270 & Quince Orchard Road, Gaithersburg, MD 20899.

1.3 Renewing License Number

Renewal is requested for Materials License Number SNM-362.

1.4 Possession Limits

Information on the qualities and quantities of radioactive materials for which this application requests licensing is given in Table I.1-1(a), where activities are in curies unless otherwise noted. |

1.5 Locations Where Materials Are Used

It is possible that any location within the NIST perimeters could be authorized by Health Physics for radioactivity controlled under the materials license. The probability that radioactivity operations might be authorized in a given location varies. Permanent authorizations exist for facilities within Buildings 235 and 245. It is highly probable that authorizations could exist for laboratories within Buildings 220, 221, 222, 223, 224, 225, and 226, i.e., the designated general purpose laboratory buildings. It is likely that authorizations could exist for rooms in Buildings 101 and 231. There is a low, but not zero, probability, that authorizations could exist for specific uses within Buildings 102, 202, 205, 206, 230, 233, 236, 237, 238, 301, 302, 303, 304, 306, 307, 309, 310, and 411. There is also a reasonable possibility that an authorization could be granted for operations utilizing sealed sources on the NIST grounds, outside a building, for example, for calibrating environmental monitors.

Major material uses are in Buildings 235 and 245. In Building 235, Rooms B119 through B154 and Rooms C001 and C002 are used for radiochemistry, normally associated with irradiated samples from the NIST Reactor. Building 235's Cold Neutron Facility Guide Hall and the E and the A wings might be used for storage of radioactive materials or for small source or activated equipment use. Also associated with Building 235, Room H100, the Radioactive Waste Annex, is dedicated to receiving, processing (such as solidifying liquids or compacting certain solids), packaging, and delivering to disposal agents the low-level radioactive wastes from NIST. In Building 245, incidental radiochemistry, such as the separation of bulk materials into aliquots for small source preparation, is conducted in Rooms B44 through B53, B146 through B157, C11, C13, C15, E103, E105, and E106. Source receiving and storage are conducted in Rooms B131, B132, and B133. Rooms B141 through B145 are used for sealed source receiving and measurements. Sealed source operations are conducted in Rooms B05 through B25, and in Rooms B013 through B043. Irradiator facilities are maintained in Rooms B143, B034, B036, and F101.

1.6 Definitions

The following definitions, italicized, are given to provide a precise reference for the use of the defined words and terms in Parts I and II of this Materials License Document. The definitions given here will apply unless specifically noted otherwise at use.

frequency - Any technique applicable to the radiological safety program, including surveillance or calibrations, and that is scheduled at regular intervals is subject to the following limits on the scheduled interval:

a...... *biennial* means not to exceed thirty months.
b...... *annual* means not to exceed fifteen months.
c...... *semiannual* means not to exceed eight months.
d...... *quarterly* means not to exceed four months.
e...... *monthly* means not to exceed one and one-half months.
f...... *biweekly* means not to exceed twenty working days.
g...... *weekly* means not to exceed ten working days.

irradiator - A configuration of gamma-emitting sealed sources totalling 250 curies or more, maintained in a fixed location, and normally used for irradiation purposes.

Radiation (or Radiological Hazard) Control Area - Any area to which access is controlled for purposes of radiation protection.

radioactive waste - All materials to be dealt with under this document as radioactive waste are classified as low level radioactive waste, i.e., not high-level radioactive waste as defined in 10CFR60.2. Radioactive materials with half-lives of less than 65 days may be held for decay-in-storage for a period of 10 half-lives before disposal as normal trash. Processing of these decay-in-storage wastes is described in section 4.1.

safety approval - After a safety review, a Supervisory Health Physicist or a person with the same qualifications may approve a radiation project proposal.

safety review - A radiation project proposal is reviewed by Health Physics, subject to further review by the Ionizing Radiation Safety Committee. The Ionizing Radiation Safety Committee will review proposals that could credibly lead to a whole body dose equivalent greater than 1.25 rem.

sealed source - Radioactive material encased in a capsule or bonded cover designed to prevent leakage or escape of the material under the conditions of use for which the source is intended, including normal wear and tear.

1.7 Authorized Activities

No provision exists at NIST as part of this license for very high level activity, i.e., kilocurie, work that requires a "hot cell" or an equivalent containment mechanism. There is no process or production line type of operation at NIST; all are batched mode, i.e., of finite duration, even though the duration may be of some length, perhaps years, in completing a research project or in completing a contracted or regulated obligation, or, for functions such as instrument characterization projects, intermittent tasks with work required on demand by customers or clients. There are no critical assemblies and no live animal exposures.

Among the types of activities that may be authorized, the following topical list illustrates typical projects that may exist. Also listed are building designations for those buildings that would most probably be involved in a particular type of activity. The designations are of functional origin and include ADM for administrative buildings; SRL for special radiological laboratories, i.e., Buildings 235 and 245; SPL for special purpose laboratories other than radiological; and GPL for general purpose laboratories, i.e., Buildings 220 through 226.

- materials and equipment irradiations - SRL
- source preparations - SRL, SPL, GPL
- source calibrations - SRL, SPL, GPL
- instrument calibrations - SRL, SPL, GPL
- sample assays - SRL, SPL, GPL
- source characterizations - SRL
- instrument and device characterizations - SRL, SPL, GPL
- reference or counting source uses - ADM, SRL, SPL, GPL
- radiochemistry - SRL, SPL, GPL
- general research and development - ADM, SRL, SPL, GPL
- sources incorporated into devices or equipment - ADM, SRL, SPL, GPL
- miscellaneous, e.g., static elimination - ADM, SRL, SPL, GPL

1.8 Exemptions and Special Authorizations

a. We request exemption from the requirement to maintain criticality monitors or conduct criticality reviews because all SNM except for PuBe sealed sources are controlled to maintain a minimum separation of three feet between each 300 grams of plutonium or U-233 or uranium enriched in the U-235 isotope or combination of these. Each room or area involving SNM operations is the responsibility of a single person who controls the movement of materials for that area according to written procedures to insure that the material quantity limits are maintained.

b. We request that radioactive material use may be authorized for an off-site location subject to the following provisions:

- the proposal is reviewed and approved by Health Physics and, if required, by the Ionizing Radiation Safety Committee.
- the radioactive material is controlled by an authorized individual, who possesses written operating instructions while engaged in the project.
- the radioactive material is an integral part of a measurement instrument or a contained source, such as a check or reference source.
- lead-in-paint detectors may not exceed 100 millicuries of cadmium-109 or americium-241 as sealed sources in each device, otherwise the total quantity of radioactive material for a single authorized use may not exceed ten times the activity listed in 10CFR20, Appendix C, or, for those radionuclides not listed in Appendix C, may not exceed one microcurie of activity.

c. We request permission to dispose of radioactive materials as ordinary trash when the conditions specified in 10CFR35.92 are met. Short-lived radioactive material with long-lived daughter radioactive nuclides will not be considered for this disposal mechanism.

d. We request authority to release contaminated equipment to uncontrolled areas in accordance with the USNRC's August, 1987 "Guidelines for decontamination of facilities and equipment prior to release for unrestricted use or termination of licenses for byproduct, source, or special nuclear material." A copy of the guidelines is attached to this chapter.

e. We request an extension to the requirement for submission of an emergency response plan according to 10CFR70.22(i)(1). We are developing a plan but have not completed our work, and need more time. We will submit the required information and will be in full compliance with 10CFR70.22(i)(1) on or before nine (9) months from the issue date of the renewal of this license.

f. We request a schedular exemption to the requirement for submission of a decommissioning funding plan according to 10CFR70.22(a)(9). We are developing a plan but have not completed our work, and need more time. We will submit the required information and will be in full compliance with 10CFR70.22(a)(9) on or before eighteen (18) months from the issue date of the renewal of this license.

TABLE I.1-1(a)
NIST RADIOACTIVE MATERIALS LICENSE LIMITS

A.	Uranium enriched to less than 20 wt% in the U-235 isotope	Any	30 grams of U-235 21 grams of U-235*
B.	Uranium enriched to or greater than 20 wt% in the U-235 isotope	Any	230 grams of U-235 157 grams of U-235*
C.	Uranium-233	Any	6 grams of U-233
D.	Plutonium	Any	40 grams of any Plutonium isotope except Pu-238 46 grams of any Plutonium isotope except Pu-238**
E.	Plutonium	Sealed sources	800 grams of plutonium
F.	Plutonium enriched in the Pu-238 isotope	Any	0.1 grams 4.9 grams**
G.	Natural uranium	Any insoluble form Any soluble form	150 kilograms 9 kilograms
H.	Thorium	Any	69 kilograms
I.	Uranium depleted in the U-235 isotope	Any insoluble form Any soluble form	42 kilograms 4 kilograms
J.	Co-60	Sealed sources	58,000 curies
K.	Cs-137	Sealed sources	9,000 curies
L.	Po-210	Sealed sources	20 curies
M.	Am-241	Sealed sources	40 curies
N.	Cf-252	Sealed sources	10 curies
O.	Sr-90	Sealed sources	3 curies

continued, next page

P. Any other byproduct material 1. any nuclide of half-life less than 30 days 2a. any nuclide of half-life more than 30 days 2b. except for the following nuclides: H-3 Au-198 Kr-85 Cs-137 Mo-99 Xe-133 C-14 Co-60 Ac-227 Am-241 Am-242m Am-243 Bk-247 Cf-249 Cf-250 Cf-251 Cf-252 Cf-254 Cm-242 Cm-243 Cm-244 Cm-245 Cm-246 Cm-247 Cm-248 Cm-250 Np-236 Np-237 Sm-146 Sm-147	 Any Any Any	 1. 4 curies 2a. 1 curie 2b. except for the following nuclides: Curies 2,000 300 35 20 20 20 5 5 0.025
Q. Any byproduct material with Atomic Number 3 to 83 except for the following nuclides: Ag-108m Eu-152 Eu-154 Nb-94 Tb-158 Be-10 P-32 Os-194 Cd-113m Cl-36 I-130 Hf-178m Hf-182 Bi-210m I-125 Sm-146	Neutron irradiated samples or containers	1,100 curies total except for the following nuclides: Curies 800 800 800 800 800 500 400 350 200 200 200 100 100 30 20 3
R. Irradiated Fuel	Four pellets	0.25 grams of U-235*

*storage only, awaiting disposition

**storage only, in type B shipping containers, awaiting disposition

1.9 Possession Limit Weighting Factors

In addition to the quantity limits of Table I.1-1 for the neutron irradiated samples or containers shown in Category Q, the following weighted summed ratio shall not exceed 1 in order to meet the NIST accident evaluation results:

$$\Sigma WF_i \cdot A_i/L_i \leq 1$$

where WF_i is the weighting factor, taken from Table I.1-1(b), A_i is the activity of each nuclide in Category Q, and L_i is the activity limit for that nuclide. The weighting factors are the projected accident dose divided by the dose allocated for Category Q nuclides, i.e., 0.3 rem. For the great majority of nuclides analyzed, the assigned weighting factor is conservative by more than an order of magnitude.

TABLE I.1-1(b)
NIST RADIOACTIVE MATERIALS LICENSE LIMIT WEIGHTING FACTORS

Nuclide Group	Weighting Factor (F_i)
all the excepted nuclides in Category Q except ^{125}I and ^{130}I* (^{10}Be, ^{32}P, ^{36}Cl, ^{94}Nb, ^{108m}Ag, ^{113m}Cd, ^{146}Sm, ^{152}Eu, ^{154}Eu, ^{158}Tb, ^{178m}Hf, ^{182}Hf, ^{194}Os, ^{210m}Bi)	1.0
^{26}Al, ^{33}P, ^{35}S, ^{88}Kr, ^{102}Rh, ^{109}Cd, ^{114m}In, ^{126}Sn, ^{121}Xe, ^{146}Pm, ^{202}Pb	0.5
^{41}Ar, ^{74}Kr, ^{82}Sr, ^{110m}Ag, ^{115m}Cd, ^{137}La, ^{177m}Lu	0.3
^{68}Ge, ^{77}Kr, ^{87}Kr, ^{89}Sr, ^{91}Y, ^{102m}Rh, ^{123}Xe, ^{138}Xe, ^{134}Cs, ^{144}Pm, ^{147}Pm, ^{155}Eu, ^{146}Gd, ^{182}Ta	0.2
All other nuclides**	0.1

*: These two iodine nuclides are limited by the thyroid dose criteria, satisfied by the specific activity limit given in Category Q. The external dose criteria and the 1100 Ci total activity limit are satisfied with a WF of <0.01

**: The majority of the remaining nuclides have actual weighting factors much less than 0.1, thus this is a very conservative assignment.

CHAPTER 2 - GENERAL ORGANIZATIONAL AND ADMINISTRATIVE REQUIREMENTS

2.1 National Institute of Standards and Technology Policy

The policy of the National Institute of Standards and Technology is to maintain radiation exposures and releases of radioactive materials in unrestricted areas to magnitudes as low as reasonably achievable (ALARA).

2.2 Organizational Responsibilities and Authority

The Chief, Occupational Health and Safety Division, reporting through the Director of Administration to the Director of NIST, who is the ultimately responsible official, serves as Materials License Manager, representing NIST in all matters relating to this license, and as the manager of the radiological safety program at NIST. Health Physics is a unit of the Occupational Health and Safety Division, with a Chief and Supervisory Health Physicists directing a staff of professional and sub-professional health physics personnel. The Chief of Health Physics administers the radiological safety program, allocates resources determined by NIST management, and reviews and determines approval or disapproval for major safety issues as presented by the Supervisory Health Physicists. The Supervisory Health Physicists apply NIST and regulatory policy and rules to day-to-day administration of the radiological safety program, review and determine action on non-routine issues, and submit major issues to the Chief of Health Physics for policy decisions. A Supervisory Health Physicist or higher management level has the authority to shut down an operation that he or she believes threatens the health and safety of the employees or the public or poses a potential for violation of applicable regulations, license conditions, or implementing procedures.

2.3 Ionizing Radiation Safety Committee

The NIST Ionizing Radiation Safety Committee reports to the NIST Deputy Director. Fields of expertise represented on the Committee include physics, chemistry, health physics, materials science, industrial safety, and nuclear research reactors. The Committee meets at least once annually, providing oversight for the NIST radiological safety program, reviewing radiological safety related matters, advising the Chief, Occupational Health and Safety Division on operations, and recommending corrective actions when necessary. The Committee serves as the ALARA review committee. The Chief of Health Physics or a Supervisory Health Physicist is a member and serves as a qualified expert for the Committee. Minutes of the Committee meetings are maintained in the Chairperson's file. An annual report from the Committee to the Deputy Director of NIST summarizes the following information:

- trend analysis of data from personnel dosimetry, including internal exposures, environmental monitoring, and effluent surveillance;
- ALARA reviews and decisions;
- results of reviews of resource allocations for the radiological safety program; and
- required program audits and inspections conducted during the previous year.

There is no fire protection review committee as such. However, any proposed laboratory or facility construction or modification must be reviewed by and have the approval of such management interests as the head of the Safety Office, the Chief of the Fire Protection Services, and the Chief of the Plant Division or his designated representative.

2.4 Approval Authority for Personnel Selection

The Chief, Occupational Health and Safety Division, is responsible for Health Physics staff selections. The NIST Deputy Director appoints Ionizing Radiation Safety Committee members.

2.5 Personnel Education and Experience Requirements

The Chief of the Occupational Health and Safety Division must have a B.S. in science or engineering and at least five years of professional safety- and health-related experience. The Chief of Health Physics, as a minimum, must be certified in Health Physics by the American Board of Health Physics, or must have a bachelor's degree in a science or engineering field and at least five years of professional level radiological safety experience. Supervisory Health Physicists must have bachelor's degrees in science or engineering and two years of experience in applied health physics. A fully qualified Health Physics technician must have completed training as required by the Supervisory Health Physicist and have at least one full year of service in typical Health Physics technician assignments. Members of the Ionizing Radiation Safety Committee must have a degree or equivalent professional experience in their respective fields of expertise, and at least five years of pertinent experience.

2.6 Training

Prior to receiving authorization to work independently with radioactive materials or radiation, workers receive training in topics such as these:

- storage, transfer, or use of radioactive materials at their workplaces;
- health protection problems associated with exposure to radioactive materials or radiations;
- precautions or procedures to minimize exposure;
- purposes and functions of protective devices employed;
- agency and other rules and regulations and conditions of licenses, and responsibilities for observing and complying with these to the extent under the worker's control;
- requirements for reporting to supervisors any condition that may lead to or cause a violation of the rules, regulations, or conditions of licenses or an unnecessary exposure to radiation or radioactive materials;
- appropriate responses to warnings given in the event of any unusual occurrence or malfunction that may result in or involve excessive radiation or radioactive material exposure;
- availability of radiation exposure reports that may be requested; and
- fire safety and the use of portable fire extinguishers.

The extent of these instructions is commensurate with potential radiological health protection problems associated with the workplaces involved. New radiation workers must receive the training before permission to perform unescorted operations is given. A Health Physics review of prior work experience and training in radiological safety may show that such training or experience can be substituted for all or any part of the training described above. Evaluations of trainee understanding is by performance observations, dosimetry reviews, personal interviews, prior work experience, or similar testing methods. Should safety-related changes by made in operations, or should any employee be reassigned or return after extended absence, the Division Chief determines the need for retraining.

Health Physics technicians are trained in fundamentals of radiological safety commensurate with their levels of responsibilities. Topics for this training might include the following:

- basic principles;
- particle and photon properties;
- dosimetry concepts and practices;
- shielding;
- biological effects of radiation;
- protection standards;
- instrumentation and equipment concepts and practices; and
- operations for which specific responsibilities are assigned, such as radioactive materials, and personnel or environmental dosimetry.

All individuals who work with radioactive materials and the Health Physics technicians are required to participate in biennial radiological safety training. The Chief of Health Physics assures that training programs are available as required.

2.7 Operating Procedures

Written operating, maintenance, and test procedures for work with licensed radioactive materials are developed and followed. Those generated by the prospective radioactive material user are reviewed by Health Physics. Following the review and upon agreement on the safety practices to be observed, a Supervisory Health Physicist or a person with the same qualifications approves the proposal, subject to review if necessary by the Ionizing Radiation Safety Committee.

Similarly, proposals for radiological safety-related changes in existing procedures, equipment, or facilities also require Health Physics review and approval, subject to Ionizing Radiation Safety Committee review if necessary. Health Physics review addresses compliance with regulatory requirements and limits, ALARA commitments, monitoring concerns, emergency planning, and training needs. Any required Health Physics surveillance and observations of procedures, including frequencies, are specified. Health Physics surveillance of radiation and radioactive material control during operations indicates if there is a need for any procedural updating and review.

Health Physics operating procedures and major changes proposed for those procedures are reviewed and approved by the Chief of Health Physics. Health Physics procedures will be observed and followed.

2.8 Audits and Reviews

Ionizing Radiation Safety Committee representatives other than Health Physics staff annually audit the performance quality of operations that provide radiological safety assurance, reporting to the Committee and indicating necessary actions and follow-up audits. At least annually, Health Physics staff members review surveillance techniques and results to assure compliance with applicable protocols, documenting results and follow-up actions and results.

Supervisory Health Physicists or persons with qualifications equivalent to those of a Supervisory Health Physicist conduct radiation workplace safety observation tours at least quarterly for those workplaces that pose significant potential for radiation exposures or releases of radioactive materials, following written plans. Results of the tours are documented and corrective action needs found during the tours are transmitted to workplace supervisors in a timely fashion.

2.9 Investigations and Reporting of Off-Normal Occurrences

Health Physics, based on reports from Division Chiefs or workers, or on results of monitoring or surveillance, investigates suspected off-normal occurrences. The Chief, Occupational Health and Safety Division, reports these conditions to authorities and to management, as required by applicable regulations, procedures, and license conditions.

2.10 Records

Health Physics maintains documentation on the results of required monitoring and surveillance, the results of approved proposal reviews, off-normal occurrence investigations, and other radiological safety program information, sufficient to demonstrate the adequacy of the radiological safety program. The Ionizing Radiation Safety Committee documents and retains information on audits and provides reports to management as required. Retention times for documents are as required by regulations or for at least two years.

2.11 Fire Protection

A Fire Protection Services group in the Facilities Services Division provides a trained fire and emergency response organization. Any proposed laboratory or facility construction or modification must be reviewed by and have the approval of such management interests as the head of the Safety Office, the Chief of the Fire Protection Services, and the Chief of the Plant Division or his designated representative. Members of the staff of the Fire Protection Services group are trained to the equivalent of Fire Fighter III level. Maintenance of fire fighting equipment is conducted according to written procedures. Extensive pre-fire plans exist, with information on locations of radioactive materials, flammable materials, and other hazardous materials, and includes fire fighting protocols for those areas. The plans include locations of water supplies, storage areas, and other appropriate information. Fire Protection Services maintains extensive documentation on maintenance and deployment of equipment, pre-fire planning, facility characteristics, training, results of actual occurrences, etc.

CHAPTER 3 - RADIOLOGICAL PROTECTION

3.1 Special Administrative Requirements

3.1.1 Radiation Work Permit Procedures

For special tasks, i.e., when a task could result in significant exposure or contamination, or as determined necessary by Health Physics, Form NIST-362, Radiation Work Permit, or equivalent is prepared to provide radiation safety control, if a standing procedure does not exist. Following a review, including a review of industrial safety considerations, a Supervisory Health Physicist or a person with the same qualifications approves the proposal, subject to review if necessary by the Ionizing Radiation Safety Committee. A previously approved proposal may be approved and reissued by a Health Physics Technician.

3.1.2 ALARA Commitment

The NIST commitment to the As Low As Reasonably Achievable (ALARA) concept is stated in section 2.1 of this manual. Health Physics reviews the dosimetry reports, contamination survey results, external radiation level survey data, and other radiological safety program information for ALARA purposes. The Ionizing Radiation Safety Committee, as a part of its annual audit, inspects Health Physics documentation of these reviews and analyzes other safety and operations information for ALARA purposes.

3.2 Technical Requirements

3.2.1 Access Control

Health Physics establishes and monitors the control features of certain areas as required in 10CFR20. Signs, monitors, protection facilities, and other necessary provisions are specified at the time the area is established. Workers are required to perform personal contamination monitoring as they leave a designated contamination monitoring area.

3.2.2 Ventilation Requirements

Based on quarterly tests of hood face air velocities, Health Physics causes work to stop for an air flow of less than 75 linear feet per minute at any measured hood face location, if the approved work proposal requires the work to be done in a hood.

If approved work proposals require high-efficiency particulate filters (HEPA) for hoods or glove boxes at the workplace, Health Physics requires acceptance testing by the dioctyl phthalate (DOP) aerosol or equivalent method. Testing is performed using written operating procedures derived from accepted standards and guidance and results of the testing is documented. Quarterly magnahelic or equivalent pressure drop indicator observations demonstrate HEPA filter loading; work requiring HEPA filters is suspended if readings or indications show the equivalent of four times the reading for clean or freshly installed filters.

3.2.3 Instrumentation

Table I.3-1 describes typical radiation detecting instruments commonly available for use in the radiological safety program at NIST, and their characteristics. Substitutions are acceptable as long as there is no degradation of the radiation safety surveillance program. Calibration for routinely used ranges is done semiannually, with sources traceable to national standards.

TABLE I.3-1

TYPICAL HEALTH PHYSICS INSTRUMENTS

INSTRUMENT TYPE	NUMBER	RANGE
liquid scintillator	1	counts per time, integrating
smear counter	1	counts per time, integrating
alpha survey meter	1	0 to 50,000 dpm
beta/gamma survey meter	4	0 to 50,000 dpm
gamma survey meter	1	0 to 1,000 R/h
gamma survey meter	3	0 to 50 R/h
neutron survey meter	1	0 to 20 rem/h
area gamma monitor	1	0 to 1 R/h
particulate air sampler	1	not applicable

3.2.4 Internal and External Exposure

Health Physics conducts weekly radiation and contamination surveys for operations involving radioactive materials and for which approval conditions include that surveillance. Removable surface contamination action levels are as follows:

- alpha above 200 dpm/100 sq. cm;
- unknown beta and known beta other than ^{3}H or ^{14}C, above 0.005 mrad/h or 2000 dpm/100 sq. cm; and
- 200,000 dpm/100 sq. cm. for ^{3}H, or 20,000 dpm/100 sq. cm. for ^{14}C.

The action to be taken for contamination on work surfaces in excess of an action level is to initiate decontamination efforts promptly after discovery, unless Health Physics determines that an alternative action is more feasible, such as area isolation for a period to permit decay of a short-lived nuclide. Any action taken is documented with the results of follow-up surveys.

For skin contamination, any level of detected radiological contamination is cause for prompt decontamination attempts. A Supervisory Health Physicist must approve the departure from the controlled area of any individual who is found to be contaminated above background levels.

If a proposal review shows that routine air sampling is required, Health Physics establishes an air sampling protocol, detailing sample type and frequency, and develops operating techniques to limit exposures.

Health Physics determines the need for external and internal personal radiation monitoring, reviewing external dose assignments upon receipt of processor results and internal dose assignments monthly, or as results of monitoring or bioassay become available, registers appropriate workers as radiation workers; and assigns TLD's, pocket dosimeters, or other devices or other techniques for personal dose monitoring. Health Physics assures that any device or devices, or techniques, used for these purposes is acceptable according to appropriate standards and regulations. Since almost any radionuclide could be involved in a given project, during the review of the initial proposal for that project, Health Physics determines the need for internal monitoring and specifies the program to be followed, including participants, frequency and type of bioassay measurements and dose assessments, and actions levels and actions to be taken. Bioassay programs will be established similar to those described in Regulatory Guide 8.11 for uranium, Regulatory Guide 8.20 for iodine, Regulatory Guide 8.26 for fission and activation products, and the HPSSC draft standard for plutonium. If the Health Physics group determines that the proposed work requires air sampling, the airborne concentration of radioactivity in the worker's breathing zone air will be determined after each working day.

3.2.5 Local Emergency Actions

Emergency evacuation is required for unexpected or inadvertent situations that could cause radiation doses in excess of the applicable whole-body radiation exposure limits and that cannot be controlled with prompt and appropriate actions. Health Physics review is required for such situations to determine work times for necessary actions.

3.2.6 Sealed Source Control

A. 1. Each sealed source containing more than 100 microcuries of beta and/or gamma emitting material or more than 10 microcuries of alpha emitting material, other than Hydrogen-3, with a half-life greater than 30 days and in any form other than gas, shall be tested for leakage and/or the contamination at intervals not to exceed 6 months. In the absence of a certificate from a transferor indicating that a test has been made within 6 months prior to the transfer, a sealed source received from another person shall not be put into use until tested.

2. The periodic leak test required by this section does not apply to sealed sources that are stored and not being used. Prior to any use or transfer to another person, the source shall be leak tested within 6 months prior to the date of use or transfer.

B. The test shall be capable of detecting the presence of 0.005 microcuries of radioactive material on the test sample. The sample shall be taken from the sealed source or appropriate accessible surfaces of the container or from the device where the sealed source is mounted or stored in which one might expect contamination to accumulate. Records of leak test results shall be kept in units of microcuries and maintained for inspection by the USNRC.

If the test reveals the following:

1. The presence of 0.005 microcuries or more of removable contamination from the sealed sources other than described below, or
2. The presence of 0.05 microcuries or more of removable contamination from the teletherapy sealed source, or
3. An indication that the irradiator sealed source which is stored in the water pool for shielding purposes is leaking, then

NIST shall immediately withdraw the sealed source from use and shall cause it to be decontaminated and repaired by a person appropriately licensed to make such repairs or to be disposed of in accordance with USNRC regulations.

Within 5 days after determining that any source has leaked, NIST shall file a report with the Division of Industrial and Medical Nuclear Safety, USNRC, Washington, D. C. 20555, describing the source, test results, extent of contamination, apparent or suspected cause of source failure, and corrective action taken. A copy of the report shall be sent to the Administrator of the NRC Regional Office for Region I.

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CHAPTER 4 - ENVIRONMENTAL PROTECTION

4.1 Effluent Control Systems

Health Physics monitors airborne effluents to provide an assessment of radioactivity concentrations at the discharge point at least once in each quarter for continuing operations or at least once for short-term operations, to establish that releases are less than 10% of the concentration given in 10CFR20, Appendix B, Table 2, Col. 1, averaged over a calendar quarter. Should the concentration exceed that value, continuous monitoring will be initiated. Where effluent monitoring is required, air sampling arrangements shall be designed to assure that air samples taken will be representative of the actual release for the sampling period. Measurement of air sampling media will be with a lower limit of detection of no greater than 5% of the concentration given in 10CFR20, Appendix B, Table 2, Col. 1, for the major radionuclide(s) involved in the process being monitored.

No liquid releases from NIST are permitted under this license that could exceed regulatory limits. Liquid wastes that could exceed the limits normally are either drained to tanks for discharge to the sanitary sewer with appropriate dilution or are collected in specially marked containers for solidification and disposal as solid waste. Building 235 waste holdup tanks are equipped with remote readout level monitors, and Health Physics inspects the level monitors for the Building 245 holdup tanks quarterly, documenting the inspection. Health Physics assays the contents of the tanks for radioactivity concentrations prior to discharge.

Health Physics collects solid radioactive wastes from the laboratories and prepares them for transfer to disposal agents normally acting by contracted service. A solid waste compactor may be used for reducing the volume of solid waste in a package.

Radioactive wastes with half-lives less than 65 days may be stored in the Radioactive Waste Annex to Building 235 or an equivalent secured area. Short-lived wastes held for decay-in-storage are surveyed at least weekly and the results are documented. After at least 10 half-lives have elapsed for the radionuclide under consideration, the waste is taken to a low background area and any shielding around the material is removed. An assay of activity is performed using a low-level GM-type survey meter on its most sensitive scale or a technique of at least equivalent sensitivity. When the assay shows that the activity level cannot be distinguished from background levels, the waste may be disposed of as normal trash. Records of these decay-in-storage disposals will be maintained.

4.2 Environmental Monitoring

Health Physics maintains a listing of the locations of environmental monitoring stations and the specific monitoring techniques used at those sites, e.g., the numbers and locations of thermoluminescent dosimeters on the fence and on the buildings on site or the on-site grass plots used for vegetation sampling.

Quarterly changes of thermoluminescent dosimeters or equivalent integrating monitors about the site and off-site provide measurements of ambient radiation levels. These are maintained under the Health Physics quality assurance program. Quarterly sampling of vegetation or soil, seasonally dependent, and of surface water, and assays under the Health Physics quality assurance program demonstrate radioactive material control. Sampling locations include on-site and off-site stations so that potential NIST contributions to the environment can be evaluated.

4.3 Nonradiological Hazards

Nonradiological hazards are the responsibility of the Safety Office of the Occupational Health and Safety Division. Regulatory oversight by agencies such as OSHA, EPA, and the state Department of the Environment assure that toxic material control is adequate for regulatory compliance. Each laboratory or work area is equipped with an appropriate fire extinguisher if necessary and with either combination rate-of-rise/fixed temperature or smoke detectors that provide signals to a central fire response facility.

CHAPTER 5 - SPECIAL PROCESS COMMITMENTS

5.1 Special Nuclear Material Accounting and Control

Accounting and control of special nuclear materials to prevent and detect unauthorized diversions of material quantities are conducted according to provisions of 10CFR70. Health Physics maintains the SNM accountability office for NIST and administers the accountability program.

5.2 Alpha-Emitting Nuclide Chemistry Operations

The activities of alpha-emitting nuclides in dispersable form in any one laboratory operation are controlled as described in Table I.5-1. Health Physics may approve limits above those shown in the table or may approve variances to the conditions shown for lower toxicity nuclides or if the proposing user can demonstrate adequate provision for safety, such as training, equipment, or other considerations. Radiochemistry hoods are provided with local indicators for air flow and operators are instructed to observe them. Should an air flow system for any hood in use fail, the operator is to suspend operations in that hood and notify Health Physics immediately. Health Physics reviews the situation and determines the need for and the type of further action. Should gloves break or other operative defect appear for a glove box, any processes being conducted in the box are to be suspended and Health Physics notified immediately so that corrective action may be planned.

TABLE I.5-1

ALPHA CHEMISTRY LABORATORY LIMITS AND RULES
FOR HIGH-TOXICITY* MATERIALS AND URANIUM

TYPE OF OPERATION	LIMIT (lesser of)	CONDITIONS
simple storage	100 mCi or 10 g	in closed containers
simple wet chemistry, e.g., aliquot extraction	10 mCi or 1 g	within hoods
normal chemistry, e.g., analysis	1 mCi or 0.1 g	in HEPA filtered hoods
complex wet chemistry, e.g., complex apparatus	0.1 mCi or 0.01 g	in HEPA filtered hoods
simple dry operations	0.1 mCi or 0.01 g	in HEPA filtered hoods
dry and dusty operations, e.g., grinding	0.01 mCi or 0.001 g	in glove boxes

* see, e.g., IAEA Safety Series No. 38, Radiation Protection Procedures

NOTE: Plutonium in solution will be limited to less than 10 millicuries at any one location or in any one process.

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CHAPTER 6 - NUCLEAR CRITICALITY SAFETY

No accumulations of special nuclear materials exceeding 300 grams are permitted in any one area or room, with the exception of plutonium sealed sources. Thus, no criticality program is necessary.

CHAPTER 7 - DECOMMISSIONING PLAN

As a Federal agency, the National Institute of Standards and Technology will generate and implement a decommissioning plan at the time that operations are to be terminated and in accordance with Federal rules and regulations in effect at that time.

CHAPTER 8 - EMERGENCY PLAN

An evaluation of dose to the public offsite due to a release of radioactive materials demonstrates that no emergency plan is required.

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PART II - SAFETY DEMONSTRATION

CHAPTER 9 -OVERVIEW OF OPERATION

9.1 Corporate Information

The National Institute of Standards and Technology is an agency of the United States Government, in the Department of Commerce. It is located in Gaithersburg, Montgomery County, Maryland, approximately 20 air miles northwest from the zero milestone in Washington, DC. The most prominent natural features are the Potomac River flowing to the west and south of the facility and Sugarloaf Mountain to the northwest. Attachment 1 has a locator map of the Gaithersburg site.

9.2 Mission

Title 15 of the Code of Federal Regulations contains information on the functions and duties of NIST. With respect to radiological work, NIST provides services and sources to customers and conducts miscellaneous research and development activities.

9.3 Site Description

NIST is located on a fenced site of about 575 acres. It is bounded by highways I-270, MD124, and Muddy Branch Road, by residential and commercial properties, and by parklands. About 3,000 persons occupy the site on a normal workday. Table II.9-1 shows local populations from preliminary census data for 1990. Meteorology for the NIST site has been compared to that observed at Washington National Airport and, over many years, no significant differences have been found. There have been no unusual or particularly severe weather conditions that would affect radiological operations or safety. Hydrologic studies show topographic control over ground water movement. That movement is slow, about 0.3 foot per day, and directed to the south and west. Attachment 1 has a topographic map of the Gaithersburg site. Seismic activity is low level, typical of the Piedmont Belt. NIST is located in an area that has experienced only a minor amount of earthquake activity.

TABLE II.9-1

1990 POPULATION DENSITIES AROUND NIST

RADIUS (in miles)	POPULATION
0 to 1	7,500
0 to 3	86,000
0 to 5	162,000
0 to 10	727,000

9.4 Maps, Buildings, and Site Information

Attachment 1 contains a NIST site plan and a topographical representation, building locations on site, and floor plans for buildings. The site exhibits a gently rolling topography and contains both open and wooded areas. Buildings include a central complex of the main administration building and several general purpose buildings designed to contain laboratories that accommodate customary scientific research and development functions, buildings that house the support functions ranging from grounds management, heating and air conditioning, and the like, to procurement, and special purpose laboratory buildings that are dedicated to specific research and development functions. This last category includes the Reactor and the Radiation Physics Buildings, where the majority of the work involving radiation and radioactive materials is conducted.

9.5 License History

Table II.9-2 shows a chronological ordering of licensing history at NIST for radioactive materials. This history tracks licenses to the most recent renewal. In some cases, e.g., for 08-00566-05, the byproduct material license, a full history would extend to more than thirty years with many amendments and renewals. In 1980 a Materials License Manager was named to bear responsibility for licensing other than for the NIST Reactor. In 1985, five major licenses were consolidated into the single SNM-362 license.

TABLE II.9-2

NIST MATERIALS LICENSING SUMMARY

YEAR	LICENSE	ACTION (identifier)
1985	08-00566-05, 08-00566-10, 08-00566-12, SMB-405, SNM-362	consolidation, incorporation into License No. SNM-362
1983	08-00566-05	Class I irradiator request
1982	all	Ionizing Radiation Safety Committee
	08-00566-05	change in limits (byproducts)
	all	personal dosimetry technique
1981	SNM-362	filter process (SNM)
	SNM-362	change in limits
	08-00566-10	renewal (teletherapy)
1980	SMB-405	license manager named (source)
1979	SNM-362	renewal
	08-00566-05	change in limits
1978	SMB-405	renewal
	08-00566-12	renewal (irradiator)
1977	08-00566-05	renewal

9.6 Changes in Procedures, Facilities, and Equipment

NIST employees and other individuals working on the NIST site are responsible for obtaining authorizations from Health Physics for radiation source acquisitions, for any modifications in radiation source use that might affect radiological safety, or for disposition of radiation sources. Division Chiefs are responsible for ensuring that staff members comply with radiological safety rules and that staff members are aware of radiological safety procedures. The Chief, Occupational Health and Safety Division, is charged with managing the radiological safety program and with representing the National Institute of Standards and Technology in all matters relating to materials licensing. The Chief, Health Physics, is charged with administering the radiation safety program at NIST, including maintaining documentation to demonstrate the adequacy of the radiological safety program. The Ionizing Radiation Safety Committee is responsible for reviewing major radiation facility proposals and significant proposals for use of radiation, including modifications to existing facilities, and for assuring the performance quality of operations that provide radiological safety assurance.

9.7 Examples of Operations That Might Be Conducted

As an example of the miscellany of types of work done at NIST, consider NCRP Report No. 58, *A handbook of radioactivity measurements procedures, second edition*. Of the fifteen consultants listed in the preface to the first edition, ten were from one working group within NIST (then NBS), as well as the chairman of the scientific committee. The preface to the second edition names twenty-four persons who made contributions to that edition. Of those, fifteen were NIST (then NBS) personnel, including Health Physics staff members. The wide variety of operational activities and of radionuclides described in the publication, essentially the product of only one of the groups at NIST, illustrates the extremely broad scope of work done at NIST.

For the specific nuclides listed in Table I.1-1, the following examples of research, development, and other activities will suggest the variety of operations involving radioactive materials at NIST. Uranium at any enrichment, from depleted through 99.9% ^{235}U, ^{233}U, any nuclide of plutonium, and thorium, might be used in metallurgical research, for beam transmission studies, in neutron beam research, for check sources, or as beam filters. Sealed sources of ^{238}Pu are used as thermal sources. PuBe, PuLi, and other sealed Pu-X sources are used in neutron research and are calibrated for customers. Sealed sources of ^{60}Co, ^{137}Cs, ^{210}Po (sometimes as PoBe), ^{241}Am, ^{252}Cf, or ^{90}Sr might be used in research requiring photon, neutron, or beta radiations, for instrument calibrations, in neutron physics research, medical device (implant seeds, eye irradiation applicators, etc.) calibrations and research, or basic nuclear chemistry and physics research such as half-life studies. Irradiators with ^{60}Co and ^{137}Cs are used in materials irradiation studies, calibrations, and basic research. Miscellaneous byproduct materials, including materials and containers irradiated in the NIST Reactor and brought out of the Reactor licensed area, might be used as check sources, in laboratory intercomparison tests and studies, for light sources, for basic radiochemistry and nuclear physics research, for sample preparations for authorized customers, or in research for medical or other specific laboratory types.

Quantities of special nuclear materials and the irradiated fuel pellets are stored in secure areas, awaiting authorizations and instructions for disposition of the materials.

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CHAPTER 10 - FACILITY DESCRIPTION

10.1 Layout

Attachment 1 shows building locations on the NIST site. The attachment also shows floor plans for those buildings. Buildings 235 and 245 are dedicated to uses of radioactivities and all of these two buildings will retain their authorizations for work with radioactivities until the buildings themselves are decommissioned. Of the remaining buildings, only a few laboratories in Bldg. 222 are currently authorized for unsealed radionuclide operations using activities greater than 10CFR20, Appendix C, quantities. The laboratories and the number of units of App. C activity quantities in each are: Room B207 with 10 units, Room B363 and Room A368 that share 88 units, and Room A242 with 13 units. These represent the facilities that will require substantial investments of time and attention when the authorization for radioactive materials work is terminated, i.e., that will require extensive decommissioning planning and implementation. Other facilities within NIST have authorizations for storage of radioactive materials with no open source work permitted, for sealed radioactive materials, usually reference or calibration sources, tritium light sources, or other non-radiochemistry type sources. The decommissioning requirements on these other facilities will be at a lower intensity than for the higher-level, unsealed work type radionuclide laboratories.

10.2 Utilities, Including Emergency Power

Electrical power is provided to NIST by the Potomac Electric Power Company, using a site-resident substation. Each building is in turn supplied from that substation. No processes are permitted that require permanent application of utility protection services. Fail-safe mechanisms are built into equipment such as automatic shutter closing for teletherapy-type devices so that loss of power cannot cause unsafe radiological conditions.

10.3 Heating, Ventilation, and Air Conditioning

Steam and chilled water are generated in Building 302 and distributed to the various buildings on site with underground conduits. These are combined in varying portions for heating and air conditioning. Filtered air is supplied for each building and laboratory spaces are maintained at negative pressure relative to corridors and office spaces. Exhausts from radioactivity hoods are equipped with velocity-controlled automatic dampers to insure positive air flows through the hoods. High-efficiency particulate filter systems are maintained so that no leakage paths can exist, so that magnahelic or equivalent pressure-drop gauges show no more than four times the clean or fresh reading, and so that hood face velocities are maintained at 100 linear feet per minute over the open area of the hood face. Any degradation in these limits causes review, by the Heating, Ventilation, and Air Conditioning Shop of the Plant Division for pressure-drop to determine remedial action. In some instances, too great an air flow can also be detrimental and must be corrected.

Health Physics performs a quarterly air flow test of radioactivity hoods. The open area of the hood work face is divided into a nine-cell grid and an air-flow measurement is made in the center of each cell. Should a cell be deliberately blocked by, for example, shielding material within the hood, the air flow through that cell is not measured. Should any cell measurement fall below 75 lfm, work in the hood is halted until the air flow reduction is corrected.

10.4 Waste Handling

10.4.1 Liquid Wastes

All liquids from the B- and C-wing radiochemistry labs in Building 235 drain to a tank of approximately 19,000 liters that is located underground on the east side of the building. As the tank fills, Health Physics assays the contents and dumps the liquid to the sanitary sewer if the activity permits. All releases are less than applicable limits. Since considerable liquid from the building drains through the tank, ten to thirty tank dumps each year are necessary, particularly in the summer, when the air conditioning condensate runoff is collected.

Radioactivity laboratories in Building 245 provide drains that lead to two tanks of approximately 19,000 liters each located in the subbasement in Room B045. Health Physics assays the contents and, if the activity concentration permits, dumps the contents to the sanitary sewer. All releases are less than applicable limits. As these tanks fill very slowly, an occasional dump, perhaps once in a year, is necessary.

For other laboratories, and for any process in which liquid wastes with significant activity concentrations are expected, polyethylene or equivalent collectors are placed at the work station and instructions given to the operators to collect all effluent liquids in these bottles. When full or when the process is complete, the bottles and appropriate information on the contents are delivered to Health Physics for transfer to the waste handling facility in Building 235. Liquids are either solidified for disposal as solid radioactive waste or disposed of via the liquid waste tanks. To insure that the systems operate as described, various mechanisms are employed. A liquid level monitor with remote alarm warns that the tank at Building 235 is near full. Typically, monthly readings are taken of the sight glasses on the tanks in Building 245 to assure that these are kept at manageable levels. Health Physics trains workers who generate liquid radioactive waste to assure that liquid waste collection containers are properly used.

10.4.2 Solid Wastes

Each work station that can generate solid radioactive waste is provided with marked containers for low-level wastes. Health Physics trains workers who generate solid waste to assure collection of all solid waste materials that could contain activity. On request from the worker, Health Physics collects the wastes in polyethylene bags or equivalent containers and transports the wastes to the radioactive waste facility in Building 235. The materials normally deposited in the containers are residues from chemical operations, paper towels or wipers, glassware, and miscellaneous solid substances. Radioactive sources and other relatively high activity materials are treated individually, separately from the low-level wastes. Waste is disposed of either by using a waste disposal contractor or by shipping direct to a licensed burial site. If a contractor is used, the waste is packaged according to their instructions. If the shipment is direct to the burial site then all applicable regulations and restrictions on packaging are followed. If possible, the wastes are compacted with a commercial trash compactor. Protective features incorporated into the compactor facility include a filtered ventilation system and regular air samples to identify potential releases of airborne radioactivity. Wastes that cannot be accommodated in drums are packaged appropriately in boxes or other containers as specified by the contractor. Since the compactor has been in operation, each year's disposal quantity has ranged up to 244 cubic feet of waste, with activities ranging up to one curie.

When the radioactive wastes are composed of nuclides with half-lives less than 65 days, Health Physics may store these in the Annex or an equivalent secured area such as Room B131, Building 245, for at least ten half-lives. The materials are then taken to an area with a low background, e.g., the fenced yard at the back of Building 235, and any shielding components are removed from the waste. A GM survey meter, on the lowest range, i.e., 0.2 mR/h full scale, or a detector at least as sensitive is used to assay residual activity. If the activity cannot be distinguished from the background level, the waste may be placed in the normal trash for disposal. Health Physics documents these disposals and retains the documentation as required.

10.5 Chemical Systems

Nonradioactive chemical operations are the responsibility of the Safety Office of the Occupational Health and Safety Division. Any facility or operation involving toxic materials is reviewed to insure compliance with appropriate regulations.

10.6 Fire Protection

The buildings and facilities at NIST were constructed in accordance with applicable regulations for Federal facilities at the time of construction and are maintained under the fire protection auspices of Fire Protection Services of the Facilities Services Division. The coverage by this trained fire and emergency response brigade includes around-the-clock fire and emergency medical response capabilities.

The Fire Protection Services Chief serves as the fire safety review person for plans for modification or construction of facilities. Complete facility plans, including locations of hydrants, sprinkler system layouts, access pathways, and other layout information related to fire fighting are maintained in the offices and workspaces of the Fire Protection Services work areas. Training of fire fighters is according to the National Fire Protection Association (NFPA) voluntary codes for such training; fire fighters are trained to the level equivalent to Fire Fighter III. Materials and equipment available to the group include appropriate vehicular fire fighting units, water supply systems including hydrants and automatic sprinkler systems, portable fire extinguishers, protective clothing, and tools used in fighting fires. Maintenance and deployment of fire fighting equipment is in accord with standards such as the NFPA codes. Extensive pre-fire plans have been developed, incorporating information on locations of radioactive materials, flammable substances, and hazardous materials storage areas, and include fire fighting protocols for those areas. The plans include locations of water supplies, automatic fire fighting response mechanisms that might be employed, and other appropriate information. Fire Protection Services maintains extensive documentation on deployment and maintenance of equipment, pre-fire planning, facility characteristics, training, results of actual occurrences, etc. Portable fire extinguishers are deployed according to NFPA 10; these are commonly dry chemical loaded. In addition, portable extinguishers are commonly located in each laboratory area with the type of loading dependent on the primary fire hazard of that laboratory. Stairwells have standpipe connections and hydrants are located at various positions on the exterior of buildings. The loading dock in Bldg. 245 has a sprinkler system. Laboratories are monitored with fixed temperature, rate-of-rise, or smoke detectors, the type dependent on the hazard expected from that area. Manual fire alarm boxes are located according to the NFPA code. These notify the central console when activated; local evacuation warnings are manually activated from that console or, in the case of Bldg. 245, from an annunciator box in the lobby. The system is fail-safe, i.e., any failure causes a warning annunciation.

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CHAPTER 11 - ORGANIZATION AND PERSONNEL

11.1 Unit Functions

The functions of the various groups and individuals specifically involved in radiological safety at NIST are outlined below. Those functions designed especially to accommodate the requirements of 10CFR21 are marked with "■".

11.1.1 Ionizing Radiation Safety Committee

The Ionizing Radiation Safety Committee performs the following functions:

a. Review the past year's accomplishments, the current program status, and the long-range plans and needs for radiation safety;
b. Audit the performance quality of operations that provide radiation safety assurance;
c. Review major radiation facility proposals and significant proposals for use of radiation, including modifications to existing facilities (for matters related to the Reactor license, this function is carried out by the Safety Review and Audit Committee);
d. Advise the Chief of the Occupational Health and Safety Division on matters pertaining to radiation safety;
e. Report to the Deputy Director on the status of radiation safety annually; and
f. Review incidents and compliance citations and recommend corrective actions where needed (for matters related to the Reactor license, this function is normally carried out by the Safety Evaluation Committee).

11.1.2 Chief, Occupational Health and Safety Division

The Chief, Occupational Health and Safety Division, is responsible for the following:

a. Establishing an effective radiation safety program;
b. Handling matters which involve the position of the Gaithersburg laboratories as a licensee of the NRC, except for matters dealing with the NIST Reactor license; and
■ c. Reporting to the NRC on defects and items of noncompliance with NRC regulations, except for matters dealing with the NIST Reactor.

11.1.3 Chief, Health Physics

The Chief, Health Physics, is responsible for the following:

a. Providing services to ensure compliance with regulatory requirements pertaining to radiation safety;
■ b. Evaluating reports of substantial radiation safety hazards from division chiefs and reporting evaluation results that imply the existence of defects or noncompliance with NRC regulations promptly upon a report from a division chief to the Chief, OHSD;
c. Establishing and updating guidance, procedures, instructions, and other rules required to promote radiation safety and establishing adequate safeguards to see that these are observed;
d. Providing training and retraining in radiation safety for employees; and
e. Maintaining documentation required to demonstrate the adequacy of the radiation safety program.

11.1.4 Division Chiefs

Each Division Chief managing radiation work is responsible for the following:

a. Ensuring that staff members comply with radiation safety rules in implementing the NIST radiation safety policy;

b. Ensuring that staff members are aware of radiation safety procedures and receive training as required;

■ c. Reporting potential items of substantial safety hazard as defined in 10CFR21.3(k) to the Chief, Health Physics, within 24 hours of occurrence or discovery, except for items relating to the Reactor license which are to be handled according to that license; and

d. Reporting significant radiation safety matters to his or her supervisor.

11.1.5 Staff

NIST employees and other individuals working on the NIST site are responsible for the following:

a. Observing approved radiation safety rules;

b. Consulting with Health Physics early in the planning of operations that might involve radiation sources;

c. Obtaining authorization from Health Physics for radiation source acquisitions, for any modifications in radiation source use that might affect radiation safety, or for disposition of radiation sources;

d. Notifying Health Physics of any occupational radiation exposure from work at facilities other than NIST;

e. Immediately informing Health Physics upon discovery of loss or theft of any radioactive materials;

f. Immediately informing their supervisors and Health Physics of accidents involving radiation or radiation sources; and

■ g. Informing their supervisors of defects that could create a substantial safety hazard.

11.2 Organization

| The Ionizing Radiation Safety Committee members' and alternates' names and pertinent resumes are listed below. The size and composition of the Committee are subject to change at the discretion of the Deputy Director.

(Chair) Dr. Chris E. Kuyatt, Coordinator of Radiation Measurement Services, PhD, Physics, 1960, Nebraska Univ.; physicist and manager in electron, photon, and particle physics.

Dr. Randall S. Caswell, Chief, Ionizing Radiation Division, PhD, Physics, 1951, MIT; Physics Professor at Univ. of Kentucky and American Univ.; service with NCRP, ICRU, CIRRPC, national and international government radiation groups.

Mr. Keith H. Eggert, Safety Engineer, Occupational Health and Safety Division, B. S., Chemistry, 1976, The American Univ.; B. S. Chemical Engineering, 1978, Univ. of MD; health physicist/ radiological chemist, certified as Hazardous Material Manager-Master Level by the IHMM (1989).

Dr. Robert R. Greenberg, Group Leader, Nuclear Methods Group (Inorganic Analytical Research Division), PhD, Chemistry, 1976, University of Maryland; experience in nuclear analytical chemistry, radiochemistry and environmental chemistry.

Mr. Thomas G. Hobbs, Chief, Health Physics, Occupational Health and Safety Division, M. S., Physics, 1975, The American Univ.; applied health physics experience as Health Physicist/Supervisory Health Physicist/Chief of Health Physics, Certified Health Physicist.

Dr. Richard M. Lindstrom, Research Chemist, Inorganic Analytical Research Division, PhD (Chemistry) 1970, University of California, San Diego; nuclear analytical chemistry.

Mr. J. Franklin Mayo-Wells, Staff Assistant for Technical Coordination/ Operations, Electronics and Electrical Engineering Laboratory, B. S. Physics, 1957, The Johns Hopkins Univ.; division and center safety representative, low-level monitoring training, non-ionizing radiations experience.

Dr. Santos Mayo, Physicist, Semiconductor Electronics Division, PhD, 1955, Nat'l Univ. of LaPlata; accelerator and sealed source research, non-ionizing radiations.

Mr. Lyman E. Pevey, Chief, Occupational Health and Safety Division, B. S. Engineering, 1959, Lowell Technological Institute; MBA, 1983, Frostburg State University; diversified safety engineering/safety and health management experience, Certified Safety Professional and Certified Hazard Control Manager.

Dr. Henry J. Prask, Research Physicist, Reactor Radiation Division, PhD, Nuclear Physics, 1963, Univ. of Notre Dame; nuclear experience at Notre Dame and the NIST Reactor.

Dr. J. M. Rowe, Chief, Reactor Radiation Division, PhD, Physics, 1966, McMaster Univ., Canada, nuclear experience at Chalk River, Argonne, and NIST.

(Vice Chair) Dr. Harry L. Rook, Deputy Director, Materials Science and Engineering Laboratory, PhD, Nuclear Analytical Chemistry, 1969, Texas A & M Univ.; experience in nuclear chemistry.

Dr. Francis J. Schima, Physicist, Ionizing Radiation Division, PhD, Physics, 1964, Univ. of Notre Dame; nuclear physics and radioactivity metrology experience.

Dr. Robert B. Schwartz, Physicist, Ionizing Radiation Division, PhD, Nuclear Physics, 1955, Yale Univ.; neutron dosimetry and neutron cross sections experience.

Mr. Lester A. Slaback, Jr., Supervisory Health Physicist, Occupational Health and Safety Division, B. S. Physics and Mathematics, 1962, San Jose State Coll.; applied health physics experience as Health Physicist/Radiological Safety Department Head/Supervisory Health Physicist, Certified Health Physicist.

Dr. Christopher G. Soares, Physicist, Ionizing Radiation Division, PhD, Physics, 1976, Univ. of Florida; photon/electron spectroscopy, thermoluminescence dosimetry, calibration source development, measurement assurance, and electron source calibration experience.

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CHAPTER 12 - RADIATION PROTECTION PROCEDURES AND EQUIPMENT

12.1 Procedures

Health Physics makes an initial assessment of radiological protection needs for a task based on an appropriately completed Form NIST-364, Proposal to Acquire Radiation Source, or equivalent document. Usually, Health Physics compares the proposed task's characteristics to criteria such as those in IAEA Safety Series 38, Radiation Protection Procedures, for applying classifications of workplaces, radiotoxicities, and job types. Health Physics assigns an initial frequency and type of surveillance commensurate with perceived hazards for the task. Personal monitoring, access controls, additional training, protective clothing, and facility design characteristics are chosen to meet required rules. Changes or modifications to facilities, users, or source characteristics require that Form NIST-365, Proposed Change in Utilization of Radiation Source, or an equivalent document be submitted for Health Physics review. Should any review disclose that a whole body dose equivalent greater than 1.25 rem could credibly be generated, the proposal is submitted to the Ionizing Radiation Safety Committee for further review. Ionizing Radiation Safety Committee review may be requested for any proposal by the proposer, by Health Physics, or by the Committee.

Health Physics establishes the methods, frequencies, and plans for surveillance based on the review. Observation of operational techniques and performance results such as personnel dosimetry data yield information for ALARA compliance monitoring. Should any condition threaten to expose uncontrolled areas to excessive radiation levels, measures are implemented to restrict access to the areas and to control worker occupancy times. Scheduled, on demand, or intermittent surveys of external radiation levels, contamination levels, airborne activity concentration levels, or other measurement techniques can identify any need to impose more restrictive controls on access or occupancy. Health Physics designs plans and documents results for radiation field quality and level monitoring, as necessary.

A Health Physicist will review HP operating procedures at least biennially.

12.2 Posting and Labeling

Table II.12-1 shows control mechanisms and action levels under which radioactivity operations are permitted. The contamination limits shown represent a departure from customary practice in that specific nuclide limits are provided for beta-emitting nuclides when the identity of the nuclide is known. As an ALARA precaution, Health Physics requests decontamination of areas in which any detectable contamination above normal background levels are found. Health Physics review may result in a determination that actions other than described in this table should be implemented. Such alternate actions are documented by Health Physics.

12.3 Personnel Monitoring

Health Physics maintains a primary personnel dosimetry program that employs thermoluminescent dosimeters (TLD), or other devices such as direct-reading pocket dosimeters. Health Physics assures that any device used in the primary personnel dosimetry program meets quality assurance requirements equivalent to the dosimetry national laboratory accreditation program (NVLAP), either by performing suitable tests and checks on the devices or by requiring suppliers and processors to certify to quality assurance acceptability. Any worker who could be exposed to 25% or more of the regulated radiation limits is registered in the primary program upon approval of the applicable work proposal. Such a registration causes the review of the applicant's work environment to assess potential for the worker to be listed as a "radiation worker". Usually, a radiation worker is assigned one device, or for special circumstances, such as those with mixed-field radiations for which one device may not adequately measure the dose, more than one device. Those radiation workers who may be exposed to different work environments for which the radiation doses are to be separated, such as work with californium neutron sources and with reactor-generated radiations, may be issued one device or set of devices for one environment and another device or set for the other. In some instances, Health Physics may determine that a more immediate indication of exposure is necessary and issue personnel devices, such as direct-reading pocket dosimeters, that are not maintained according to a full NVLAP QA program but are checked to demonstrate a response to radiation. Primary personnel dosimeters are evaluated at least quarterly and the records reviewed for radiological safety control and for ALARA purposes. Primary personnel dosimeters may be film, supplied by the Lexington Signal Depot, or TLD, supplied by either the Lexington Signal Depot or by the Naval Medical Command. Alternative suppliers may be consi[illegible] f the appropriate quality assurance requirements are met.

[illegible] workers, for whom registration as radiation workers is determined not to be necessary, but who could enter controlled areas, may be issued supplementary personnel dosimetry, such as film, TLD, or pocket dosimeters, at Health Physics discretion. Such supplementary dosimetry would be subject to internal supplementary quality assurance but need not be submitted to a NVLAP QA type program. Results from these devices would help to establish and support the provisions for personnel selections for the primary dosimetry [illegible]gram and would also help in the evaluation of radiation work for ALARA reviews.

12.4 Surveys

Health Physics performs weekly routine surveys of a laboratory in which unsealed RAM is utilized when the initial proposal or subsequent evaluation of the work environment demonstrates that levels could exceed the levels at which posting is required, as shown in Table II.12-1. As specified by Health Physics, the surveys could include smear tests of surfaces, radiation level tests, radiation quality tests, air activity contamination tests, or combinations of these, and other radiation safety assurance procedures. For spe[illegible] situations, such as maintenance, similar surveys, time and motion studies, or practice sessions on [illegible] up assemblies are initiated to assure that operations are conducted with minimal exposures.

12.5 Reports and Records

The Chief, Occupational Health and Safety Division, documents management and authority notifications resulting from reports from Health Physics on off-normal investigations. Health Physics maintains documentation on routine and special radiological surveys, personnel monitoring, licensing interactions with NRC, instrument calibrations, ALARA reviews and findings, employee training and familiarization, environmental monitoring, and source control. The Chairperson of the Ionizing Radiation Safety Committee maintains records of meetings of the Committee, Committee audits, and special reviews and investigations by the Committee. Normal retention time for these records and documents is two years unless otherwise specified by regulations.

12.6 Instruments

Health Physics semiannually calibrates or response-checks each instrument or marks the calibration/check record with appropriate information, such as "not located" or "inoperative (reason)". Radiation calibrations for portable survey meters are performed routinely with Cs-137 for photons or with Cf-[illegible]2 for neutrons. Response checks are performed with Am-241 for alphas or Sr-90 for betas. Other sources, such as x-rays, Co-60, Pu-Be, U-nat, Pm-147, or Po-210 may be used. Any source used for calibrating instruments is calibrated, itself, using techniques providing traceability to national standards. Radiation source calibrations are performed at points in the lower and the upper 25% of the normally used span. Intrascale calibrations are performed on at least two points on each normally used scale with electronic devices simulating radiation sources or with radiation sources. Electronic calibrations are done whenever possible to provide maximum accuracy and in the interest of minimizing radiation exposures to calibration personnel. Each source calibration is to within ±20% of the true value, or ±35% if correcting information such as charts or graphs are supplied with the instrument. Electronic calibration is to within ±10% of the true value, or to within ±20% of the true value if correcting information such as charts or graphs are supplied with the instruments. If the calibration criteria cannot be met, the instrument failing to meet the calibration criteria is removed from service for radiation control purposes. Health Physics insures that beta and alpha portable survey instruments respond appropriately to radioactive materials. Those instruments are checked with a source on one range and the full response of the various ranges and the linearity are tested as described above.

Health Physics selects instruments for monitoring surface contamination, radiation levels, particulate and gaseous airborne contamination, radiation levels, particulate and gaseous airborne radioactivity concentrations, radiation qualities, etc., based on the requirements for assuring radiological safety as specified in action level commitments given in this manual and in the regulations as given in 10CFR20. Normally, a complement of twice the numbers of instruments of each type shown in Table I.3-1 is available and usable according to the Health Physics instrument quality assurance program. This set of instruments is fully capable of providing instrument coverage for normal and any anticipated off-normal radiological safety situations. Instruments are normally stored at locations convenient to work places. Health Physics maintains a master list of instruments in the quality assurance program and the last known status of each instrument described.

12.7 Sealed Source Leak Testing

Each sealed source containing more than 100 microcuries of beta- or gamma-emitting radioactive material or more than 10 microcuries of alpha-emitting radioactive material, other than hydrogen-3, gaseous sources, sources with half-lives of 30 days or less, or sources in storage, will be tested for leakage at least semiannually. Prior to use or transfer, a source that has not been leak tested within the past six months will be leak tested. The test will be capable of revealing the presence of 0.005 microcuries of removable contamination on the test sample. The sample will be taken from the source or from an associated surface where contamination might be expected to accumulate. Sources will be immediately withdrawn from use and action taken to repair or dispose of the source, and appropriate actions taken to notify the NRC, if the following limits are exceeded for removable contamination:

- any indication of leakage from the irradiator sealed source in the water shielding pool.
- 0.05 microcuries or more from a teletherapy-type sealed source.
- 0.005 microcuries or more from any other sealed source.

12.8 Protective Clothing

Health Physics maintains a nominal supply of various protective clothing items, including gloves, shoe covers, coveralls, head covers, etc. These are freely available as needed for issue to laboratory workers using dispersable radioactive materials. For situations requiring protective clothing beyond the normal issue quantities, the requesting work unit may be asked to replenish the supply.

12.9 Administrative Control Levels

Table II.12-2 describes the administrative action levels and the actions taken at those levels to control radiation and radioactive materials in specific situations and under specific conditions. Table II.12-3 describes the possession limits for the nuclides listed in Category Q, Table I.1-1(a). These are administrative apportionments of the nuclide limits shown in Category Q, allowing the weighted summed fractions (WSF) to be met, independent of the activity in each subcategory. These apportionments may be adjusted with the approval of the Chief of Health Physics, subject to the constraints of Table I.1-1(a).

12.10 Respiratory Protection

Health Physics may issue dust stop or similar particulate breathing masks for dusty work environments. At the conclusion of the job, Health Physics retrieves the masks and prepares them for reuse.

TABLE II.12-1

CONTROLS AND ACTION LEVELS

Radiation Level	Action
greater than the most restrictive of: a. 500 mrem in a year* b. 100 mrem in seven days* c. 2 mrem in one hour*	restrict occupancy for general public
greater than 5 mrem in 1 hr**	post as "Radiation Area"
greater than 100 mrem in 1 hr**	post as "High Radiation Area"
greater than 500 rads in 1 hr***	post as "Very High Radiation Area"
greater than derived air concentration (DAC), or greater than 0.6% of the annual limit on intake (ALI) or 12 DAC-hours	post as "Airborne Radioactivity Area"
greater than 10 times an exempt quantity of radioactive material	post room or area with "Radioactive Material" sign
greater than an exempt quantity of radioactive material	post unattended and otherwise unmarked container with "Radioactive Material" label, with information
for alpha contaminants, greater than 200 dpm/100 cm^2	post as "Contamination Control Area"
for unknown beta contaminants or for known beta contaminants other than ^{14}C or ^{3}H, greater than 2,000 dpm/100 cm^2	post as "Contamination Control Area"
for ^{14}C, greater than 20,000 dpm/cm^2	post as "Contamination Control Area"
for ^{3}H, greater than 200,000 dpm/cm^2	post as "Contamination Control Area"

NOTE: Any dose or dose rate marked "*" means substantially whole body exposure or equivalent.
Any dose rate marked "**" means the result of an individual receiving such an absorbed dose in excess of that rate at 30 centimeters from a radiation source or from any surface that the radiation penetrates.
Any dose rate marked "***" means the result of an individual receiving such an absorbed dose in excess of that rate at 1 meter from a radiation source or from any surface that the radiation penetrates.

TABLE II.12-2

ADMINISTRATIVE ACTION LEVELS AND ACTIONS

DOSE EQUIVALENT		
external, penetrating, whole body	0.05 rem	notify worker
external, non-penetrating, extremity	0.50 rem	review situation, recommend actions
internal	0.25 rem	review situation, recommend actions
SKIN CONTAMINATION		
fixed or removable	any level	review situation, cleanse, Health Physics may release when 0.05 mrad/h achieved
AIR AND LIQUID EFFLUENT		
worker breathing zone	25% occupational ALI	review situation, recommend actions
environmental air	25% environmental ALI	locate source, suspend operations
liquid for release	25% environmental ALI	dilute before discharge
REMOVABLE SURFACE CONTAMINATION		
alpha	20 $dpm/100cm^2$	review situation, restrict access
unknown beta	200 $dpm/100cm^2$	review situation, restrict access
known beta, other than ^3H or ^{14}C	200 $dpm/100cm^2$	review situation, restrict access
^{14}C	2,000 $dpm/100cm^2$	review situation, restrict access
^3H	20,000 $dpm/100cm^2$	review situation, restrict access

12.11 Administratively Controlled Nuclide Possession Limits

Table II.12-3 presents the administratively controlled activity possession limits for the nuclides listed in Table I.1-1(a), permitting the weighted summed fraction (WSF) to be met, independent of the activity in any other of the table's classifications. These allocations may be adjusted with the approval of the Chief of Health Physics. Note that the maximum sum of the weighted fractions from Table II.12-3 is 0.955, so the NRC offsite accident dose cannot be exceeded.

TABLE II.12-3

NUCLIDE POSSESSION LIMIT FACTORS

Category Q Nuclide	Administratively Controlled Possession Limit
^{10}Be, ^{36}Cl, ^{94}Nb, ^{108m}Ag, ^{113m}Cd, ^{146}Sm, ^{152}Eu, ^{154}Eu, ^{158}Tb, ^{178m}Hf, ^{182}Hf, ^{194}Os, ^{210m}Bi	1% of license limit for each nuclide (a total of 14% of WSF, total of <67 Ci)
^{32}P	120 Ci (30% of WSF)
all other nuclides*	total not to exceed 900 Ci (<41% of WSF)
any one other nuclide*	total activity not to exceed Category Q activity limit or 110 Ci/WF, whichever is less (<10% WSF)

*: One nuclide will be administratively assigned to the last classification, as needed, to permit operational flexibility.

CHAPTER 13 - OCCUPATIONAL RADIATION EXPOSURES

13.1 Occupational Exposure Analysis

For the period from 1985 through 1989, no monitored employee accumulated in any year a total external dose equivalent greater than 25% of the annual limit from external sources involved in materials licensed operations. Internal dose equivalents from these operations have been negligible. Measurements of radioactivity concentrations in air showed less than minimum detectable levels, i.e., less than at most 10% of MPC, demonstrating that no radiation worker was exposed to significant air activity concentrations resulting from radiation work for 1985 through 1989.

The principal exposure-producing operation for materials licensed operations for some years has been the Cf-252 irradiation project. This is expected to continue into the foreseeable future. Measures to limit exposures to these sources have been and are being implemented by the work group. These measures include installing remote handling devices for source transfer, planning for relocation of the irradiation facility to a more isolated environment, and stricter administrative control for operations timing.

No off-normal occurrence resulting in excessive exposure has been documented. Bioassays of tritium workers, workers from gaseous iodine processes, and other potential internal dose contributing work have demonstrated extremely good control of dispersable radioactive materials.

Between 1985 and 1991, 827 hood air flow measurements were performed; only two adjustments for low air flow resulted from this monitoring. For the same period, 73 air samples indicated that, based on a beta MPC of 3×10^{-9} microcuries per milliliter and an alpha MPC of 6×10^{-13} microcuries per milliliter, the beta exposure to any individual was 0.22 MPC-hours while the alpha exposure, subject to a great uncertainty from many false positives from the low count rates obtained at near background, was less than 33 MPC-hours. Again, for that same six year period, the bioassay results, these being from tritium urinalyses for workers in the Reactor and, therefore, under the Reactor license, showed that 41 persons showed a range of summed dose equivalents from 5 mrem to 475 mrem in the six years, with a total population dose equivalent of 6.24 person-rems.

13.2 Measures Taken to Implement ALARA

Health Physics dosimetry programs have been centralized, with results reviewed by a single responsible individual, who ensures that ALARA concepts are observed in surveying dosimetry data. Environmental monitoring responsibility has also been assigned to a single individual, who reviews data for ALARA purposes. Information about the ALARA concept and the NIST ALARA program has been widely disseminated and workers are requested to inform Health Physics of any pertinent data or information that could affect this program.

13.3 Bioassay Program

Workers involved in projects with a potential for significant internal dose, such as operations that could create significant airborne levels of tritium, iodine, or transuranics, may be required, at Health Physics discretion, to participate in a bioassay program. Appropriate techniques for bioassay are developed from available regulatory guidance, contracted assays may be utilized, or other acceptable bioassay mechanisms may be specified.

13.4 Air Sampling Program

Table II.12-1, Controls and Action Levels, and Table II.12-2, Administrative Action Levels and Actions, list the various levels at which certain actions would be implemented. In addition, should any measurement of air radioactivity concentration indicate that an applicable limit would be exceeded, the operation involved or the operation generating the activity concentration would be suspended unless the condition could be remedied by prompt corrective action.

Proposal reviews and analytical observations to determine actions for specific situations involving potential airborne radioactivity releases are approached using conservative techniques, for example, conservative resuspension factors or mass loading values would be assumed for extended operations. Health Physics evaluates a proposal to conduct processes that could release radioactive material to the effluent streams and considers the potential for such release. Material containment, resuspension probability, effluent stream access, filtration available, and other chemical and physical properties involved are part of the criteria used. Should the potential for a release be greater than 10% of the maximum permissible concentrations as given in 10CFR20, Appendix B, Table 2, Col. 1, then air sampling of the workplace will be initiated.

13.5 Surface Contamination

Table II.12-1, Controls and Action levels, and Table II.12-2, Administrative Action Levels and Actions, list controlling levels for surface contamination. Measurements for surface contamination checking and protective measures are described in sections II-12.1, II-12.4, and II-12.7 of this manual.

Hand and shoe monitoring may be performed with conveniently placed equipment; resuspension factors for transforming surface contamination levels to airborne activity concentrations are applied as described in section II-13.4 of this manual.

13.6 Shipping and Receiving

All radioactive materials received at NIST and all radioactive materials shipped from NIST are controlled by Health Physics. Usually, incoming packages are brought to the Health Physics receiving area in Building 245, unless alternate provisions are made with the ultimate recipient. In either case, surveys for compliance with transport regulations are made within time limits specified by the regulations. Health Physics and the recipient then survey the package and contents and determine if the shipment is acceptable for incorporation into the project for which the source is intended. Usually, outgoing packages are held in the NIST shipping area in Building 301 until Health Physics or a designated representative checks the package for compliance with transport regulations.

Type B shipments are made in accord with the provisions of the quality assurance program as detailed in a separately submitted document.

If an incoming shipment shows contamination at any level of packaging, the package is held in the Health Physics or other designated storage area until a decision is made, jointly between Health Physics and the recipient, on returning the source, decontaminating the source, disposing of the materials, or establishing proper controls for safe use of the source.

NIST MATERIALS LICENSE DOCUMENT

ATTACHMENT NUMBER 1

Gaithersburg Site Plan and Building Descriptions for National Bureau of Standards (1964 Edition)
Directions to NIST (1989 Edition)
Topographical Map of NIST Site (1989 Edition)
Building Descriptions for NIST Buildings Not Included in 1964 Issue (1990 Edition)

NIST MATERIALS LICENSE DOCUMENT

ATTACHMENT NUMBER 2

| Form NIST-362 . . . Radiation Work Permit (typical procedural instructions)
| Form NIST-364 . . . Proposal to Acquire Radiation Source
| Form NIST-365 . . . Proposed Change in Utilization of Radiation Source