ABBOTT

R. L. Fredrickson
Corporate Radiation Protection Officer
Employee Health Department

Abbott Laboratories
14th & Sheridan Road
North Chicago, Illinois 60064

May 10, 1985

George M. McCann
Materials Licensing Section
United States Nuclear Regulatory Commission
Region III
799 Roosevelt Road
Glen Ellyn, Illinois

Subject: Application for Renewal of License 12-00621-03. Control No. 15772.

Dear Mr. McCann:

This letter is in response to your requests for additional information made at our meeting of February 26, 1985. Further, because our original renewal application was submitted twenty months ago, some changes have taken place which will become part of the application. I am attempting to accomodate both of these needs in the revised attachments which accompany this letter. In each case where a revised attachment is submitted (specifically Attachments A, B, C, E, F, G, and I), please replace the ones which accompanied the renewal application dated August 26, 1983.

I have reviewed the notes of our meeting of February 26 and tried to address all of your concerns and answer the questions you raised. Please note, too, that demonstrations by sales personnel are no longer an authorized use under this license, and that we have reduced the authorized quantities for all radionuclides except iodine-125.

Please contact me if you have further questions or comments.

Sincerely yours,

R. L. Fredrickson

R.L. Fredrickson

RLF:kc

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Attachment A - Item 5

Street Addresses Where Licensed Material Will Be Used

1. 1400 Sheridan Road
   North Chicago, Illinois 60064

2. Abbott Park
   Route 43 (Waukegan Road) at Route 137 (Buckley Road)
   Lake County, Illinois

3. Abbott Laboratories
   Diagnostics Division Distribution Center
   Intersection of U.S. 41 & 22nd Street
   North Chicago, Illinois 60064

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Attachment B - Item 8A, 8B, 8C, 8D

Licensed Material

Line No.	Element and Mass Number	Chemical and/or Physical Form	Name of Manufacturer and Model Number (If Sealed Source)	Maximum Number of Millicuries and/or Sealed Sources and Maximum Activity Per Source which will be Possessed at any one time.
	A	B	C	D
(1)	Any byproduct material with atomic number 1 through 83, inclusive.	Any		Not to exceed 1 curie per radionuclide. Not to exceed 5 Curies total.
(2)	Iodine-125	Any		75 Curies
(3)	Cesium-137	Sealed Sources	Ronan Engineering Company Source Holder X90-SA1-F37	No single sealed source to exceed 50 millicuries.
(4)	Cesium-137	Sealed Source	J.L. Shepherd Calibrator 3M type 4F6H	1 Curie

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Attachment C - Item 8E

Use of Licensed Material

1. Manufacture and quality control of radioimmunoassay (RIA) diagnostics products.

2. Distribution of RIA diagnostics products in accordance with 10 CFR 30.41 or 10 CFR 32.71. Verification of licenses or form NRC 483 for customers is computerized, and each order is handled by the computer. Orders for which a license or form 483 is not on file are rejected by the computer, and the customer placing the order is required to verify that he or she is authorized to receive the material. "Hard copy" files of all licenses and form 483's are maintained in addition to the computer record.

3. Process and product research and development as defined in paragraph 30.4(q) of 10 CFR Part 30. Most research is directed toward the development of RIA products containing iodine-125 for <u>in vitro</u> clinical testing. There is also biological tracer research which involves the use of labeled organic biological compounds in experiments with, for example, tissue culture, microorganisms, enzymes, all <u>in vitro</u>. Some work is carried out in experimental animals in special facilities by trained scientists who also provide the needed animal care.

4. Storage for physical decay of radionuclides with half-lives of 60 days or less.

5. Calibration of radiation survey instruments.

6. Use of cesium-137 for level gauging in liquid waste sterilization processes.

Abbott Laboratories does <u>not</u> use radioactive material in or on human beings, in field applications, or for manufacture of sealed sources.

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North Chicago, Illinois

Attachment E - Item 11

Calibration of Instruments

Analytical counting units (Tri-Carbs, gamma spectrometers, etc.) are calibrated with NBS traceable standards frequently, but at least once each year.

A 1 Curie (nominal) source of cesium 137 in a J.S. Shepherd Model 28-6A Calibrator is used to calibrate radiation survey meters. Low level calibrations are made possible by using a J.L. Shepherd attenuator with a reduction factor of 11.9. In this manner we are able to calibrate in the range of about 0.25 mR/hr up to 400 mR/hr. Decay corrections for the decreased output of the calibrator are made at 6 month intervals. Meter readings are taken at various distances from the calibrator, making use of the inverse square law to determine theoretical readings at each point. The following details are used in this program:

A.I. Survey meters will be calibrated at least annually and after servicing.

II. Each scale will be calibrated at least at two points about 1/3 and 2/3 full-scale deflection. (Except see the last sentence of III.)

III. We will calibrate our instruments to ±10% from the true exposure rate where possible and prepare a suitable response chart, graph, or factor for those whose calibration is between 10% and 20% of the true exposure. Meters beyond 20% deviation will be repaired or rejected. In a few cases we will attach a notice that one of the scales is not to be used for exposure measurements.

IV. We will assign a long half-life check source to each of our health physics offices as an operational check on the survey instrument. This will be used:

a. Before each use and after each survey to ensure that the instrument was operational during the survey.

b. After each maintenance and/or battery change.

c. At least quarterly.

If any reading with the same geometry is not within ±20% of the reading measured at time of calibration, the instrument will be recalibrated.

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Attachment E - Item 11 (Cont.)

V. Readings for iodine-125 will be corrected as necessary by use of the manufacturer's energy response curve.

B. Attached to this section is a facsimile of our calibration form.

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RADIATION SURVEY METER CALIBRATION DATA

INSTRUMENT TYPE ____________________ CALIBRATION SOURCE ________________

ID NO. ______________ CALIBRATION DATE ______________

LOCATION ________________________ CALIBRATED BY ____________________

OPERATIONAL CHECK SOURCE READING ________________ SOURCE # ______________________

DISTANCE (METERS)	1	1.5	2	2.5	3	4	5	6	7	8	9	10	12	
CALCULATED mR/hr														
1st Reading mR/hr Scale														
2nd Reading mR/hr Scale														
3rd Reading mR/hr Scale														

X 11.9 Attenuation:

DISTANCE (METERS)	1	1.5	2	2.5	3	4	5	6	7	8	9	10	12	
CALCULATED mR/hr														
1st Reading mR/hr Scale														
2nd Reading mR/hr Scale														
3rd Reading mR/hr Scale														

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North Chicago, Illinois

Attachment F - Item 12

Personnel Monitoring

Bioassays

Urine samples from persons working with beta-emitting radionuclides (e.g., ^{3}H, ^{14}C, ^{35}S, ^{32}P) are counted once each quarter or at any time ingestion of radioactive material is suspected. Samples are counted on a Packard Tri-Carb beta spectrometer along with suitable standards.

Persons performing iodinations are subject to thyroid uptake measurements; other persons handling radioiodine-labeled compounds are subject to thyroid measurements if they handle one millicurie or more in a single experiment.

The above bioassays are performed at intervals determined by the nature of the work. In addition, the above bioassays, with nose swabs, are performed after known accidents, elevated workplace air samples, or suspected accidental intake of radioactive material.

Action taken after ingestion of radioiodine is based on section 5, Action Points and Corresponding Actions, of USNRC Regulatory Guide 8.20, "Applications of Bioassay for I-125, I-131", Revision 1. Action taken after ingestion of hydrogen-3 is based on section V, Action Points & Corresponding Actions, of USNRC "Guidelines for Bioassay Requirements for Tritium", October 19, 1977.

Similar graded action is taken for other radionuclides at any time that bioassay measurements indicate 25% of 100% of a body burden for the nuclide in question.

Film Badges

Film badges are assigned in accordance with the requirements of our Operating Procedures (see attachment K). Films are changed monthly or weekly as dictated by the magnitude of the expected exposures, and wrist films are used to measure extremity exposures where necessary. TLD rings are also used in some cases to monitor extremity exposures.

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Attachment G - Item 13

Facilities and Equipment

Buildings in which most of our licensed work is carried out are R-1, R-1-A, R-1-B, and L-3 (1400 Sheridan Road, North Chicag); AP-1, AP-1A, AP-8, AP-8A, AP-8B, AP-9, AP-9A, AP-10, and AP-15A (Abbott Park, Lake County); and K-2 (U.S. 41 at 22nd Street, North Chicago).

Laboratories used for low-level tracer work have no special construction requirements, although a fume hood is recommended. Most of the work in our radionuclide restricted laboratories is in this tracer category, and we presently have no high-level (100 millicuries or more) beta gamma laboratories nor laboratories using alpha emitters. Our high level laboratories do, however, use multi-millicurie quantities of iodine-125, in amounts presently as high as 120 millicuries, for iodination work.

Enclosed is a copy of the specifications for these high-level laboratories (see Abbott Engineering Standards - Environmental Standards for Buildings - Restricted Radionuclide Laboratories). Laboratories are generally classified according to the scheme of the international Atomic Energy Agency: "Classification of Isotopes According to Relative Toxicity Per Unit Activity" from SAFE HANDLING OF RADIOISOTOPES, Safety Series No.1, I.A.E.A., Vienna, 1958 (copy enclosed).

Iodination laboratories are Type A and meet the requirements of the referenced Abbott Engineering Standards. They are classified as Red Restricted areas in every case. Tracer laboratories are generally classified as Green Restricted areas and would be Type C in the I.A.E.A. classification system. Type B laboratories would be used for intermediate operations not requiring as stringent controls as Type A and would, in most cases, be Red Restricted areas. The area definitions in our Abbott Diagnostics Division - Operating Procedures - Radiation Workers deviate slightly from the values used by the I.A.E.A.

Waste storage is located in building R-1-B, room 1040; building AP-1A, room S-04; building AP-8, room 808; and building AP-9, AP-9/10 lower-level link. All of these rooms are somewhat isolated and are used mainly for storing soft beta or low-energy gamma-emitting radionuclides (e.g., iodine-125) not requiring special shielding. Storage of short half-life (60 days or less) radionuclides for decay is done in building AP-15A in an isolated area used only for this purpose. All material in this warehouse storage room is in closed drums which have been checked for presence of external contamination.

Remote handling equipment, if needed, is available, as are lead bricks and lead storage containers. Volatile or potentially volatile radioactive materials are stored and used in fume hoods.

May 10, 1985

RESTRICTED RADIONUCLIDE LABORATORIES

NOTE - The Corporate Radiation Safety Comittee is required by the provisions of Title 10 Code of Federal Regulations Part 33.13 (c) (3) (ii and iii) (Nuclear Regulatory Commission Rules & Regulations) to review, approve, and record safety evaluations of new and modified facilities for handling radioactive materials. Therefore, the Corporate Radiation Safety Committee must be involved in all phases of planning, design, construction and start up of such facilities.

XIII-1 GENERAL

Radionuclide laboratories at Abbott are divided into the following classifications:

- High level restricted radionuclide laboratory - more stringent classification assigned to laboratories where more hazardous (higher radiation levels, larger quantities, etc.) materials are handled.

- Restricted radionuclide laboratory - less stringent classification for laboratories where less hazardous materials are handled.

It is the responcibility of the Corporate Radiation Safety Committee to assign the classification to each radionuclide laboratory.

If a building is to consist mainly or entirely of high level restricted radionuclide laboratories, its distance form other buildings not carrying out similar work, and from the perimeter of company property shall be determined by the Corporate Radiation Safety Committee.

Restricted radionuclide laboratories should be kept, whenever possible, in general proximity to one another within a building, and should be kept away from areas of heavy pedestrian traffic such as hallways leading to building exits.

Space allotment per worker in restricted redionuclide laboratories should normally be at least 200 square feet. For routine production where most work is done in a hood, this figure may be somewhat reduced.

XIII-2 BARRIERS

Walls between high level restricted radionuclide laboratories and their surroundings should be of material of suitable density to provide adequate shielding for the type of radiation involved.

Counting rooms should be in the general area of the laboratories but far enough removed that low background conditions will prevail.

XIII-4.4 Air Pressure and Flow. Air flow shall be from the non-restricted to the low level restricted to the high level restricted laboratories, not the reverse. Final discharge to the atmosphere is done via the hoods; air from radionuclide restricted laboratories shall not be recirculated through the building

XIII-4.5 Dust and Vapor Removal. In a radionuclide laboratory, proper hood design is critical. The hood surface must be non-porous, smooth and suitable for easy decontamination. Stainless steel is excellent for this purpose and offers additional advantages of flame and chemical resistance. The hood should also have a 1/2 inch deep recessed floor so that radioactive material will be contained in the event of a spill.

The hood shall be provided with a vertical sliding door containing a window. For hoods to be used for low energy gamma-emitting radionuclides (e.g., iodine-125), this window shall contain a section fabricated from leaded glass bonded to lucite. For hoods to be used for high energy gamma-emitters, special glass is not required (shielding is accomplished by physically placing lead barriers inside the hood).

Hoods shall be designed to maintain an airflow face velocity of 125 lineal feet per minute with the door opened wide, and should be equipped with a bypass to keep face velocity constant as the door position is changed. If required, approved types of laminar flow hoods may be used for radionuclide work if they are equipped with proper filters.

Hoods should be equipped with switches connected to audiovisual alarms to indicate that air flow has fallen below acceptable levels. In the event of total air failure in the hood, manual or automatic cutoff of the room air supply should be possible to prevent backflow of air from the laboratory to surrounding areas.

Hood ducts from high level restricted radionuclide laboratories may be connected with ducts from other high level radionuclide laboratories, but shall not be interconnected with ducts from regular chemical laboratories. All sheet metal ducts should have soldered seams or be well caulked to prevent leakage.

Exhaust stacks discharging air from high level restricted radionuclide laboratory hoods should extend an optimum height above roof level and be located away form any air intakes; conversely, air intakes should be located away from fume hood exhausts.

Suitable charcoal filters shall be installed on all hood exhaust ducts to minimize or prevent discharge of radioactive material to the environment. Experience in removing radioiodine from hood exhaust air has shown that frequently the manufacturer's recommended charcoal bed depth and flow capacity are inadequate to meet Abbott

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It is the responcibility of the Corporate Radiation Safety Committee to assign the classification to each radionuclide laboratory.

If a building is to consist mainly or entirely of high level restricted radionuclide laboratories, its distance form other buildings not carrying out similar work, and from the perimeter of company property shall be determined by the Corporate Radiation Safety Committee.

Restricted radionuclide laboratories should be kept, whenever possible, in general proximity to one another within a building, and should be kept away from areas of heavy pedestrian traffic such as hallways leading to building exits.

Space allotment per worker in restricted redionuclide laboratories should normally be at least 200 square feet. For routine production where most work is done in a hood, this figure may be somewhat reduced.

XIII-2 BARRIERS

Walls between high level restricted radionuclide laboratories and their surroundings should be of material of suitable density to provide adequate shielding for the type of radiation involved.

Counting rooms should be in the general area of the laboratories but far enough removed that low background conditions will prevail.

Counting rooms should not be located where radioactive material in quantity passes nearby.

Radioactive waste storage rooms should be provided with adequate shielding and be located where traffic of workers is at a minimum.

XIII-3 CONSTRUCTION AND FINISHES

Because of the use of dense walls and heavy lead shielding in some restricted radionuclide laboratories, the structure may have to support more weight than in a conventional laboratory.

XIII-3.1 Floors. Floors should be of concrete with a continuous, seamless covering so that contamination from spills cannot become lodged in cracks.

XIII-3.2 Walls. Walls shall be sealed and painted to provide a glossy, non-porous surface for ease of decontamination. Strippable paints shall be used where unusual contamination problems are known to exist.

XIII-3.3 Ceilings. Ceilings may be hard finish plastered and painted, or acoustical tile.

XIII-3.4 Doors. All radionuclide laboratories shall be equipped with locking doors.

XIII-3.5 Windows. Window treatment will be as required by the functional and aesthetic needs of the area.

XIII-4 ATMOSPHERE

XIII-4.1 Temperature. Temperature shall be controlled at 68^oF ($+ 2^o -0^o$) during heating season, and $78^oF \pm 2^o$ during cooling season.

XIII-4.2 Humidity. As required by materials being handled, with a tolerance of ± 5 % R.H. In the absence of any such special need, humidity should be between 25 and 60% R.H. In winter, 20% may be used if necessary to minimize condensation on cold window surfaces (see Chapter 19 of the ASHRAE Guide)

XII-4.3 Air Filters. Except for laboratories where microbiological or other sensitive work is performed, air filters should be 50% ASHRAE efficiency (55% NBS efficiency).

XIII-4.4 Air Pressure and Flow. Air flow shall be from the non-restricted to the low level restricted to the high level restricted laboratories, not the reverse. Final discharge to the atmosphere is done via the hoods; air from radionuclide restricted laboratories shall not be recirculated through the building

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The hood shall be provided with a vertical sliding door containing a window. For hoods to be used for low energy gamma-emitting radionuclides (e.g., iodine-125), this window shall contain a section fabricated from leaded glass bonded to lucite. For hoods to be used for high energy gamma-emitters, special glass is not required (shielding is accomplished by physically placing lead barriers inside the hood).

Hoods shall be designed to maintain an airflow face velocity of 125 lineal feet per minute with the door opened wide, and should be equipped with a bypass to keep face velocity constant as the door position is changed. If required, approved types of laminar flow hoods may be used for radionuclide work if they are equipped with proper filters.

Hoods should be equipped with switches connected to audiovisual alarms to indicate that air flow has fallen below acceptable levels. In the event of total air failure in the hood, manual or automatic cutoff of the room air supply should be possible to prevent backflow of air from the laboratory to surrounding areas.

Hood ducts from high level restricted radionuclide laboratories may be connected with ducts from other high level radionuclide laboratories, but shall not be interconnected with ducts from regular chemical laboratories. All sheet metal ducts should have soldered seams or be well caulked to prevent leakage.

Exhaust stacks discharging air from high level restricted radionuclide laboratory hoods should extend an optimum height above roof level and be located away form any air intakes; conversely, air intakes should be located away from fume hood exhausts.

Suitable charcoal filters shall be installed on all hood exhaust ducts to minimize or prevent discharge of radioactive material to the environment. Experience in removing radioiodine from hood exhaust air has shown that frequently the manufacturer's recommended charcoal bed depth and flow capacity are inadequate to meet Abbott

requirements. Typically, Abbott is using 2 - 4 times more charcoal per cu. ft. of air than the manufacturer recommends. Following are specifications for the charcoal filters to be used for radiocative applications:

- 1" deep Series FE 24" x 24" cells containing Type 727 charcoal - manufactured by Barneby Cheney Company, Columbus, Ohio. This filter is stocked in the North Chicago Maintenance stockroom as Item no. 40-24-515. (Equivalent charcoal filters from other manufacturers may be substituted if approved by the Corporate Radiation Safety Committee).
- Two of the above cells shall be installed in series for each 500 SCFM of hood exhaust air flow.

Hood fans and all controls shall be designed and constructed to appropriate explosion-proof standards. Minimum classification shall be Class I Division I Group C. Final decision on actual classification must be approved by Corporate Loss Prevention Department.

Because the major part of high level work will be done in the hood, radioactive waste drains should be provided in all hoods located in buildings equipped with liquid waste retention systems.

Various utilities will be needed within the hoods, but controls for these should be located outside the hoods.

Hoods arranged back-to-back and containing multi-millicurie levels of high energy gamma-emitting radionuclides shall have shielding between them. Shielding may also be needed at each end of the hood as well as at the floor and top of the hood in high level radionuclide laboratories using these gamma emitters. This shielding plus lead bricks occasionally placed inside the hood will probably necessitate reinforced hood construction to support the weight.

XIII-4.6 Particulate Matter. A glove or containment box or specially ventilated laboratory area should be provided where dry or dusty radioactive material is handled.

XIII-4.7 Viable Microorganisms. Usually not monitored.

XIII-5 PROCESS EQUIPMENT

In general, requirements shall be defined for individual laboratories. Instrument selection shall consider section 17402, "Selection of Critical Instruments".

All refrigerators and freezers must be modified electrically - usually by the Abbott Maintenance Department - to eliminate or relocate all arcing devices so they are outside the storage chamber, to minimize explosion hazard. See Standard 1813.5.

XIII-6 FURNITURE

Stainless steel bench tops with an elevated lip at all edges are recommended, but stainless steel trays on standard laboratory benches may be used instead.

Sink surfaces should be of stainless steel construction throughout. Each laboratory should have at least one deep sink with foot or knee-operated faucets. Additional cup sinks with conventional faucets will be needed and should also be of stainless steel. Each hood should be equipped with an easily accessible radioactive waste drain which runs to a holding pit or container isolated so that no workers are exposed to a radiation hazard. Pipes from these radioactive waste drains should be constructed without traps and be as leak resistant as possible.

Office and desk space for workers in high level restricted laboratories should not be located in the laboratories in order to minimize exposure of the workers to radiation and radioactive materials.

XIII-7 ILLUMINATION

As provided in the lighting section of the Abbott Electrical Standards.

XIII-8 AUXILIARY SERVICES

Appropriate health physics instruments should be provided for each high level restricted laboratory. Among these instruments are audio monitor ratemeters, portable survey meters and, where applicable, alarm devices or air samplers for detecting and measuring airborne radioactivity.

Various audible and/or visible alarms (redundant systems desirable) should be used in high level restricted laboratories to call the attention of personnel to existing or potential hazards.

a. Level control alarms should be used to provide warning when hot drain receptacles or pits are nearly full.

b. Doors to high radiation areas must be provided with a lock and/or an interlocking alarm system which operates when the door is opened.

c. Hood air flow alarm systems are discussed under paragraph 4.4.

XIII-8 AUXILIARY SERVICES (Contd.)

Although much equipment can, and should, be decontaminated in the laboratory where it is used, an equipment decontamination room may be provided, with a hood, to serve the needs of several high level laboratories.

Animal quarters suitable for metabolic studies with high levels of radioactive material should be provided as necessary to support the work of the high level laboratories. Metabolism cages with containers for collecting excreta should be available. In those cases where radioactive material is present in the air expired by experimental animals, provision must be made to exhaust and discharge this air through a hood, or other, exhaust to remove it from the work areas. A freeze chest should be provided for storage of carcasses and excreta until radioactivity is gone by decay or, for long-half-life radionuclides, the material can be shipped away for burial.

Proximity of shower and change rooms for persons working in high level laboratories is desirable.

CLASSIFICATION OF ISOTOPES ACCORDING TO RELATIVE RADIOTOXICITY PER UNIT ACTIVITY

(The isotopes in each class are listed in order of increasing atomic number)

Class 1 (very high toxicity)

Sr-90 + Y-90, Pb-210 + Bi-210 (Ra D + E), Po-210, At-211, Ra-226 + 55% daughter products, Ac-227, U-233, Pu-239, Am-241, Cm-242.

Class 2 (high toxicity)

Ca-45, Fe-59, Sr-89, Y-91, Ru-106 + Rh-106, I-131, Ba-140 + La-140, Ce-144 + Pr-144, Sm-151, Eu-154, Tm-170, Th-234 + Pa-234, natural uranium.

Class 3 (moderate toxicity)

Na-22, Na-24, P-32, S-35, Cl-36, K-42, Sc-46, Sc-47, Sc-48, V-48, Mn-52, Mn-54, Mn-56, Fe-55, Co-58, Co-60, Ni-59, Cu-64, Zn-65, Ga-72, As-74, As-76, Br-82, Rb-86, Zr-95 + Nb-95, Nb-95, Mo-99, Tc-98, Rh-105, Pd-103 + Rh-103, Ag-105, Ag-111, Cd-109 + Ag-109, Sn-113, Te-127, Te-129, I-132, Cs-137 + Ba-137, La-140, Pr-143, Pm-147, Ho-166, Lu-177, Ta-182, W-181, Re-183, Ir-190, Ir-192, Pt-191, Pt-193, Au-196, Au-198, Au-199, Tl-200, Tl-202, Tl-204, Pb-203.

Class 4 (slight toxicity)

H-3, Be-7, C-14, F-18, Cr-51, Ge-71, Tl-201.

The various types of laboratories or working places required are indicated in the following table:

Radiotoxicity of isotopes	Minimum significant quantity	Type of laboratory or working place required		
		Type C Good Chemical Laboratory	Type B Radioisotope Laboratory	Type A High Level Laboratory
Very high	0.1 uc	10 uc or less	10 uc - 10 mc	10 mc or more
High	1.0 uc	100 uc or less	100 uc - 100 mc	100 mc or more
Moderate	10 uc	1 mc or less	1 mc - 1 c	1 c or more
Slight	100 uc	10 mc or less	10 mc - 10 c	10 c or more

Modifying factors should be applied to the quantities indicated in the last 3 columns of the above table, according to the complexity of the procedures to be followed. The following factors are suggested but due regard should be paid to the circumstances affecting individual cases.

Procedure	Modifying factor
Storage (stock solutions)	x 100
Very simple wet operations	x 10
Normal chemical operations	x 1
Complex wet operations with risk of spills	x 0.1
Simple dry operations	x 0.1
Dry and dusty operations	x 0.01

From SAFE HANDLING OF RADIOISOTOPES, Safety Series No. 1, I.A.E.A, Vienna, 1958.

Form NRC-313I
Abbott Laboratories
North Chicago, Illinois

Attachment I - Items 15, 16, and 17

Radiation Protection Program

Please refer to additional attachments to this section: Abbott Diagnostics Division - Operating Procedures - Radiation Workers, the Corporate Radiation Protection Officer - (R.P.O.) job description which sets forth responsibilities and authority of the R.P.O., and Corporate Radiation Safety Committee (RSC) which describes the RSC operation and responsibilities.

The current members of the RSC are:

Dr. Carl Bodo - Project Manager, Sterilization
Mr. Robert Dal Bello - Operations Manager, Physiologic Diagnostics
Mr. Ronald Fredrickson, Secretary - Corporate Radiation Protection Officer
Mr. George Kinsley - Director, Corporate Loss Prevention
Mr. Ralph Robinson, Chairman - Operations Manager, PPD Production
Dr. Robert Sonders - Manager, PPD Drug Metabolism
Mr. Paul Ward - ADD Health Physicist
Dr. Brockton Weisenberger - Director, Corporate Employee Health Services

Dr. Carl Bodo

Training: B.A. 1963, Gettysburg College (Science)
Ph.D., 1973, Syracuse University (Microbiology)

Parts c. and d. were covered in lectures in the following one-semester courses:

1. Determinative and Physiological Bacteriology at Syracuse University (1967).
2. Virology at Syracuse University (1969).

Experience:

Over three years experience supervising the operation of a 12,500 (nominal) Curie Gammacell 220 radiation sterilizer.

Mr. Robert Dal Bello

Training: B.S., University of Illinois (Mechanical Engineering)
M.B.A., University of Chicago (Marketing)

Parts a. and d. were covered in in-house training at Abbott Laboratories.

Experience:

Ten years experience in manufacture of various radioactive products (radiopharmaceuticals and RIA's) at Abbott Laboratories.

Mr. Ronald Fredrickson, Secretary

Training: B.S., 1950, North Dakota State University (Chemistry)
M.S., 1951, North Dakota State University (Biochemistry)

Parts a., b., c., and d. were covered in the following courses:

1. Basic Isotope Methodology at Abbott Laboratories, conducted by Dr. Arthur Wase, 1961. 15 weeks-one two hour lecture and one four hour laboratory session each week.

2. Basic Radiological Health and Occupational Radiation Protection at Taft Sanitary Engineering Center, Cincinnati, Ohio, 1962.

3. Review Course for American Board of Health Physics Certification Examination at argonne National Laboratory - 26 weeks with one 3 hour lecture each week, 1969 and 1970.

Experience:

Two years laboratory radiosynthetic work at Abbott Laboratories using arsenic-73 and arsenic-74, 1960-1962.

Twenty-three years of applied health physics as Corporate Radiation Protection Officer at Abbott Laboratories, 1962 to present.

Typical amounts of radioactive material handled:

Radionuclide	Maximum Amount	Type of Use
Arsenic-74	30 millicuries	Research
Cesium-137	1 Curie	Instrument Calibration
Hydrogen-3	30 Curies	Waste Disposal
Iodine-131	1 Curie	Waste Disposal
Mercury-203	500 millicuries	Waste Disposal
Iodine-125	1 Curie	Waste Disposal

Mr. George Kinsley

Training: B.S., Chemical Engineering, Drexel University, 1969.
M.B.A., Widener University, 1979.

Certification: Certified Safety Professional, 1978.

Experience: Hands-on experience with small quantities of cesium-137.

Currently Director of Corporate Safety and Loss Prevention at Abbott Laboratories.

Mr. Ralph Robinson, Chairman

Training: M.S., 1950, University of Michigan (Chemical Engineering)
Basic Isotope Methodology course at Abbott Laboratories (1961).

Experience:

Argonne National Laboratory, Reactor Engineering Division, 1951-53.

Dr. Robert Sonders

Training: Ph.D., 1965, St. Louis University (Biochemistry).
Included radiation biology, nuclear theory, counting techniques.

Experience:

Carbon-14 synthetic work at St. Louis University, carbon-14, hydrogen-3, and sulfur-35 radiosynthetic work at Abbott Laboratories. Presently manager of Drug Metabolism, which includes radiosynthesis laboratories.

Mr. Paul T. Ward

Training: B.S., 1976, Lyman Briggs' College, Michigan State University (Biology and Physics).
M.S., 1982, School of Public Health, University of Michigan (Radiological Health).

Experience:

Research Assistant: Dept. of Environmental and Industrial Health, School of Public Health, The University of Michigan. Performed applied research in thermoluminescent dosimetry of mixed beta, gamma and neutron fields. This research was directed by Professors Phillip Plato and C. Glenn Hudson. (3 yrs. 1979-1982)

Dosimetry Consultant: General Public Utilities, Three Mile Island Nuclear Generating Station. Performed applied research regarding the suitability of existing thermoluminescent dosimetry system to post-accident radiological conditions. Made recommendations regarding new dosimetry systems. Assisted on-site dosimetry during containment venting and initial containment re-entry. (6 months, 1980)

Cyclotron Technician: Michigan State University Cyclotron Lab. Performed technical maintainance on the 60 inch, 35 MeV cyclotron and technical development on the 500 MeV superconducting cyclotron. Work was directed by Dr. Henry Blossor, Lab Director, and by Harold Hilbert, Chief Cyclotron Engineer. The MSU Cyclotron is now The National Superconducting Cyclotron Laboratory and is a Dept. of Energy facility. (4 yrs. 1973-1976).

Laser Safety and Hazards Evaluation course sponsored by the Laser Institute of America at San Antonio, TX. (1 week, February 1983).

Typical amounts of radioactive material handled:

Radionuclide	Maximum Amount*	Type of Use
Iodine-125	5 Ci	Waste Disposal
Cesium-137	1 Ci	Instrument Calibration
Cesium-137	100 Ci	Dosimeter Calibration
Cobalt-60	100 mCi	Dosimeter Calibration
Californium-252	5 Ci	Dosimeter Calibration
Promethium-147	100 mCi	Dosimeter Calibration
Thallium-204	100 mCi	Dosimeter Calibration
Strontium/Yttrium-90	100 mCi	Dosimeter Calibration
Plutonium-239	40 mCi	Pu/Be neutrons for Dosimeter Calibration
Sodium-21	unknown	Activated coolant
Zinc-65	unknown	Activated Copper Cyclotron parts
Misc. mixed fission products	unknown	Post-accident reactor coolant samples
Krypton-85	50 kCi	Containment Air Inventory

*Sources are estimated nominal activities

Other RadiationSources

100 kVp X-ray Crystalography Machine	Dosimeter Calibration
300 kVp X-ray Radiation Therapy Machine	Dosimeter Calibration

Personal

Member of the Health Physics Society.

Passed Part I of American Board of Health Physics Certification.

Dr. Brockton L. Weisenberger

Training: M.D., 1957, Indiana School of Medicine.

Certifications: Diplomat of the American Board of Preventive Medicine. Board certified in Occupational Medicine, 1976.

Fellow of the American College of Preventive Medicine.

Fellow of the American Academy of Occupational Medicine.

Fellow of the American Occupational Medical Association.

Ex; -ience:

Has served as consultant to over 190 companies regarding occupational health problems, including many which used x-ray diffraction units, industrial x-ray units, neutron beam welders, etc.

Served on Radiological Advisory Committee of Bartholomew County Hospital in Columbus, Indiana.

Presently Clinical Assistant Professor, University of Health Sciences, Chicago Medical School.

Director of Corporate Employee Health Services at Abbott Laboratories.

Safety Committee Operation

The Corporate Radiation Safety Committee (RSC) meets regularly once each quarter but occasionally meets in special session between the other scheduled sessions. The membership represents each major company area using radioactive material as well as other departments concerned with employee health and safety. Five members constitute a quorum for transacting business; of these five, the Chairman and the Corporate Radiation Protection Officer (or the Abbott Diagnostics Division Health Physicist) must be present. A simple majority vote of the members present, providing there is a quorum, is needed for approval of proposals, etc.

Proposals are made in person by the investigator at a meeting of the RSC. The investigator describes the work to be undertaken, the facilities to be used, the training of the persons doing the work, methods of waste disposal, etc. Based on these considerations the RSC approves or disapproves the proposed use; the pertinent data and action appear in the RSC minutes. In unusual circumstances where rapid action is required, the investigator may circulate the required information to each of the RSC members, and each of these members may sign approval or disapproval of the proposal, returning it to the RSC Secretary for the official record. Action must involve a quorum and a majority decision.

Health Physics Staff

See the attached Position Descriptions for the Abbott Diagnostics Division Health Physicist and our three Radiation Monitors.

Sealed Source Leak Testing

Sealed sources are leak tested by the R.P.O. or a trained Radiation Monitor. All accessible surfaces of the source holder and its surroundings are carefully swabbed with a cotton swab on a stick (e.g., Q-Tip). The swab is counted in a test tube in a gamma scintillation well for cesium-137 sources or in a liquid scintillation counter for nickel-63 sources. Suitable calibrated standards are counted with each set of leak tests in order to determine counter efficiency and express results in microcuries.

Training

All persons whose work requires entry into restricted areas are provided with training. Those persons who merely enter restricted areas but do not handle radioactive material receive non-radiation worker training. This consists of a videotaped presentation (about 15 minutes long) concerning the internal rules derived from our USNRC license. Additionally, these persons receive a copy of our Operating Procedures - Non-Radiation Workers and 10 CFR Parts 19 and 20. Women of childbearing age also are given a copy of Regulatory Guide 8.13, "Possible Health Risks to Children of Women who are Exposed to Radiation During Pregnancy".

Radiation workers, those who handle radioactive material in restricted areas, receive the above (Operating Procedures - Radiation Workers substituted for the non-radiation worker set) plus three videotaped presentations from the University of Indiana, each about 15 minutes long.

The titles of these are:

1. Introduction to Radiation Safety
2. Laboratory Techniques
3. Emergency Procedures

Although many of our radiation workers have good experience with radioactive materials, they are still required to take the training above.

A checklist record of training material is kept for each individual, and a test is given to those persons after training is completed. Copies of both of these are attached.

Radiological Contingency Plan

In accordance with an NRC Order to Modify License dated February 11, 1981 (Docket No. 30-04038), a Radiological Contingency Plan (RCP) was written for Byproduct Material License 12-00621-03 to cover buildings AP-8 and AP-15A. Building AP-8 no longer has iodine-125 in quantity greater than 8 Curies and has been removed from the RCP.

Health Physics Surveys

1. Direct Surveys -

Direct surveys are made once each month in all production iodination laboratories and, at the same time, hood velocities are measured in these high level areas. Other lower level laboratories are surveyed once each month, and hood velocity measurements are made on those units in which radioactive material is used.

2. Smear Surveys -

Smear surveys are made daily in production laboratory areas and once each quarter in the low-level laboratories devoted to other than production operations. We will use as a guide for our action levels for removable surface contamination the values set forth in Table 2 of USNRC Regulatory Guide 8.23, Revision 1, and for uncontrolled release of equipment the levels in Table 3 of that guide.

3. Air Sampling -

Production laboratories are sampled each day for the presence of airborne radioiodine, and other laboratories equipped for iodinations are sampled only when in use (infrequently, in all cases). Sampling is accomplished by passing the air through Barnabey-Cheney charcoal impregnated sample pads (or the equivalent) at a measured rate, usually about 15 liters per minute. The pad is counted and the results evaluated in terms of percent of the restricted area MPCa.

4. Stack Sampling -

All stacks from radioiodination laboratories are sampled continuously using a sampling technique similar to that described in 3, above. Sampling continues for 168 hours (one week) at a rate of 20 liters per minute to 1 cubic foot per minute. Sample pads are counted and the results are evaluated in terms of percent of the unrestricted area MPCa. In order to keep these discharges ALARA, we attempt to maintain them below an annual average discharge of 30% MPCa.

5. Audits -

All laboratories will be audited at least annually by the R.P.O. and/or the ADD Health Physicist. Any deficiencies noted are called to the attention of the users for correction. Audits include adherence to license conditions, NRC regulations, and good work practice. Hood velocities are also measured at the time the audit is conducted.

6. State of the Program -

By means of bimonthly reports from the ADD Health Physicist and monthly reports from the R.P.O., the RSC is kept informed on a timely basis of the successes or problems in the radiation protection program. Therefore, no overall annual report is prepared for the RSC; however, annual stack discharges, annual waste disposal (liquid and solid), and the annual personnel exposure report to the NRC are provided to the RSC members.

7. Close-Out Surveys -

For unrestricted release of laboratory facilities we will use the Acceptable Surface Contamination Levels in Table 1 of USNRC "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, Source, or Special Nuclear Material" (July 1982).

May 10, 1985

CORPORATE RADIATION SAFETY COMMITTEE (RSC)

CHARTER

"THIS COMMITTEE IS TO DIRECT ITSELF TO THE MAJOR POLICY AND PHILOSOPHIC QUESTIONS AND PROBLEMS INVOLVING RADIOACTIVITY, TO SERVE AS THE MONITOR UNDER ALL CORPORATE AEC LICENSES OR LAWS APPLICABLE NOW OR IN THE FUTURE, TO REVIEW PRACTICES NOT SPECIFICALLY COVERED BY LICENSE OR LAW, AND TO WORK WITH SPECIFIC OPERATING MANAGEMENT AS MAY BE APPROPRIATE." (PER DIRECTIVE BY P. GERDEN, MARCH 26, 1968)

RESPONSIBILITIES

- TO ESTABLISH POLICY FOR AND ASSURE PROCEDURES ARE DEVELOPED TO PROTECT THE HEALTH AND SAFETY OF INDIVIDUALS WORKING WITH RADIO-ACTIVE BYPRODUCT MATERIAL OR OTHER SOURCES OF IONIZING RADIATION.
- TO ESTABLISH POLICY FOR AND ASSURE PROCEDURES ARE DEVELOPED TO PREVENT CONTAMINATION OF THE ENVIRONMENT THROUGH WASTE DISPOSAL OR RELEASE TO THE ATMOSPHERE OR AIR.
- TO ASSURE COMPLIANCE WITH GOVERNMENT REGULATIONS. (FEDERAL AND STATE)
- TO REVIEW AND APPROVE SPECIFIC WORK PROCEDURES AND TECHNIQUES WHICH MUST BE DEVELOPED BY OPERATING AREAS. THESE PROCEDURES WILL BE COMMUNICATED EDUCATIONALLY TO EMPLOYEES AS JOB REQUIRE-MENTS BY THE OPERATING GROUP.
- TO MAINTAIN AN AWARENESS OF PROBLEMS, QUESTIONS, AND OPERATING ACTIVITY THROUGH THE COMMUNICATING REPORTS OF THE RADIATION PROTECTION OFFICER, (RPO), SO THAT THE RSC CAN RESPOND TO RE-PORTED FACTS.

COMMITTEE OPERATION

- THE OFFICIAL FILES OF THE RSC WILL BE MAINTAINED BY THE RPO. THIS INCLUDES MINUTES OF MEETINGS, REPORTS, CORRESPONDENCE AND THE LICENSE DOCUMENTS.

- The Chairman and members of the RSC are approved through the office of the Vice-President, Personnel, and the Division Vice-President supplying the appointee.
- The RSC is dependent upon divisional management to study proposals, suggest courses of action, and to adopt the RSC's recommendations.

An Abbott Diagnostic Division Radiation Safety Committee (ADD-RSC) has been formed for these purposes related to the RSC:

- To monitor licensed activity and related RSC policy within this Division.
- To examine personnel survey readings and prepare responses for RSC as needed.
- To review environmental readings.
- To adopt RSC recommendations.
- To evaluate new product procedures for radiation hazards and report to RSC.
- To be aware of and participate in inspection activities by NRC and state representatives.

The RSC believes this ADD-RSC is a responsive step in moving our concerns closer to the operational scene. However, the RSC cannot delegate its responsibility, but it can improve its vision, understanding and response through the co-operation of the ADD-RSC.

R. L. Fredrickson
Secretary, Corporate Radiation Safety Committee

ABBOTT DIAGNOSTICS DIVISION

OPERATING PROCEDURES - RADIATION WORKERS

Byproduct Material License 12-00621-03

I. GENERAL PROVISIONS

A. Purpose

To provide standards of conduct relative to radiation safety for persons working in or entering restricted areas. Standards of conduct for nonradiation workers who work in restricted areas are covered in another set of operating procedures.

B. Each individual radiation worker must understand the operating procedures set forth below, and put them into practice in his work, in order to ensure safety for himself and his fellow workers.

C. Supervisory personnel must ensure safety of all operations by correcting any infractions of these operating procedures by their employees.

II. DEFINITIONS

A. Personnel

1. A nonradiation worker is any person who does not work with or handle radioactive material but who may enter or work in restricted areas where ionizing radiation exists.

2. A radiation worker is any person who may enter or work in radioactive material in any form.

B. Area*

1. A Red Restricted Area is one in which radioactive material is used in open or loose form in any quantity greater than the following:

Radionuclide	Quantity
Iodine-125	0.2 millicurie
Iron-59	0.2 millicurie
Cobalt-57	1 millicurie
Phosphorus-32	1 millicurie
Carbon-14	5 millicuries
Sulfur-35	5 millicuries
Hydrogen-3	25 millicuries

Limits for other radionuclides will be established by the RSC as necessary, based on considerations of the type of radiation, hazard of the radiation, and radiotoxicity of the nuclide.

2. A Yellow Restricted Area is one in which radioactive material is transported through in closed or sealed form in quantities greater than specified in 1, above, defining a Red Restricted Area.

3. A Green Restricted Area is one in which radioactive material is used in quantities less than those which define a Red Restricted Area.

* The ADD Radiation Safety Committee has the authority to take exception to the following definitions with a majority agreement and the subsequent approval of the Corporate Radiation Safety Committee.

III. AREAS AND AREA CONDUCT

A. Area Designation

1. Restricted areas are classified into three categories and posted with signs of the appropriate color:

   a. Green
   b. Yellow
   c. Red

2. Other posting required by NRC regulations will accompany these area-designating signs, as applicable. These areas may be posted as follows:

   a. Caution - Radiation Area
   b. Caution - High Radiation Area
   c. Caution - Radioactive Material
   d. Caution - Airborne Radioactivity Area

   Areas not so marked are unrestricted. In some cases these may be marked with a sign "Radioactive Material is not permitted in this area".

B. Area Access

1. All restricted areas may be entered by authorized employees as their work requires. Women with suspected or confirmed pregnancies will be permitted in restricted areas if their radiation exposure is kept at less than 10% of applicable limits, external or internal. Women of childbearing age will sign a pregnancy agreement when hired, if their work requires them to enter restricted areas.

2. No employee under 18 years of age will be permitted to be exposed occupationally to ionizing radiation greater than 10% of the limits specified in 10CFR Part 20.

3. Visitors under 18 years of age will not be permitted to enter a Yellow or Red Restricted Area.

4. Visitors entering Yellow or Red Restricted Areas must be escorted by, or authorized to enter by, staff personnel who may further require them to wear lab coats, shoe covers, and hats.

C. Restricted Area Conduct

1. Green Restricted Areas

   a. The area is posted as a Green Restricted Area.

   b. Smoking, eating, and drinking in Green Restricted areas are not specifically prohibited but will be allowed only at desks, not where radioactive material is handled.

   c. This area must be separated from a Red Restricted Area by means of a door that can be closed plus a full height wall.

   d. Personnel monitoring should be performed before entry into a Green Restricted Area from a Red Restricted Area.

   e. All personnel working in this area will be adequately instructed in accordance with 10CFR 19.12.

2. Yellow Restricted Areas

   a. This area is posted as a Yellow Restricted Area.

   b. Workers and visitors will wear designated monitoring equipment.

   c. Clothing, shoes and hands should be monitored when leaving a Yellow Restricted Area. Persons finding contamination should decontaminate by using soap, water, and, if necessary, a brush. If the contamination resists decontaminating procedures, notify Health Physics promptly. Persons finding shoe contamination which cannot be accounted for, i.e., known or suspect spills, must report to the Health Physics Office or to supervisory personnel immediately after decontamination.

   d. There is no eating, drinking, or smoking allowed in a Yellow Restricted Area, but personnel may carry food and beverages through the area to a Green Restricted or Unrestricted Area.

   e. All personnel working in Yellow Restricted Areas will be adequately instructed in accordance with 10CFR Part 19.12.

   f. This area must be separated from a Red Restricted Area by a clear and defined boundary.

   g. Any potentially radioactive equipment to be transferred from a Yellow Restricted Area to an unrestricted area must be checked by Health Physics for contamination.

3. Red Restricted Areas

   a. This area is posted as a Red Restricted Area.

   b. All workers and visitors will wear monitoring equipment provided.

   c. Clothing, shoes and hands must be monitored when leaving a Red Restricted Area. Persons finding contamination should decontaminate by using soap, water, and, if necessary, a brush. If the contamination resists decontaminating procedures, Health Physics must be notified immediately. Persons finding shoe contamination which cannot be accounted for, i.e., known or suspect spills, must report to the Health Physics Office immediately after decontamination.

   d. There is no eating, drinking, or smoking allowed in a Red Restricted Area and no carrying of food or beverages through a Red Restricted Area.

   e. All personnel working in Red Restricted Areas will be adequately instructed in accordance with 10CFR Part 19.12.

   f. Any equipment to be transferred from a Red Restricted Area to an unrestricted area must be checked by Health Physics for contamination.

   g. Gloves, masks, caps, shoe covers, glasses, long-sleeved shirts or lab coats, or other protective garments, are to be worn as indicated by the work and the condition of the work area. The minimum clothing requirement is a lab coat to be worn over street clothes for persons working with radioactive material in a Red Restricted Area.

   h. Health Physics must be notified prior to a physical entry by any person into a hood where radioactive material is present. Health Physics must be notified prior to decontamination of hoods so that suitable monitoring may be done and necessary protective clothing and equipment designated.

   i. Persons working in Red Restricted Areas must place their film badge in the designated rack before leaving the facility after work.

4. All company uniforms and clothing worn by radiation workers must be checked for contamination before being sent to the laundry.

D. Area Contamination

1. Smear testing will be carried out as appropriate in all areas. Health Physics will notify supervisory personnel responsible for the areas if the values listed below are exceeded so they may take appropriate action.

2. Removable contamination guides for the various work areas are as follows:

Unrestricted Area	100 dpm/ft^2
Green Restricted Area Floors	2,000 dpm/ft^2
Yellow Restricted Area Floors	2,000 dpm/ft^2
Red Restricted Area Floors, Benches, Counters	10,000 dpm/ft^2

IV. PERSONNEL MONITORING

A. All personnel will wear radiation exposure monitoring devices provided.

1. All persons who regularly work in Red Restricted Areas will be provided with film badges. Other persons-visitors, transient workers, etc. - will be provided with film badges or other suitable monitoring devices, if they enter Red Restricted Areas for over eight hours per week.

a. Film badges should be worn exposed on the upper part of the body (e.g., shirt pocket, lab coat pocket, collar) by all entrants to restricted areas and must be worn in this manner by those persons actually working with radioactive material.

b. Film badges and other dosimeters must not be left in Red Restricted Areas when not in use. Workers in unrestricted or Green Restricted Areas may leave them in their desks; other workers must leave them at designated locations.

2. Wrist badges or other suitable extremity monitoring equipment will be issued to those persons using or handling quantities of radioactive material which may cause extremity exposures in excess of 10% of the quarterly limit.

a. The wrist badge must be worn on the inside of the wrist of the arm most used (for this purpose, right-handed persons should wear it on the right wrist and left-handed persons on the left wrist).

3. Other monitoring devices may be used from time to time for special purposes and must be worn as directed. This may include thermoluminescent dosimeters, chirpers, breathing zone samplers, and others.

B. All persons will be monitored for internal exposure as their work indicates.

1. Thyroid counting will be done for persons working with radioiodine, or potentially exposed to airborne radioiodine. The frequency of thyroid counting will be varied according to the probability of internal exposure.

2. Counting of urine, feces, nose swabs, etc., for radioactive material may be necessary after possible ingestion, inhalation, or absorption of radionuclides, or after the measurement of an appreciable body burden of a radionuclide.

3. Whole body counting may be required from time to time to provide or compare measurements of internal exposure.

C. Exposure Guidelines

To provide appropriate communication to operating management, a series of Abbott guidelines have been selected. Health Physics will provide reports accordingly.

	Abbott Reportable	NRC Reportable
Film Badge	150 Mr/week	Not applicable
Film Badge (Gamma)	1.7 Rem: 2.0 Rem*	3.0 Rem*
Film Badge (Beta + Gamma)	2.75 Rem*	7.5 Rem*
Wrist Badge (Beta + Gamma)	9.0 Rem: 12.0 Rem*	18.75 Rem*
Thyroid	50%; 66%	520 MPC-hours*

*Per Quarter

V. WASTE DISPOSAL

All radioactive waste must be retained and taken to a waste holding room for proper disposal. Please refer to Operating Procedures - Radioactive Waste Disposal for more complete instructions on this subject.

VI. TRAINING

A. At time of starting employment, radiation workers will have Health Physics training on responsibilities involved and safety procedures to be observed before working with radionuclides. All radiation workers will receive further on the job training by qualified, designated workers commensurate with the safety precautions and skills required to work safely with radionuclides.

VII. EMERGENCY PROCEDURES (Does not apply to building AP-15A, which is covered under a separate Radiological Contingency Plan).

EMERGENCY PLANS for building evacuation have been prepared for all North Chicago and Abbott Park locations of ADD laboratories.

At any time that the building evacuation alarm sounds, these plans are to be followed by all persons except those required to survey and restore the operational status of the building. In emergency situations where the evacuation alarm does not sound, please observe the following instructions:

A. Fire

1. At first detection of a fire, activate one of the alarms located in the building. Become familiar with the location of the alarm nearest your work area.

2. For small fires, particularly where radioactive material is not present, attempt to extinguish with one of the extinguishers located in the building after you have sounded the alarm. Become familiar with the location of the extinguisher nearest your work area.

3. For large fires, or fires in areas where radioactive material is present, sound alarm but do not attempt firefighting without wearing respiratory protective equipment. If a fire is out of control, beyond your firefighting ability, or you do not have protective equipment, evacuate the building by a safe exit and reassemble as instructed.

4. If a fire is preceded by an explosion, or if an explosion occurs without a fire, take action as described above, but be sure that no injured persons are left behind.

5. Reentry into the building will be authorized only by Health Physics or a Department Manager. Permission to leave the evacuation assembly point must also be given by Health Physics or a Department Manager.

B. Hood Alarms

1. If the hood airflow alarm bell and light above any hood are activated, evacuate the laboratory, first closing the hood door if possible. Hold your breath. Notify Health Physics and your supervisor immediately. The hood alarm may be accompanied by a warning blast from the central annunciator panel if a system failure has occurred.

2. Reentry to the affected area must have the approval of Health Physics or Department Manager.

C. Annunciator Panel

1. Remain in your work area when the annunciator panel sounds unless other alarms (such as the hood airflow warning) indicate a problem where you are working. Health Physics, your supervisor, or the building evacuation alarm will notify you if further action on your part is necessary.

D. Power Failure

1. At any indication of power failure, failure of all electrical utilities and equipment, close hood doors, if possible; hold your breath and leave the building by the nearest exit and reassemble as instructed. Remain calm. Emergency battery-powered lights will come on with the interruption of electrical service.

2. Reentry into the affected areas must have the approval of Health Physics or a Department Manager. Permission to leave the evacuation assembly area must also be obtained from Health Physics or a Department Manager.

E. Spills of Radioactive Material

1. If you have a spill of radioactive material such that severe contamination of the area or persons in the area may result, notify Health Physics or your Supervisor immediately.

   a. Isolate the contaminated area by closing doors, going no farther than necessary to protect yourself from further contamination, ingestion, inhalation, or external exposure. Notify persons mentioned above by telephone or by another person who is not contaminated. Do not spread contamination by leaving the area or permitting other persons to enter before cleanup is completed.

   b. If you are not in the area affected by the spill, keep out unless you are asked by Health Physics or your Supervisor to help in decontamination.

F. Injuries and Severe Personal Contamination

1. Any cuts or scrapes incurred at work should be reported immediately to Health Physics so that the wound can be checked for contamination. Cuts or bruises, regardless of where they happened, must be reported if they prevent the wearing of gloves or other protective equipment.

2. Any contamination about the face or hair must be reported immediately to Health Physics or your Supervisor for evaluation and cleanup.

3. Hand and skin contamination, other than about the face, must be reported to Health Physics or your Supervisor if it resists normal decontamination efforts.

4. As an aid to discovering personal contamination, workers in Red Restricted Areas should monitor themselves frequently during the work day, using the monitoring equipment provided in the various work areas. Before going home, all designated workers must survey themselves with suitable equipment.

VIII. PROPER USE OF EQUIPMENT

A. Ventilation

1. Many fume hoods are designed to provide adequate airflow only when closed to 16 inches or less face opening. As much as possible keep the doors closed to this level. This rule does not apply to hoods which have been modified by the addition of a Lucite or leaded glass panel to restrict the face opening.

B. Remote Handling Devices

1. Tongs, airplane fingers, etc., should be used whenever possible to reduce hand exposure when handling reaction vessels, control samples, or other radioactive sources.

C. Pipetting

1. Radioactive material should never be pipetted by mouth. Use pipettor bulbs or other appropriate equipment to provide suction for transfer.

Adopted by the Corporate Radiation Safety Committee on April 24, 1985.

POSITION DESCRIPTION

TITLE: CORPORATE RADIATION PROTECTION OFFICER (RPO)

DEPARTMENT: EMPLOYEE HEALTH SERVICES

NATURE AND BACKGROUND:

The Employee Health Services Department is responsible for evaluation, protection, maintenance and even the enhancement of the health of all Abbott employees, national and international, particularly as related to their work, work environment, product integrity, and job stresses, and also to show due regard for varied aspects of their personal welfare. To accomplish this goal, a comprehensive program of preventive medicine, environmental control, treatment, and health education is provided. The department is divided into three sections - Medical, Biohazards, and Health Physics. All section heads of the department report to the Corporate Director of Employee Health Services.

Health Physics designates a broad program of preventive medicine designed to protect the Health of employees who may encounter radiological hazards (ionizing radiation from x-ray machines and radioactive materials; non-ionizing radiation from lasers) in their work environment, be it laboratory, production area, or in the field. The Health Physics Section is responsible for the evaluation and control of environmental and occupational ionizing radiation, promotion of good work practices in the use of radiation-producing equipment and radionuclides, safe operation of laser units, and enforcement of all pertinent local, state, and federal regulations in these areas. This work is carried out at North Chicago, Abbott Park, and all other corporate locations as necessary.

The Company has only one RPO whose position is a legal requirement of our Nuclear Regulatory Commission (NRC) Byproduct Material Licenses. A Health Physicist, three Radiation Monitors, and a Health Services assistant report to the RPO. The objectives of the RPO are to effect whatever training of personnel is necessary to accomplish the Section objectives and to maintain strict adherence to all internal regulations and legal requirements. Training may be accomplished by means of lectures, by consultations with individual employees, or by videotape.

The Abbott Laboratories Corporate Radiation Safety Committee (RSC), of which the RPO is the Secretary, is charged with the responsibility for proper conduct of all operations involving ionizing radiation. Much of the work of the Health Physics Section is determined by RSC or legal requirements related to evaluation of ionizing radiation hazards and their control. Special assignments may be made by the RSC, the Director of Corporate Employee Health Services, or by the needs of individual radiation workers with special problems regarding hazards, work techniques, or equipment.

Most assignments or operations used in carrying out the Section objectives begin with instrumental measurements and data gathering. Hazard control begins with hazard evaluation, and the Health Physics Section must measure personnel radiation exposure, work-area radiation fields, air concentrations of radioactive material, personnel contamination, area contamination, and environmental concentrations of radioactive material.

From the evaluations, corrective measures may be proposed, then implemented, in order to minimize or eliminate hazards. This solution may range from something as simple as using lead bricks for shielding to the evaluation of, and recommendation for changes in, a complex air filtration system. The solution may also involve changing an individual's equipment or work techniques if they are deemed unsuitable for the job.

Extensive record-keeping for all the measurements mentioned is required to satisfy the laws relating to our Byproduct Material Licenses. These records require calculations, analysis, and interpretation on the part of the RPO. All such records must be available for scrutiny by NRC representatives or by state inspectors. These persons, during an inspection, may make independent measurements to confirm the accuracy of our records, techniques, and instruments.

RPO duties which indirectly help achieve our objectives are control of radioisotope purchases, checking packages upon receipt, and maintaining an inventory of quantities on hand. Included is the receipt and retention of all radioactive waste until final disposition is arranged. These all relate to our accountability to the NRC for byproduct material which we have received, including control or prevention of its release to the environment.

ADMINISTRATIVE:

The Health Physics Section of the Employee Health Services Department is under the supervision of the RPO. Reporting directly to the RPO is the ADD Health Physicist, who serves as acting RPO in the absence of the RPO. Two Radiation Monitors are directly responsible to the ADD Health Physicist, and one Radiation Monitor and the Health Services Assistant report directly to the RPO. (See attached Section organizational chart).

A separate budget account is set up within the Employee Health Services Department to accomodate the needs of the Health Physics Section for supplies. The RPO has input on the amount of money needed to carry out the goals of the Section, and the responsibility to remain within budgeting limits.

KNOW HOW:

The formal training of the RPO will be a Ph.D. in Radiological Health or the equivalent in training and experience. In all cases the minimum requirement will be a Master's degree in a life science and at least six years of experience in the special areas of health physics and radiological health or certification by the American Board of Health Physics. This position requires a sound knowledge of nuclear physics, lasers, radiobiology, and methods of radiation detection and measurement so that hazards can be measured, interpreted and controlled. Enforcing the legal provisions surrounding our work with ionizing and non-ionizing radiation is a type of police function and involves tactful relationships with a variety of people. Implicit here is the matter of communication, oral and written, with the RSC, government regulatory agencies, the Health Physicist, Radiation Monitors, Health Services Assistant and, at various times, with many radiation workers of different educational levels. The RPO's knowledge and experience make frequent contributions in consultations with design and ventilation engineers, research workers in various Abbott divisions, the safety department, and production managers. The RPO must apply his abilities in health physics to a variety of problems with insight and ingenuity. He must be responsive to emergency duties for which he is constantly on call.

PROBLEM SOLVING:

The principal problem of the RPO is evaluating data relating to radiological health, followed usually by the more difficult problem of taking corrective action. This latter problem frequently involves persuasion and tactful firmness while dealing with individuals - - - for example, convincing a production manager that he must approve a costly change or an employee that his work habits need to be improved. The use of ionizing and non-ionizing radiation is growing rapidly, and new techniques grow simultaneously. Keeping abreast of these as they apply to health physics work is another problem requiring continuous attention on the part of the RPO.

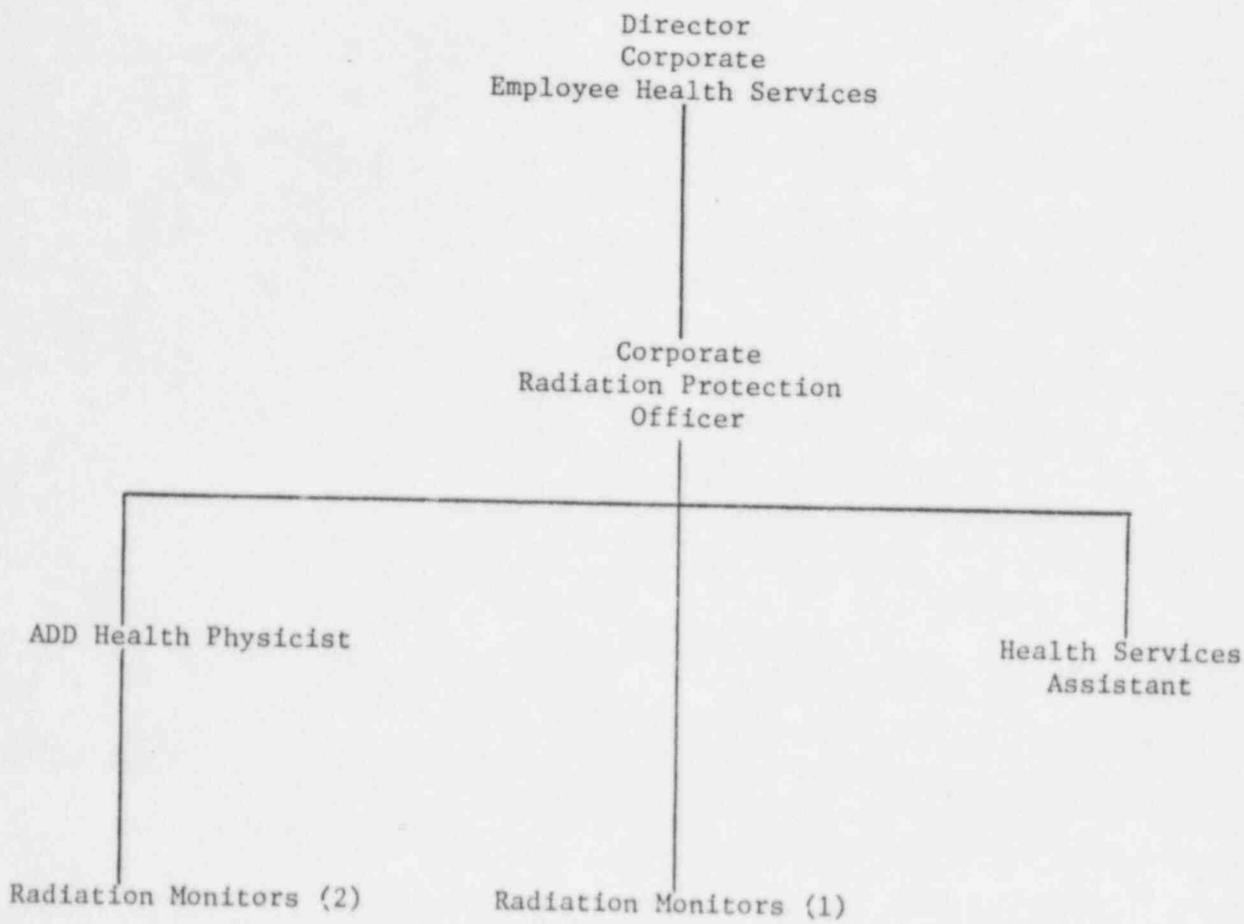
ACCOUNTABILITY:

The RPO is accountable to the Director of Corporate Employee Health Services, the RSC, and a number of federal and state regulatory agencies for the safety of operations involving ionizing radiation or lasers and the protection of the health of workers exposed to them.

R. L. Fredrickson

Corporate Radiation Protection Officer

June 21, 1984


Director
Corporate
Employee Health Services
Corporate
Radiation Protection
Officer
ADD Health Physicist
Health Services
Assistant
Radiation Monitors (2)
Radiation Monitors (1)

POSITION DESCRIPTION

TITLE: Abbott Diagnostics Division Health Physicist (HP)

DEPT.: Corporate Employee Health Services

NATURE AND BACKGROUND:

The Corporate Employee Health Services Department is responsible for evaluation, protection, maintenance, and even the enhancement of the health of all Abbott employees, national and international, particularly as related to their work, work environment, product integrity, and job stresses, and also to show due regard for varied aspects of their personal welfare. To accomplish these goals, a comprehensive program of preventive medicine, environmental control, treatment, and health education is provided. The department is divided into three sections: Medical, Biohazards, and Health Physics. All section heads report to the Corporate Director of Employee Health Services.

Health Physics designates a broad program of preventive medicine designed to protect the health of employees who may encounter radiological hazards (ionizing radiation from X-ray machines and radioactive materials; non-ionizing radiation from lasers) in their work environment, be it laboratory product area, or in the field. The Health Physics Section is responsible for the evaluation and control of environmental and occupational ionizing radiation, promotion of good work practices in the use of radiation-producing equipment and radionuclides, safe operation of laser units, and enforcement of all pertinent local, state, and federal regulations in these areas. This work is carried out at North Chicago, Abbott Park, and other Corporate locations in the United States and Puerto Rico as necessary.

The company has one HP responsible for health physics aspects of Abbott Diagnostics Divisio (ADD) operations at Abbott Park, who has two radiation monitors reporting to him. The HP objectives are to provide training to personnel as necessary to accomplish section objectives, and to maintain strict

adherence to internal regulations and legal requirements relating to the Nuclear Regulatory Commission (NRC). Training may be accomplished by means of lectures, by consultation with individual employees, or by use of videotaped lectures.

The Abbott Diagnostics Division Safety Committee (ADD-RSC), of which the HP is a member, acts as an interim deliberative body on behalf of the Corporate Radiation Safety Committee (RSC), deferring to the RSC those problems which it is unable to resolve. All actions of the ADD-RSC are reviewed by the RSC, and there is communication between the two committees by means of meeting minutes and liaison members belonging to both groups. Special work assignments for the HP may be made by the RSC or ADD-RSC, the Director of Corporate Health Services, the Corporate Radiation Protection Officer (RPO), or by the needs of individual radiation workers with special problems regarding hazards, work techniques, or equipment.

Most assignments or operations used in carrying out the Section objectives begin with instrumental measurements and data gathering. Hazard control begins with hazard evaluation, and the HP and his Radiation Monitors must measure personnel radiation exposure, work area radiation fields, air concentrations of radioactive materil, personnel contamination, area contamination, and environmental concentrations of radioactive material. From the evaluations, corrective measures may be proposed, then implemented in order to minimize or eliminate hazards. Solutions may involve changing an individual's equipment or work techniques if they are deemed unsuitable for the job.

Extensive record-keeping for all the measurements taken is required to satisfy the regulations relating to our Byproduct Material License. These ADD records require calculations, analysis, and interpretation on the part of the HP and must be available for scrutiny by the NRC or State of Illinois inspectors. These persons, during an inspection, may make independent measurements to confirm the accuracy of the records, techniques, and instruments.

EXPERIENCE:

The formal training of the HP will be a Master's degree in Radiological Health or the equivalent in training and experience. In all cases the minimum requirement will be a Bachelor's degree and at least six years of experience in the special areas of health physics and radiological health. This position requires a sound knowledge of nuclear physics, radiobiology, and methods of radiation detection and measurement so that hazards can be measured, interpreted, and controlled. Enforcing the legal provisions surrounding our work with ionizing radiation is a type of police function and involves tactful relationships with a variety of people. Implicit here is the matter of communication, oral and written, with the RSC and ADD-RSC the RPO, Radiation Monitors, and, at various times, with many radiation workers of different educational levels. The HP must apply his abilities in health physics to a variety of problems and must be responsive to emergency duties for which he is constantly on call.

PROBLEM SOLVING:

The principal problem of the HP is evaluating data relating to radiological health, followed usually by the more difficult problem of taking corrective action. This latter problem frequently involves persuasion and tactful firmness while dealing with individuals---for example, convincing a manager that he must approve a costly change or an employee that his work habits need to be improved.

ACCOUNTABILITY:

The HP is accountable to the RPO and through the RPO, to the Corporate Direc of Employee Health Services; and to the ADD-RSC and RSC. In the absence RPO from North Chicago, the HP reports directly to the Corporate Director o. Employee Health Services and has the full authority and responsibility of RPO.

April 25, 1985

POSITION DESCRIPTION

TITLE: Radiation Monitor

DEPT.: Employee Health Services

REPORTS TO: Corporate Radiation Protection Officer and the ADD Health Physicist

REPORTING TO THIS POSITION: No one

PRIMARY FUNCTION:

Make measurements and calculations appropriate to protection of personnel and the environment from the effects of ionizing radiation. Handle details pertinent to proper disposal of radioactive waste, both solid and liquid. Assure compliance with government regulations and licenses for use of radioactive material.

DUTIES PERFORMED:

Generally with minimal supervision, the Radiation Monitor performs and or all of the following duties:

1. Evaluates radioactivity discharged to the sewer by liquid waste concentrator.

2. Prepares dry radioactive waste for shipment and solidifies liquid radioactive waste so that it can be similarly handled. This preparation includes packaging, estimation of radioactivity in each barrel, and proper labelling of contents.

3. Prepares radioactive waste, liquid and solid, from various buildings at North Chicago and Abbott Park for transport to the compactor and concentrator at Building AP-8, and the waste storage area of AP-15A.

4. Checks contamination and radiation levels in restricted radionuclide laboratories by the use of smears and by the use of suitable instruments, e.g., Geiger counters.

5. Measures levels of airborne radioactivity in restricted radionuclide laboratories by the use of appropriate air sampling methods. Monitors airflow in fume hoods to make certain that proper control of airborne radioactivity is maintained.

6. Checks daily trash accumulation with a suitable radiation detector to make sure that radioactive material is not accidentally released to the environment.

7. Takes periodic sewer samples to ascertain that we are not discharging excessive concentrations of radioactive material.

8. Distributes film badge monitors to persons working with radioactive material so that external radiation exposure can be evaluated. By urinalysis methods and thyroid uptake measurements (for radioiodine), evaluates internal exposure of persons working with radioactive material.

9. Observes work practices and adherence to rules and regulations of persons working with radioactive material.

10. Performs semi-annual leak tests on sealed sources of radioactive material as required by federal regulations.

11. Ships radioactive material (excluding shipments from ADD) from Abbott in accordance with all applicable regulations. Receives incoming radioactive material shipments for monitoring as required by federal regulations. Keeps inventory of radioactive material on hand (excluding ADD inventory).

12. Supervises cleanup of spills of radioactive material until suitable radiological health conditions are restored.

13. Responds to various after-hours emergency calls involving equipment failures or malfunction, spills of radioactive material, transportation emergencies, etc. Works independently under these circumstances.

14. Perform other related duties as assigned. May, in the absence of the Corporate Radiation Protection Officer and the Health Physicist, have to accept responsibility for the overall health physics operation on a temporary basis.

KNOWLEDGE AND EXPERIENCE REQUIRED:

High school graduate, preferably with science and mathematics courses and some related course work beyond high school. Up to two years of on-the-job training may be necessary before the individual is considered fully productive and able to work independently. Must be able to deal with people diplomatically but forcefully.

PROBLEMS ENCOUNTERED:

1. Directing cleanup of spills of radioactive material.
2. Checking malfunctioning equipment at any time of the day or night.
3. Directing cleanup of workers contaminated with radioactive material.
4. Making accurate calculations and keeping supporting records for government inspection.
5. Using the new Flow Gemini computer system for information storage and retrieval.

These are the direct responsibility of the Radiation Monitors although they may at times be under the direction of professionals.

MENTAL AND PHYSICAL EFFORT AND ENVIRONMENT:

Must handle heavy waste barrels (up to several hundred pounds). Must climb ladders to roofs and down into pits. Must smear work surfaces, take air samples, and direct cleanup of spills in laboratories using infectious (biohazardous) materials. Must work in hot environment (no air-conditioning) of AP-15A waste storage, which is also from time to time subject to dumping of very malodorous liquid and/or solid wastes.

R. L. Fredrickson

RLF:kc

February 6, 1985

ABBOTT DIAGNOSTICS DIVISION (ADD)

HEALTH PHYSICS TRAINING CHECKLIST

COURSE NAME RADIOLOGICAL SAFETY

METHOD OF INSTRUCTION

VIDEO TAPE________

LECTURE__________

NAME________________________

DEPT.________________________

NRC LICENSE NO. 12-00621-03

RADIATION WORKER

TOPIC	DATE	BY
1. Atomic Theory		
2. Radioactivity and Radiation definitions, types, properties, ALARA, etc.	______	______
3. Biological Effects of Radiation	______	______
4. Personnel and Area Radiation Monitoring Procedures	______	______
5. External and Internal Radiation Protection	______	______
6. Contamination Control and Decontamination Procedures	______	______
7. Radiological Signs and Labels	______	______
8. General Radiological Protection Procedures	______	______
9. Copy and Review of ADD Radiation Worker Operating Procedures	______	______
10. Copy of Radwaste Handling Operating Procedures	______	______
11. Copy and Review of NRC Regulations 10CFR 19 and 10CFR 20	______	______
12. Copy of NRC Regulatory Guide 8.13	______	______

ADDITIONAL TRAINING/RETRAINING

______________________________	______	______
______________________________	______	______
______________________________	______	______

NON-RADIATION WORKER

TOPIC	DATE	BY
1. Radioactivity and Radiation definitions, units, ALARA, etc.	______	______
2. Biological Effects of Radiation	______	______
3. Personnel and Area Radiation Monitoring	______	______
4. Radiation and Contamination Control and Decontamination	______	______
5. Radiological Signs and Labels	______	______
6. General Radiation Protection Techniques	______	______
7. Copy and Review of ADD Non-Radiation Worker Operating Procedures	______	______
8. Copy and Review of NRC Regulations 10CFR 19 and 10CFR 20	______	______
9. Copy of NRC Regulatory Guide 8.13	______	______

ADDITIONAL TRAINING/RETRAINING

______________________________	______	______

Name____________________

Dept._____ Bldg.________

Date____________________

RADIOLOGICAL SAFETY

TRAINING QUIZ

INSTRUCTIONS: Answer all the questions. There is at least one right answer. There may be more than one right answer.

1. Who regulates the possession and use of radioactive materials?
   - a. The Bureau of Radiological Health (BRH).
   - b. The Food and Drug Administration (FDA).
   - c. The Nuclear Regulatory Commission (NRC).
   - d. Federal Bureau of Investigation (FBI).
   - e. Central Intelligence Agency (CIA).

2. How many people have ever been injured by radiation at Abbott's?
   - a. NONE
   - b. 1 - 10
   - c. 11 - 15
   - d. 16 - 20
   - e. 21 or more

3. Who has to wear film badges in restricted areas?
   - a. Production Personnel
   - b. Security Personnel
   - c. Visitors
   - d. Maintenance Personnel
   - e. All of the above

4. If you have to take a visitor into a restricted area you should:
   - a. Sign them in at a visitors station.
   - b. Issue them a visitors film badge.
   - c. Escort them while they are in the restricted area.
   - d. Monitor them and yourself when leaving the restricted area.
   - e. All of the above.

5. Which scale should the radiation monitor be set on when you are using it to monitor youself for contamination?
   - a. Off
   - b. Batt.
   - c. X1000
   - d. X100
   - e. X10
   - f. X1

6. What should you do if the alarm goes off while you are monitoring yourself for contamination?

   a. Run out of the building.

   b. Scream and shout for help.

   c. Turn off the alarm and sneak out before anybody sees you.

   d. Turn off the alarm and stay where you are.

   e. Ask somebody else to call health physics for assistance.

7. When you are in a Green Restricted Area, can you:

	YES	NO
a. Eat	_____	_____
b. Drink	_____	_____
c. Smoke	_____	_____
d. Carry food or beverage through	_____	_____

8. When you are in a Yellow Restricted Area, can you:

	YES	NO
a. Eat	_____	_____
b. Drink	_____	_____
c. Smoke	_____	_____
d. Carry food or beverage through	_____	_____

9. When you are in a Red Restricted Area, can you:

	YES	NO
a. Eat	_____	_____
b. Drink	_____	_____
c. Smoke	_____	_____
d. Carry food or beverage through	_____	_____

10. How can you tell which type of restricted area you are in?

   a. By the size of the sign on the door.

   b. By the color of the door.

   c. By the color of the floor.

   d. By the color of the restricted sign on the door.

   e. By the color of the restricted sign on the wall, by the yellow stripe on the floor.

11. What are some health effects that could be caused by excessive exposure to radiation?

    a) genetic defects in later generations
    b) skin cancer
    c) cataracts in the lense of the eye
    d) leukemia
    e) all of the above

12. Is there a safe level of exposure? That is, is there a level of radiation exposure below which it can be proven there is no effect?

    a) yes, it's about 4 rem/yr
    b) yes, it's about 12 rem/yr
    c) no, there is no level of exposure that is absolutely safe

13. What is the "natural" incidence of cancer in the general population?

    a) 1 person in every 20 (5%)
    b) 1 person in every 10 (10%)
    c) 1 person in every 5 (20%)
    d) 1 person in every 4 (25%)

14. How much of an increase in this "natural" incidence will exposure to 1 rem (1000 millirem) of ionizing radiation cause?

    a) one more per hundred (1%)
    b) one more per thousand (0.1%)
    c) five more per ten thousand (0.05%)
    d) three more per ten thousand (0.03%)
    e) one more per ten thousand (0.01%)

15. How low are you <u>required</u> (by law) to keep your own exposure to radiation?

    a) 3 rems/quarter
    b) up to 5 rems per year for each year at your age over 18
    c) 100 millirem per week
    d) 1 rem per month
    e) a and b above.

16. How low <u>should</u> you keep your own exposure to radiation?

    a) 1 rem per quarter
    b) up to 2 rem per year
    c) 50 millirem per week
    d) as low as is reasonably achievable

17. How can you control your exposure to radiation?

    a) limit the amount of time you are exposed to the radiation source.

    b) keep as much distance between the source and yourself as is possible.

    c) keep as much shielding between the source and yourself as is possible.

    d) wear lab coat, gloves, respirator, etc., as necessary to keep internal contamination controlled.

    e) all of the above.

18. What should you do if you are working at a hood and the hood alarm sounds?

    a) close the hood
    b) hold your breath
    c) leave the lab and close the door behind you
    d) call Health Physics
    e) all of the above

19. What should you do if you accidently spill some radioactive material?

    a) cover it with absorbent paper
    b) leave the room quickly and shut the door behind you
    c) clearly mark the door and control access to the area
    d) call Health Physics
    e) it depends on what you spilled. for example; a, c & d above for Co-57 and Fe-59, or b, c & d above for I-125.

20. What should you do if you detect an unsafe situation involving the transportation, use or storage of radioactive material?

    a) immediately call the police, fire department or other government agency

    b) notify Health Physics and tell them what the situation is.

    c) notify the Corporate Radiation Protection Officer.

    d) notify the chairman of the Corporate Radiation Safety Committee.

    e) notify the Nuclear Regulatory Commission

Non-Radiation Workers

Name____________________

Dept.______ Bldg.________

Date____________________

RADIOLOGICAL SAFETY

TRAINING QUIZ

INSTRUCTIONS: Answer all the questions. There is at least one right answer. There may be more than one right answer.

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	YES	NO
a. Eat	_____	_____
b. Drink	_____	_____
c. Smoke	_____	_____
d. Carry food or beverage through	_____	_____

8. When you are in a Yellow Restricted Area, can you:

	YES	NO
a. Eat	_____	_____
b. Drink	_____	_____
c. Smoke	_____	_____
d. Carry food or beverage through	_____	_____

9. When you are in a Red Restricted Area, can you:

	YES	NO
a. Eat	_____	_____
b. Drink	_____	_____
c. Smoke	_____	_____
d. Carry food or beverage through	_____	_____

10. How can you tell which type of restricted area you are in?

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   c. By the color of the floor.

   d. By the color of the restricted sign on the door.

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