metaTRACE, Inc. 13715 Rider Trail North • Earth City, MO 63045 • (314) 298-8566

January 16, 1987

Ms. Cheryl Phillips
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

RE: Control Number 382404

Dear Ms. Phillips:

Thank you for your reply to our request for a materials license. Following is the information you requested, point by point, as addressed in your letter.

1) It is our intention to use calibration standards for internal radiation detection instrumentation only. We will not be calibrating instruments for other licensees, and have therefore, not included the additional fee with this response.

2) We regret the oversight of the additional fee for a source materials provision. Please find enclosed the $350.00 fee as outlined in Category 2G of 170.31.

Sincerely yours,

Elaine M. Holland

Elaine M. Holland
Radiation Safety Officer

EMH:bcb

Encls.

cc: U.S. Nuclear Regulatory Commission
Region III
T. Will Solomon

metaTRACE, Inc. 1375 River Trail North • Earth City MO 63045 • (314) 298-8566

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Region III
T. Will Solomon

DEC 19 1986

metaTRACE, Inc.
ATTN: Elaine M. Holland
13715 Rider Trail North
Earth City, MO 63045

Dear Ms. Holland:

We have reviewed your application dated November 1, 1986 requesting a license and find that we will need additional information as follows:

1. Describe how metaTRACE, Inc. will know or determine that environmental samples received contain byproduct or source material. How will you determine the relative hazard of the samples.

2. If containers with less than the quantities in Appendix C of 10 CFR Part 20 will not be labelled "Caution, Radioactive Material", describe how they will be designated so individuals will be aware that they contain low levels of radioactive material.

3. Licensed Material

   a. Provide the name and model numbers for the gas chromatograph detector cells you wish to use. Our records do not show that Hewlett-Packard part number 19319 has been approved and registered with the NRC. In order for a device to be authorized on the license it must be registered and approved or you must submit the information requested in the Guidelines for Sealed Source and Device Custom Review (attached).

   b. Please review Section 40.22 of 10 CFR Part 40 and indicate whether you can operate under the provision of the general license.

   c. If chemical, physical or metallurgical operations are to be performed on significant quantities of source material (i.e., grinding, testing, dissolving, catalytic reactions), describe the specific processes and provide an estimate of how much source material is used in each.

4. Authorized User Training

a. In order to approve Paul Humburg as an authorized user who can supervise the use of radioactive material, we need evidence that he has actual experience handling unsealed radionuclides. Please describe his experience in this regard. List the radionuclides and quantities for which he has experience. If he does not currently have sufficient experience, he can obtain it under the license under an authorized person's supervision and reapply at a future date.

b. Please provide the name of the project manager of chromatography who will use and supervise the nickel-63 electron capture detectors.

5. Safe Handling Practices

a. Supplement the procedures described in Attachment No. 2, Item IV.D. and Attachment No.3, Item II.D. to include procedures to keep all radioactive samples in capped containers, to use trays, absorbant coverings, etc., to prevent the spread of contamination to facilities, equipment and personnel.

b. If any source material samples or byproduct samples will undergo any operation that could result in airborne contamination, please describe the precautions that will be taken to limit the spread of contamination and ingestion or inhalation by personnel. Please address the following:

1. Handling stock dry samples;

2. Performing activities such as powdering, grinding, dissolving, etc.

3. Consideration for performing air sampling to evaluate the potential airborne hazard.

6. Area Surveys

Attachment No. 3, Item III appears to require project managers or laboratory supervisors to perform wipe tests at least monthly with no requirement to keep records. Please modify your procedures to include the following:

a. Confirm that when environmental samples contain millicurie quantities of radioactive material the laboratory area will be surveyed weekly;

b. Confirm that in addition to wipe tests, survey meters will be used monthly to monitor radiation levels for potentially fixed contamination.

c. Confirm that records will be kept of both monthly surveys. It is important to keep and be able to refer to a history of contamination existence or absence in the laboratories. Only the date, location, result and name of the person performing the survey need be recorded.

d. Confirm that the RSO's quarterly surveys will include an evaluation for fixed contamination and radiation levels in addition to tests for removable contamination.

e. Please describe your action point for gamma emitting radionuclides.

7. Emergency Procedures

Please correct the NRC Region III telephone number. The correct number is (312) 790-5500. See the following sections of your program:

a. Form NRC 313, Item VIII;

b. Attachment No. 4, Item 4.0

If you have any questions or require clarification on any of the information stated above, you may contact us at (312) 790-5625.

We will continue our review of your application upon receipt of this information. Please reply in duplicate, within 30 days, and refer to Control Number 82404.

Sincerely,

Original Signed By
Evelyn R. Matson
Materials Licensing Section

Attachment: Sealed Source
and Device Custom Review Guide

RIII
Matson/pd
12/19/86

metaTRACE, Inc.
2391 Grissom Drive
St. Louis, MO 63146
(314) 432-6642

November , 1986

U.S. NRC
Material Licensing Section
799 Roosevelt Road
Glen Ellyn, IL 60137

Gentlemen:

We would like to request that our facility, metaTRACE, Inc., be granted an NRC by-product material license with a provision for source materials. Enclosed please find our completed NRC Form 313 and fee pursuant to 10 CFR 170, Category 3P.

MetaTRACE, Inc. is a new analytical laboratory located in the St. Louis area. Currently, the actual laboratory facility is under construction (anticipated completion date - December 10, 1986), and we are operating out of a temporary facility. The enclosed descriptions of our new facility and equipment are true to the best of our knowledge. Should any relevant or significant changes occur, we will notify the NRC.

The purpose of this license request is to allow us to accept environmental samples which may contain low levels of radioactive materials for analysis. The nature of our business is to contract with outside industries and government agencies to perform analysis on a variety of sample types for many different constituents. We want to stress that most environmental samples will contain, at most, very low levels of radioactive materials and will be of unknown composition. Furthermore, we do not anticipate o significant percentage of the 100 mCi limit doses include a substantial safety margin for total inventory to allow for unexpected operating contingencies.

Should any additional information be required, please contact the undersigned at:

metaTRACE, Inc.
Elaine M. Holland
2391 Grissom Drive
St. Louis, MO 63146
(314) 432-6642
(Prior to 11/17/86)

OR

metaTRACE, Inc.
Elaine M. Holland
13715 Rider Trail North
Earth City, MO 63045
(314) 298-8566
(After 11/17/86)

Sincerely yours,

Elaine M Holland

Elaine M. Holland
Radiation Safety Officer

EMH:bbg

Enclosures

## ENCLOSURES

NRC License Application; NRC Form 313

Fee

Figure #1 - Facility Blueprint

## ATTACHMENTS

#1 - Qualifications, training, experience, and education of individuals who will use or directly supervise the use of licensed material

#2 - Outline of initial Radiation Safety Training Session for all employees

#3 - Safety Guidelines for Radioactive Materials and Samples

#4 - Radiation Safety Manual

#5 - Radiation Exposure and Risk of Health Effects Information

#6 - The records system established at metaTRACE to comply with NRC regulations 10 CFR 20.401

NRC FORM 313
(1-84)
10 CFR 30, 32, 33, 34, 35 and 40

U.S. NUCLEAR REGULATORY COMMISSION
APPROVED BY OMB
3150-0120
Expires: 8-31-87

# APPLICATION FOR MATERIAL LICENSE

INSTRUCTIONS: SEE THE APPROPRIATE LICENSE APPLICATION GUIDE FOR DETAILED INSTRUCTIONS FOR COMPLETING APPLICATION. SEND TWO COPIES OF THE ENTIRE COMPLETED APPLICATION TO THE NRC OFFICE SPECIFIED BELOW.

**FEDERAL AGENCIES FILE APPLICATIONS WITH:**

U.S. NUCLEAR REGULATORY COMMISSION
DIVISION OF FUEL CYCLE AND MATERIAL SAFETY, NMSS
WASHINGTON, DC 20555

**ALL OTHER PERSONS FILE APPLICATIONS AS FOLLOWS, IF YOU ARE LOCATED IN:**

**CONNECTICUT, DELAWARE, DISTRICT OF COLUMBIA, MAINE, MARYLAND, MASSACHUSETTS, NEW JERSEY, NEW YORK, PENNSYLVANIA, RHODE ISLAND, OR VERMONT, SEND APPLICATIONS TO:**

U.S. NUCLEAR REGULATORY COMMISSION, REGION I
NUCLEAR MATERIAL SECTION B
631 PARK AVENUE
KING OF PRUSSIA, PA 19406

**ALABAMA, FLORIDA, GEORGIA, KENTUCKY, MISSISSIPPI, NORTH CAROLINA, PUERTO RICO, SOUTH CAROLINA, TENNESSEE, VIRGINIA, VIRGIN ISLANDS, OR WEST VIRGINIA, SEND APPLICATIONS TO:**

U.S. NUCLEAR REGULATORY COMMISSION, REGION II
MATERIAL RADIATION PROTECTION SECTION
101 MARIETTA STREET, SUITE 2900
ATLANTA, GA 30323

**IF YOU ARE LOCATED IN:**

**ILLINOIS, INDIANA, IOWA, MICHIGAN, MINNESOTA, MISSOURI, OHIO, OR WISCONSIN, SEND APPLICATIONS TO:**

U.S. NUCLEAR REGULATORY COMMISSION, REGION III
MATERIALS LICENSING SECTION
799 ROOSEVELT ROAD
GLEN ELLYN, IL 60137

**ARKANSAS, COLORADO, IDAHO, KANSAS, LOUISIANA, MONTANA, NEBRASKA, NEW MEXICO, NORTH DAKOTA, OKLAHOMA, SOUTH DAKOTA, TEXAS, UTAH, OR WYOMING, SEND APPLICATIONS TO:**

U.S. NUCLEAR REGULATORY COMMISSION, REGION IV
MATERIAL RADIATION PROTECTION SECTION
611 RYAN PLAZA DRIVE, SUITE 1000
ARLINGTON, TX 76011

**ALASKA, ARIZONA, CALIFORNIA, HAWAII, NEVADA, OREGON, WASHINGTON, AND U.S. TERRITORIES AND POSSESSIONS IN THE PACIFIC, SEND APPLICATIONS TO:**

U.S. NUCLEAR REGULATORY COMMISSION, REGION V
MATERIAL RADIATION PROTECTION SECTION
1450 MARIA LANE, SUITE 210
WALNUT CREEK, CA 94596

**PERSONS LOCATED IN AGREEMENT STATES SEND APPLICATIONS TO THE U.S. NUCLEAR REGULATORY COMMISSION ONLY IF THEY WISH TO POSSESS AND USE LICENSED MATERIAL IN STATES SUBJECT TO U.S. NUCLEAR REGULATORY COMMISSION JURISDICTION.**

1. THIS IS AN APPLICATION FOR *(Check appropriate item)*

- [X] A. NEW LICENSE
- [ ] B. AMENDMENT TO LICENSE NUMBER _____
- [ ] C. RENEWAL OF LICENSE NUMBER _____

2. NAME AND MAILING ADDRESS OF APPLICANT *(Include Zip Code)*

metaTRACE, Inc.
13715 Rider Trail North
Earth City, MO 63045

3. ADDRESS(ES) WHERE LICENSED MATERIAL WILL BE USED OR POSSESSED.

metaTRACE, Inc.
13715 Rider Trail North
Earth City, MO 63045

4. NAME OF PERSON TO BE CONTACTED ABOUT THIS APPLICATION

Elaine M. Holland

TELEPHONE NUMBER

(314) 298-8566

SUBMIT ITEMS 5 THROUGH 11 ON 8½ x 11" PAPER. THE TYPE AND SCOPE OF INFORMATION TO BE PROVIDED IS DESCRIBED IN THE LICENSE APPLICATION GUIDE.

5. RADIOACTIVE MATERIAL
a. Element and mass number, b. chemical and/or physical form, and c. maximum amount which will be possessed at any one time.

6. PURPOSE(S) FOR WHICH LICENSED MATERIAL WILL BE USED.

7. INDIVIDUAL(S) RESPONSIBLE FOR RADIATION SAFETY PROGRAM AND THEIR TRAINING AND EXPERIENCE.

8. TRAINING FOR INDIVIDUALS WORKING IN OR FREQUENTING RESTRICTED AREAS.

9. FACILITIES AND EQUIPMENT.

10. RADIATION SAFETY PROGRAM.

11. WASTE MANAGEMENT.

12. LICENSEE FEES *(See 10 CFR 170 and Section 170.31)*

FEE CATEGORY

AMOUNT ENCLOSED $

13. CERTIFICATION. *(Must be completed by applicant)* THE APPLICANT UNDERSTANDS THAT ALL STATEMENTS AND REPRESENTATIONS MADE IN THIS APPLICATION ARE BINDING UPON THE APPLICANT.

THE APPLICANT AND ANY OFFICIAL EXECUTING THIS CERTIFICATION ON BEHALF OF THE APPLICANT, NAMED IN ITEM 2, CERTIFY THAT THIS APPLICATION IS PREPARED IN CONFORMITY WITH TITLE 10, CODE OF FEDERAL REGULATIONS, PARTS 30, 32, 33, 34, 35, AND 40 AND THAT ALL INFORMATION CONTAINED HEREIN, IS TRUE AND CORRECT TO THE BEST OF THEIR KNOWLEDGE AND BELIEF.

WARNING: 18 U.S.C. SECTION 1001 ACT OF JUNE 25, 1948, 62 STAT. 749 MAKES IT A CRIMINAL OFFENSE TO MAKE A WILLFULLY FALSE STATEMENT OR REPRESENTATION TO ANY DEPARTMENT OR AGENCY OF THE UNITED STATES AS TO ANY MATTER WITHIN ITS JURISDICTION.

| SIGNATURE—CERTIFYING OFFICER | TYPED/PRINTED NAME | TITLE | DATE |
|---|---|---|---|
| Elaine M Holland | Elaine M. Holland | Radiation Safety Officer | 11/1/86 |

14. VOLUNTARY ECONOMIC DATA

a. ANNUAL RECEIPTS

- [ ] <$250K
- [ ] $250K–500K
- [ ] $500K–750K
- [ ] $750K–1M
- [ ] $1M–3.5M
- [ ] $3.5M–7M
- [ ] $7M–10M
- [ ] >$10M

b. NUMBER OF EMPLOYEES *(Total for entire facility excluding outside contractors)*: 60

c. NUMBER OF BEDS: N/A

d. WOULD YOU BE WILLING TO FURNISH COST INFORMATION *(dollar and/or staff hours)* ON THE ECONOMIC IMPACT OF CURRENT NRC REGULATIONS OR ANY FUTURE PROPOSED NRC REGULATIONS THAT MAY AFFECT YOU? *(NRC regulations permit it to protect confidential commercial or financial—proprietary—information furnished to the agency in confidence)*

- [X] YES
- [ ] NO

FOR NRC USE ONLY

| TYPE OF FEE | FEE LOG | FEE CATEGORY | COMMENTS | APPROVED BY |
|---|---|---|---|---|
| APP | New | 26A/3P | Not applicable - see 1/16/87 ltr. | CP |

| AMOUNT RECEIVED | CHECK NUMBER | | DATE |
|---|---|---|---|
| $250/$350 | 140/120 | CONTROL NO. 8404 | 1/20/86 |

PRIVACY ACT STATEMENT ON THE REVERSE

8702260346 4pp

5. RADIOACTIVE MATERIALS

A. All isotopes of elements with atomic numbers 1 through 92 inclusive.

B. Any chemical or physical form.

C. Total facility inventory for all isotopes not to exceed 100 mCi not including ten (10) electron capture gas chromatographic detectors each containing 8 mCi 63Ni in sealed foil form (Hewlett-Packard part number 19319, or equivalent). Total facility inventory of all radioactive materials and sealed radioactive sources (EC detectors) not to exceed 180 mCi.

D. We request, also, a provision allowing possession of up to 50 pounds of source material. Certain environmental samples received at the facility may exceed the 0.05% source material concentration noted under 10 CFR 40.13.

6. PURPOSE FOR WHICH LICENSED MATERIAL WILL BE USED

A. Sealed Sources

Sealed sources are used as ionization sources for the gas chromatographic detection of certain analytes in environmental samples.

B. Radioactive Materials

Radioactive materials will be contained in various environmental samples received at the facility for analysis. Typical expected levels of all radioactive materials contained in the samples will be in the 10-12 to 10-4 Ci/kg range. Depending on the origin of the samples, some may contain low levels of source material (non-enriched uranium and/or thorium). It is not anticipated that any samples received at the facility will contain any measurable concentrations of special nuclear material.

By-product materials will also be used as calibration standards for radiological analysis instrumentation. These materials will be microcurie standards in plated planchet form and/or dilute, low specific activity solutions. They will be purchased from licensed domestic vendors such as the National Bureau of Standards, Amersham Corporation, New England Nuclear, etc.

Although it is anticipated that all individual environmental samples will contain extremely low levels of radioactive materials (if any), the 100 mCi radioactive material facility inventory limit reflects possible operating contingencies of very high sample loads, delays in analysis, and/or delays in return of excess samples and disposal of laboratory generated low level radioactive waste.

The source material provision of Item #5, above, reflects the fact that some environmental samples may contain appreciable concentrations of source materials.

7. INDIVIDUALS RESPONSIBLE FOR RADIATION SAFETY PROGRAMS AND THEIR TRAINING AND EXPERIENCE

Elaine M. Holland, Radiation Safety Officer
Paul Humburg
T. Will Solomon

Qualifications, training, experience and education of the above-mentioned personnel are included in attachment #1.

All use and analysis of samples confirmed to contain concentrations of radioactive materials greater than 1 microcurie/gram will be used only by or under the direct supervision of the above listed individuals.

Electron capture detectors and associated instrumentation containing 63Ni will be used by or under the direct supervision of the project manager of chromatography and/or T. Will Solomon.

Calibration standards for radiation detection instrumentation will be used by or under the direct supervision of Elaine M. Holland; who is also designated the Radiation Safety Officer for this license application.

8. TRAINING FOR INDIVIDUALS WORKING IN OR FREQUENTING RESTRICTED AREAS

Formal training will be given to all laboratory and ancillary personnel within 2 weeks of hire and/or prior to their handling of radioactive materials. Training will be updated on an annual basis thereafter. The training will be conducted by the R.S.O., Elaine Holland and consists of a formal presentation lasting approximately one hour. The training is supplemented by a slide presentation prepared by the Training Resources Division of Nuclear Support Services, Inc., Columbus, Maryland 21045. An outline of the topics covered in this initial training session are included in Attachment #2.

All personnel who work with radioactive materials directly and personnel whose duties require access to areas where radioactive materials are used are given copies of and required to become familiar with two (2) internal publications dealing with the safe use of radioactive materials (see Attachments #3 and #4). Attachment #3 is a condensed guide to familiarize personnel with safe handling practices of radioactive materials. Attachment #4 is a more general account of corporate radiation safety policy and practices. Personnel will also receive a paper titled "Radiation Exposure and Risks of Health Effects" (Attachment #5).

Both the distributed publications and the formal training are specifically presented so as to address items noted in 10 CFR 19.12 including, but not limited to: proper handling, transfer, and storage of radioactive materials; health concerns from exposure to ionizing radiation, and accepted procedures for minimizing such exposure; use of personnel monitoring devices and survey instruments and proper laboratory techniques for manipulation of radioactive materials; appropriate responses to unusual circumstances such as spills and proper disposal methods for contaminated materials.

Finally, complete records of all training will be kept by the R.S.O. including topics covered, type of presentation, attendees, date, and time. It will be noted if at these meetings personnel have any specific concerns or questions.

9. FACILITIES AND EQUIPMENT

I. Facilities in general:

A. The Building

The building housing metaTRACE's environmental analysis laboratories and offices is one (1) floor, approximately 27,000 square feet, with cinder block exterior walls. All of the interior walls are drywall except the RCRA sample storage area which is cinder block. The facility has two (2) independent fresh air supplies and central air conditioning and heat. Currently, metaTRACE employs 15 people, but anticipates a staff of approximately 60 within the next six (6) months.

This facility will be engaged in state-of-the-art analytical chemistry analysis of environmental samples of various types (soil, vegetation, sludge, water, air, etc). The purpose of this NRC license application is to allow 1) the analysis of and handling of large numbers of very low level radioactive environmental samples, 2) the ownership and use of appropriate low level radioactive standards for calibration and standardization of radiological analytical instrumentation and 3) the use of gas chromatographic electron capture detectors.

B. Laboratory areas

Due to the fact that we are currently under construction, actual room numbers for the laboratory areas have not been assigned. For the sake of brevity in writing this license application, we have arbitrarily assigned the following room numbers:

| Laboratory | Assigned Room Numbers |
|---|---|
| Radiological Laboratory | 101 |
| GC/MS Laboratory | 102 |
| Radiological Instrumentation Room | 101A |
| GC Laboratory | 103 |
| Physical Laboratory | 104 |
| Technical Laboratory | 105 |
| Spectroscopy Laboratory | 106 |
| Chem. Characterization Laboratory | 109 |
| Balance Room | 107 |
| Oven/Furnace Room | 108 |
| Regulated Access Laboratory | 110 |
| Robotics Laboratory | 111 |

B. Laboratory areas (Continued)

Again, should these room numbers designations change when construction is complete (anticipated date - December 10, 1986), we will notify the NRC. The general layout of metaTRACE, Inc. is shown in attached facility blueprint, Figure I.

All laboratory areas listed above, except the GC/MS laboratory, have a common filtered fresh air supply. Typically, the fresh air exchange is 10-15 times per hour. The GC/MS laboratory has a separate filtered fresh air supply system which is also capable of 10-15 fresh air exchanges per hour.

In laboratories with solid epoxy top benches approved for radiological work, the samples will be segregated by classes: 1) standards, 2) prepared samples, 3) raw materials 4) confirmed versus suspected radioactive materials of samples.

The sink fixtures throughout the laboratory areas are the same; stainless steel sinks with either polyvinylchloride or glass traps and piping that connects into a common drain system and discharges laboratory effluents into the public sanitary sewer system.

Ten of the twelve hoods within the building are identical. They are Class A (OSHA) baffled fume hoods with at least a 100 FPM face velocity. The hood located in the Radiological Laboratory (Room 101) is a stainless steel, Class A (OSHA) baffled fume hood connected to a HEPA-filter. Also, in the Chemical Characterization Laboratory, Room 109, on the bench closest to the south wall, there is a canopy hood (used for cyanide analysis) located on the west end of that bench.

All rooms approved for radiological studies will have a sufficient number of appropriately labeled waste receptacles, double lined with plastic bags and equipped with lids, available to facilitate segregation of potentially contaminated waste from all other waste generated in that laboratory.

Finally, the Radiological Laboratory and the Chemical Characterization Laboratory will have an appropriately labeled glass container available for disposal for non-dispersable liquids.

## II. Laboratory Areas

### A. Radiological Laboratory

All samples requiring only radiological analysis will be prepared in Room 101.

The solid epoxy top benches, located along the west, north and east walls, and a center island are all cleared for work involving radioactive materials. A stainless steel sink located in the north wall bench, is used for disposal of dispersable liquids as specified under Item II - Waste Management. The sink has polyvinylchloride plastic traps and piping and is connected with a drain system that collects effluents from many laboratories and discharges it into the public sanitary sewer system.

A stainless steel, Class A (OSHA) baffled fume hood is located along the east wall. The fume hood has at least a 100 FPM face velocity and a built-in HEPA-filter system.

Fresh air is supplied by overhead distributed ducts that are common to several laboratories. The system is capable of 10-15 fresh air exchanges per hour. The building ventilation system (with hoods running) provides a slight pressure differential so that any air flow at the doorways is from the hallway into the laboratories.

The adjacent Instrumentation Room (Room 101A) will house only radiological instrumentation (proportional counters, Liquid scintillation counters, ionization chambers, etc). Since only prepared samples and standards will be taken into this room, and the only entrance is through the radiological laboratory, there are no special facilities in this area.

B. Chemical Characterization Laboratory

Samples which may contain low levels of radioactive materials and require multiple analyses will be prepared for analysis in Room 109.

The laboratory is equipped with six (6) solid epoxy top island benches spaced from the north wall to the south wall. An L-shaped bench extends along the west and north walls. There are four (4) hoods on the second bench, two (2) hoods on the fifth bench and a canopy hood on the sixth bench. All the hoods in this laboratory, except the canopy hood, are Class A (OSHA) baffled fume hoods with at least a 100 FPM face velocity.

Stainless steel sinks, located in the first, third, fourth and sixth benches, are the same as described in the Radiological Laboratory.

The ventilation system is similar to that of Room 101 and provides 10-15 fresh air exchanges per hour. With hoods running, there is a slight pressure differential so the air flow is from the hallway into the laboratory.

The laboratory is equipped with a Fisher Isotemp Flammable Storage Freezer (Fisher Scientific, Pittsburg, PA. 15280) and a Kenmore Refrigerator (Sears, Roebuck & Co., Chicago, IL) for sample storage should the sample matrix warrant refrigeration prior to analysis.

Radioactive waste receptacles for solids and non-dispersable liquids are kept in Room 109. Solids are collected in appropriately labeled containers which are double lined with plastic bags and equipped with lids. Non-dispersable liquids are collected in glass containers. The receptacles are marked with appropriate "radioactive materials only" signs.

The periphial rooms off of the Chemical Characterization Laboratory include:

| Room Number | Laboratory |
|---|---|
| 103 | GC Laboratory |
| 104 | Physical Laboratory |
| 105 | Technical Laboratory |
| 106 | Spectroscopy Laboratory |
| 107 | Balance Room |
| 108 | Oven/Furnace Room |

The only access to the above-mentioned rooms is through the Chemical Characterization Laboratory. These instrumentation laboratories will contain prepared

B. Chemical Characterization Laboratory (Continued)

samples and/or standards only. The fume hood located in Room 104 is a Class A (OSHA) baffled fume hood with at least a 160 FPM velocity.

The ventilation in these areas is the same as described in Room 109, with the exception of the GC Laboratory.

The GC Laboratory ventilation system provides a positive pressure airflow to prevent any organics generated in the sample preparation area from interfering with the GC analysis.

The GC Laboratory (Room 103) will be the location of the electron capture gas chromatographic detectors.

C. GC/MS Laboratory

The GC/MS Laboratory may receive prepared samples that contain low levels of radioactive materials. Since this is strictly an instrumentation laboratory, only prepared samples and standards will be taken into this area. However, since the sample preparation necessary for GC/MS analysis may not remove the radioactive materials, it is necessary that this room be approved for handling radioactive materials.

Waste receptacles, double lined with plastic bags and equipped with lids, are available to segregate any potentially contaminated waste. These receptacles will be labeled with appropriate "Radioactive Materials Only" signs.

The GC/MS Laboratory has a separate filtered fresh air system from the rest of the building. The system is capable of 10-15 fresh air exchanges per hour. This laboratory has a positive pressure air flow to prevent any organics generated in the Chemical Characterization Laboratory from interfering with the GC/MS analysis.

D. Regulated Access Area

The primary use of this laboratory area will be 2,3,7,8-tetrachlorodibenzodioxin analyses. Again, since some environmental samples may contain low levels of radioactive materials that are not removed in sample preparation, it is necessary that this room be approved for handling of radioactive materials, also.

D. Regulated Access Area (Continued)

The solid epoxy top benches located along the west and east walls, as well as a center island bench, are approved for low level radioactive materials.

A stainless steel sink, located on the north side of the center island bench, is used for disposal of dispersable liquids as specified in Item II - Waste Management. The sink has either polyvinylchloride or glass traps and piping and is connected to a common drain discharging into the public sewer system.

The ventilation system is similar to that of Room 101 and provides 10-15 fresh air exchanges per hour. The design of the system is such that, with hoods running, there is negative pressure within this laboratory.

E. Robotics Laboratory

The Robotics Laboratory will be set up as an experimental area. MetaTRACE intends to work with vendors in an attempt to develop robotics to handle hazardous materials such as dioxin or samples containing significant levels of radioactive materials. Presently, this laboratory is not designated for any particular analysis. However, in anticipation of developing procedures in the near future, we request that this room be approved for radioactive materials handling, also.

The laboratory area contains a single center island solid epoxy top bench. On the north end of the bench is a stainless steel sink. The sink will be used for disposal of dispersable liquids as specified under Item II - Waste Management. The sink has either polyvinylchloride or glass traps and piping and connects with a common drain that discharges into the public sanitary sewer system.

The ventilation system is similar to that of Room 101 and provides 10-15 fresh air exchanges per hour. The design is such that with hoods running, this room has negative pressure air flow.

The Robotics Laboratory is equipped with a Class A (OSHA) baffled hood with at least a 100 FPM face velocity.

There will be limited access into both the Robotics Laboratory and the Regulated Access Laboratory. Personnel must enter through a chamber and put on appropriate tyvek clothing before entering either laboratory. When leaving, personnel must exit through

E. Robotics Laboratory (Continued)

the same chamber and dispose of the tyvek clothing. Shower facilities are available. Also, escape doors are located at both ends of the north corridor.

F. Shipping and Receiving

The rear northwest corner of the facility is designated the Shipping and Receiving area. This area contains loading docks, two (2) walk-in coolers, sample storage areas and the RCRA storage area, as well as an office for overseeing all receiving area activities.

The north cooler along the west wall will be used for storage or radioactive samples. It will be posted with an appropriate "Caution Radioactive Materials" sign.

Directly across from the cooler is a fume hood. This hood is identical to those in Room 109; Class A (OSHA) baffled fume hood with at least a 100 FPM face velocity, and can be used for initial inspection of incoming radioactive materials.

The RCRA storage area is separated from the rest of the building by cinder block walls. The RCRA storage area is built according to EPA hazardous waste storage specifications although it is not a present licensed storage area. Radioactive non-dispersable liquids awaiting final disposal will be stored here. Appropriate signs and warnings will be posted.

Access to the receiving area is limited to authorized personnel only. The office in this area has large windows which facilitate a constant monitoring of the activities in the receiving area.

G. Radiation Detection Equipment

| Type of Instrument | Manufacturer's Name | Model No. | Number Available | Radiation Detected | Sensitivity Range |
|---|---|---|---|---|---|
| Survey meter w/Thin end window prode, Model 44-7 | Ludlum | 14C | 1 | Alpha beta-gamma | 0-200 mR/hr |
| Survey meter w/pancake g-m detector, Model 44-9 | Ludlum | 14C | 2 | Alpha, beta-gamma | 0-2 mR/hr |

G. Radiation Detection Equipment

| Type of Instrument | Manufacturer's Name | Model No. | Number Available | Radiation Detected | Sensitivity Range |
|---|---|---|---|---|---|
| Scaler | Ludlum | 2929 | 1 | Alpha beta-gamma | - |

These meters will be calibrated on a semi-annual basis by:

R.M. Wester and Associates
#1 Lone Eagle Trail
St. Charles, MO 63301

H. Radiation Detection and Equipment

Although the following are not currently available, metaTRACE, Inc., is now seeking vendor price quotations on these types of instrumentation. We anticipate purchasing these instruments within the next several months. During the interim, we will contract with an outside laboratory (e.g. R. M. Wester and Associates, St. Charles, MO) to perform any analysis needed for personnel monitoring, surveys of laboratory surfaces and equipment, or leak test on Electron Capture Detectors.

| Type of Instrument | Manufacturer's Name | Model No. | Number Available | Radiation Detected | Sensitivity Range |
|---|---|---|---|---|---|
| Proportional counter | Tennelec | LB5100 Series III | 1 | Alpha, beta-gamma | - |
| Proportional counter | Nuclear Measurements, Corp. | PC-55 | 1 | Alpha, beta-gamma | - |
| Liquid scintillation counter | * | * | 1 | beta | - |

*Manufacturer and model number to be determined. These instruments will be monitored and calibration checks performed internally by prepared standards purchased from an outside source (Amersham, New England Nuclear, etc).

## 10. RADIATION SAFETY PROGRAM

### Introduction

All sources of potential ionizing radiation exposure at metaTRACE are radioactive materials. Generally, radioactive materials will be used 1) as sealed sources for radiation of target materials, 2) contained in some environmental samples or, 3) as calibration sources for analytical instrumentation. The objectives of our Radiation Safety Program are:

1) to assure compliance with Federal and State regulations,

2) to minimize the exposure of employees to sources of ionizing radiation,

3) to ensure that no employee receives more than the permissible dose, and

4) to minimize the possibility of contamination of individuals, the work place, and the environment by radioactive materials.

### I. Prior to Receiving Radioactive Samples

A. The R.S.O. at metaTRACE has safety responsibility for projects carried out under the NRC license requiring the handling of radioactive materials.

B. To assist the R.S.O. in making an evaluation of a radiochemical project, project managers complete a copy of The Incoming Radioactive Sample Checklist (Form I) prior to initiation of the project or shipment of samples to metaTRACE, and forward the checklist to the R.S.O. for evaluation and approval or disapproval.

C. If the situation warrants it, project managers will also allow the R.S.O. enough lead time to evaluate the project and provide any additional safety precautions that may be required.

### II. Receipt of Radioactive Materials

A. The amount of radioactive materials received will be in accordance with that allowed by metaTRACE's NRC license and current inventories.

B. The R.S.O. or designate will make arrangements for metaTRACE to receive a package when it is offered for delivery by the carrier.

II. Receipt of Radioactive Materials (Continued)

C. The R.S.O. or designate, upon receipt of a package, will monitor the shipment for surface contamination as soon as practical after receipt (but no later than 3 hours after the package is received during normal work hours, or 18 hours if package is received after normal working hours).

If removable contamination in excess of 0.01 microcuries (22,000 DPM) per 100 cm2 of package surface is found, the R.S.O. will notify the carrier and the Region III NRC office immediately.

The R.S.O. or designate will also monitor radiation levels external to the package within the same time frame described above. If external radiation levels exceed 10 mR/hr at 3 feet or 200 mR/hr at the surface, the R.S.O. will notify the Region III NRC office and the carrier immediately.

D. The R.S.O. or designate will then open the radioactive shipment in the designated hood in the receiving area or the hood in the radiological laboratory; and, the package will then be checked for internal leakage, verified as to contents, and the packing materials will be surveyed for contamination and properly disposed of.

E. Results of the shipment surveys will be recorded on the Sample Receipt Checklist (Form II) and filed in the Sample Inventory Log book.

III. Handling of Radioactive Materials

A. Authorized Users

Only those persons who have been formally trained by the R.S.O. in the safe handling practices of radioactive materials, or who have had sufficient formal training and/or on the job experience with radioactive materials (as determined by the NRC) are authorized to work with radioactive materials.

III. Handling of Radioactive Materials (Continued)

B. Authorized Work Areas

Radioactive materials and samples can only be taken into or analyzed in rooms clearly exhibiting Caution: Radioactive Materials" sign on the door.

C. Protective Clothing

Employees are required to follow good laboratory practices concerning clothing - latex gloves, lab coats, eye protection - when working in any laboratory area containing radioactive samples.

D. Storage of Radioactive Samples

Containers of radioactive materials will be properly labeled (see section on signs, labels, signals, and controls) and stored only in designated areas.

1. Radioactive materials may be stored in designated restricted areas secured from unauthorized removal from the place of storage.

2. Radioactive materials may be stored in designated unsecured areas if under the direct constant surveillance and immediate control of a metaTRACE employee.

E. Disposal of Radioactive Materials

As outlined in Item II - Waste Management.

IV. Caution signs, labels, signals and controls

A. Radiation symbol: magenta cross-hatched symbol on a yellow background

Laboratory Areas

B. "Caution: Radioactive Materials" will be posted outside any room which contains radioactive materials as outlined in 10 CFR Part 20 Appendix C. Generally, radioactive materials received at metaTRACE will be environmental samples of unknown composition containing alpha and/or beta-gamma emitting radionuclides.

IV. Caution signs, labels, signals, and controls (Continued)

Containers

C. 1) Containers of radioactive materials will be appropriately labeled if it contains radioactive materials in quantities greater than the applicable quantities list in 10 CFR Part 20 Appendix C.

2) Containers in transport which have been packaged and labeled in accordance with DOT regulations do not require additional labeling.

3) Prior to disposal of an empty, uncontaminated container to unrestricted areas, all radioactive material labels will be removed or defaced to indicate that the container no longer contains radioactive materials.

V. Sealed Sources

Areas in which the only radioactive material is a sealed source will not be posted with a radioactive materials sign unless the radiation level 12 inches from the surface of the source container or housing exceeds 5 millirem per hour.

VI. Radiation Protection

A. Exposure to personnel

Film dosimetry badges will be issued to personnel who work with radioactive materials routinely. Film badges will be issued to other personnel at the discretion of the R.S.O. when warranted by the nature of the radioactive materials being handled (as outlined in 10 CFR Part 20.202).

Film badges will be exchanged on a a quarterly basis. Reports are forwarded to the R.S.O. and filed in the personnel exposure logbook.

Film badges and film badge development and analysis are supplied by:

R.M. Wester and Associates
#1 Lone Eagle Trail
St. Charles, MO 63301

## VI. Radiation Protection

### B. Bioassays

Bioassays, usually urinalysis, will be performed at the direction of the R.S.O. when the chemical or physical form of any radioactive material, or the procedures and equipment used make it possible for radioactive materials to be inhaled, ingested, or absorbed into the body.

In general, we anticipate all environmental samples received at metaTRACE to be well below the millicurie level and in a non-volatile form. If, however, any routine urinalysis results exceed 5 microcuries per liter corrective actions will be taken to lower the potential for further exposures.

### C. Permissible dose levels

In keeping with the ALARA concept, metaTRACE, Inc. will take all practical steps to keep personnel exposure as far below permissible dose levels as possible.

#### Exposure to personnel

1) Exposure to personnel will be determined on a quarterly basis by Film badge monitoring. When warranted, bioassays will be performed. The calendar quarter will not be less than 12 or more than 14 weeks.

2) Prior to Handling Radioactive Materials

A) Training

Any employee whose work involves handling radioactive materials must first receive a formal training session provided by the Radiation Safety Officer. This training session will be updated annually.

B) Previous Exposure

Before working with radioactive materials, all employees must disclose a written signed document stating:

1) no known prior occupational dose
2) or the nature and amount of any occupational dose

MetaTRACE will contact the previous employers for an occupation dose history of these employees.

VI. Radiation Protection (Continued)

3) Radiation Exposure Reports

A. Exposure reports

Exposure reports will be in writing and include:

1) name of company
2) name of individual
3) individual social security number
4) date of birth
5) exposure information

B. Exposure records

1) Employees have the right to know their exposure history
2) If, for any reason, metaTRACE is required to report exposure of an employee to the NRC, we will at the same time provide that employee with a copy of that report.
3) At termination, metaTRACE will provide a written report regarding radiation dose received by that employee. If any part of the results are estimated, it will be clearly indicated as an estimate in that report.

VII. Surveys

A. Laboratory Areas

Wipe tests on bench tops, hood areas, desks and equipment within the laboratories will be performed on a quarterly basis by the R.S.O. or designate any time there are radioactive materials in the facility. These results will be tabulated and recorded in the Survey Logbook.

B. Intermittent Surveys

At appropriate intervals during work with radioactive materials, contamination levels will be monitored with portable survey meters. The survey meters can be found in the Chemical Characterization Laboratory, the Radiological Laboratory, the receiving area office and the R.S.O.'s desk. The results of these intermittent surveys are not recorded unless unusual and high contamination levels are found. Appropriate decontamination efforts will then be made followed by repeat surveys (results recorded).

VII. Surveys (Continued)

C. Radiation Sources

Radiation sources, including electron capture detectors, will be surveyed semiannually by the R.S.O. or designate. The results will be tabulated and recorded in the Radiation Source Logbook.

D. Shipping and Receiving Area

Waste storage areas, shipping and receiving area, and the RCRA waste storage area will be surveyed monthly by a designated technician under the direction of the R.S.O. The receiving area technicians will also be instructed in the proper use of survey meters. This area will be surveyed quarterly by the R.S.O. or designate and the results will be tabulated and recorded in the Survey Logbook.

E. Survey Analysis

Until such time as metaTRACE has the capabilities to do the survey analysis internally, we will contract an outside laboratory to analyze all survey and bioassay samples.

F. Action Points

Typical radioactive materials received at metaTRACE will be very low level environmental samples; so it is unlikely that individuals in any laboratory area will be exposed to radiation intensities that might cause an occupational radiation dose to exceed 10 percent of the limits of 10 CFR 20.201. However, if during any intermittent, monthly or quarterly survey, removable contamination levels are found to be >2000 DPM/100 cm2 beta or >200 DPM/100 cm2 alpha, decontamination efforts will be performed.

VIII. Emergency Procedures

The order and rapidity with which the following actions are accomplished will vary with the type and extent of the emergency.

A. Confinement of contamination and notification of the R.S.O.

In the accident area, every effort will be made to confine the contamination. This includes

VIII. Emergency Procedures (Continued)

containing spills, closing hoods, closing doors, etc. The R.S.O. or designate will be notified immediately.

B. Evacuation of Personnel

Personnel are to immediately evacuate an area where a major radiochemical accident has occurred and remain in an adjacent area in order to minimize the spread of contamination. In the event of some hazards, other appropriate actions may precede evacuation.

C. Survey of Personnel

Examination with a portable survey instrument is used to determine the extent of contamination of personnel.

D. Decontamination of Personnel

Decontamination is accomplished in an expedient manner usually by removal of contaminated clothing and repeated washing of affected skin areas with soap and water. Care is exercised to avoid damage to the skin. Contaminated clothing is placed in a plastic bag and labeled as such.

E. Posting of Warning Signs

Radioactive warning signs are promptly posted to keep other personnel out of the emergency area.

F. Survey of Facilities

A prompt survey by the R.S.O. or designate is carried out to identify the extent of the contamination.

G. Decontamination of facilities

The steps required are dictated by the extent and the type of contamination. A careful evaluation of the hazards and other factors (types of surface, matrix, type of radiation, etc) involved is appropriate before beginning decontamination. A thorough decontamination is necessary before the facilities are placed into operation in order to avoid personnel exposure.

VIII. Emergency Procedures (Continued)

H. Part 20.403 of TITLE 10, chapter 1, Code of Federal Regulations requires NRC Regional Office Director notification in certain emergency situations. An accident investigation and report to NRC are also required as stated in Part 20.405.

I. Assistance Personnel

In the event of a radiochemical emergency or accident, contact the following persons:

| Person/Function | metaTRACE phone | Home phone |
|---|---|---|
| Elaine Holland<br>Radiation Safety Officer | * | (314) 534-8383<br>St. Louis, MO |
| T. Will Solomon<br>Laboratory Manager | * | (314) 352-3653 |
| Paul Humburg<br>Safety Officer | * | (314) 928-0580 |

Special Support

For emergencies where additional special services are necessary:

Medical - Dr. C. Douglas Meadows - (314) 567-6581

General Emergency - 911

NRC Region III - (312) 858-2660
(Call collect if necessary)

* Phone numbers will be included as soon as installation is complete and extensions are known.

IX. NRC Records System

Ten (10) logs are kept to comply with NRC regulations 10 CFR 20.401. The logs will be maintained in three=ring notebooks by the R.S.O. Following is a brief description of each log.

A. Log 1 - Radioactive Samples

This log is the first step in the chain-of-custody of environmental radioactive samples received at metaTRACE. The log contains three (3) sections: 1) sample status sheet, 2) sample receipt checklist and 3) sample return checklist.

IX. NRC Records System (Continued)

1) Sample Status Sheet
This contains minimal information. It's primary purpose is to keep track of the sample status of radioactive samples (received and returned) at metaTRACE.
2) Sample Receipt Checklist
This checklist will be completed by the R.S.O. or designated alternate during the initial screening of incoming samples. The form will be filed by the R.S.O. following completion.
3) Sample Return Checklist
As stated under Item 11 - Waste Management, metaTRACE will return any unused portion of the samples received for analysis to the supplying client. The R.S.O. or designated alternate will record the necessary information on Form III during the packing stage of sample return. The completed forms will be filed by the R.S.O.

B. Log 2 - Survey Log

Summary statements reporting the range of observed results from surveys which are performed to verify the safe handling of Radioactive materials.

C. Log 3 - Personnel Exposure Log

The results of film badge evaluations and bioassays are recorded in this log. Film badge reports are forwarded to the R.S.O. from Radiation Detection, Inc., (Sunny Vale, CA) via R. M. Wester and Associates. Bioassays will be performed and tabulated by a contract laboratory until such time as metaTRACE has the instrumentation to perform the analyses in house.

D. Log 4 - Disposal Log

The matrix, amount of radioactive material, mode of disposal, date of disposal and project manager will be recorded.

E. Log 5 - Drum Log

Records of drums packaged and sent for disposal are maintained. The information includes drum number, waste category, date packed, date shipped, amount of activity, destination and waste broker.

11. WASTE MANAGEMENT PROGRAM

All radioactive waste generated at metaTRACE, Inc., will be segregated by types. We anticipate generating the following types of waste: 1) combustible, 2) non-combustible, 3) dispersable liquids and 4) non-dispersable liquids. A sufficient number of appropriate labeled containers will be available in all laboratory areas to facilitate the segregation of waste as it is generated.

Waste will be collected and stored in the designated areas of the shipping and receiving areas or the RCRA storage area until such time as enough waste has been collected to prepare for final disposal.

Final disposal of all radioactive waste will be handled by an NRC license broker.

Also, whenever possible, it will be the policy of metaTRACE to return any excess sample to the supplying client as soon as practical after final analysis and associated paperwork is completed. Following are the steps that will be followed before shipment is made:

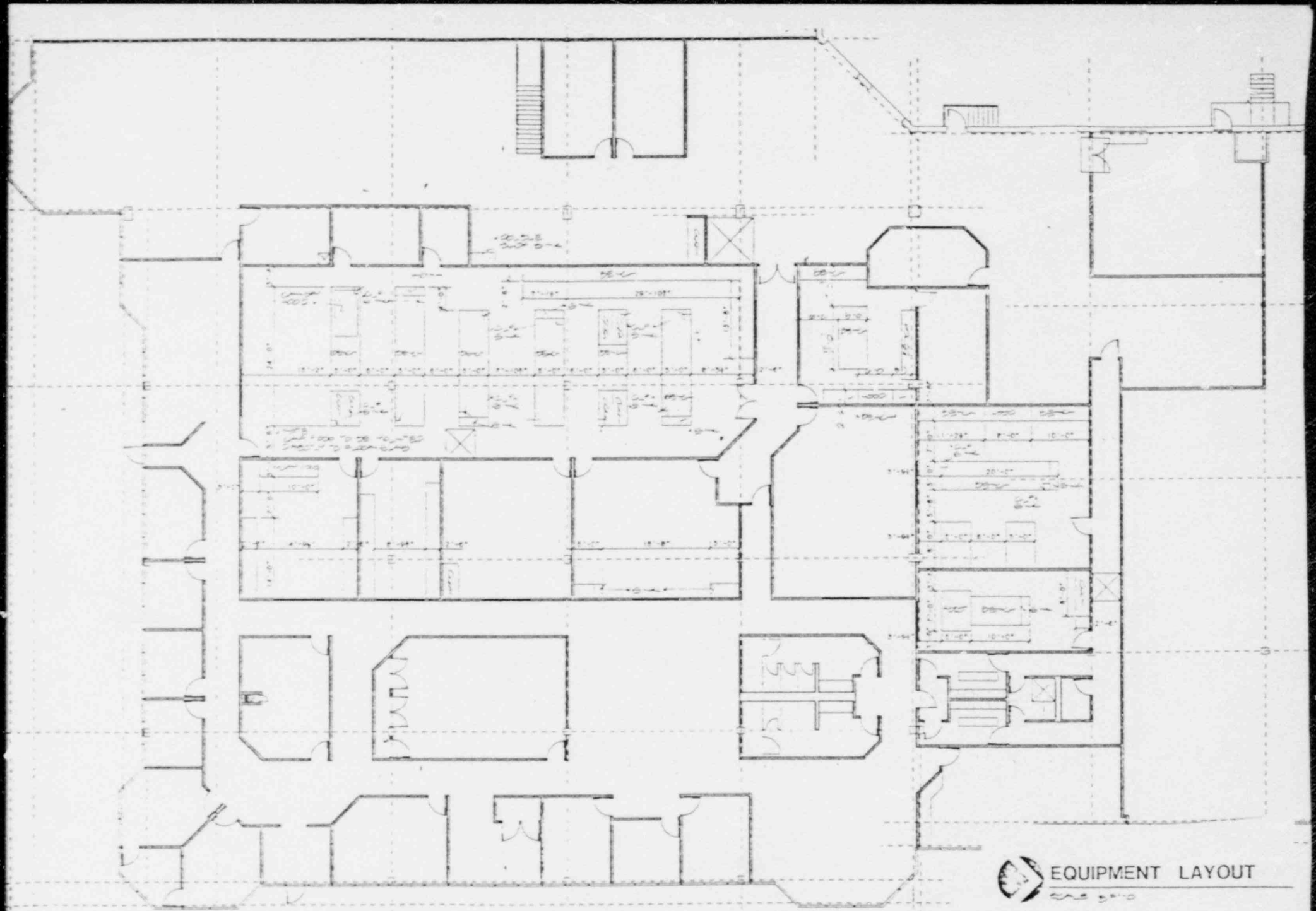
1) Complete analysis and associated paperwork. Notify project manager of sample status.

2) Project manager will notify the R.S.O. when project is complete and give the status and location of the samples.

3) The R.S.O. or designate will complete Form III, Sample Return Checklist, and see that the samples are labeled and packaged according to applicable NRC and DOT regulations.

4) The R.S.O. or designate will arrange for a carrier to deliver the package to the client and notify the client when the shipment will be made.

5) Any changes in the inventory as a result of radioactive material disposal or returning samples to a client will be entered into the Disposal Log.


EQUIPMENT LAYOUT

ATTACHMENT #1

TYPES OF TRAINING

ELAINE M. HOLLAND

| | Where Trained | Duration of Training | On the Job | Formal Course Work |
|---|---|---|---|---|
| principles and practices of radiation protection | Goodyear Atomic Corp. | 5+ years | 1980-1985 | - |
| | Mallinckrodt Diagnostics Division, Mallinckrodt Corp. | 4 months | 1986 | 1 week 1986 |
| radioactivity measurement standardization and monitoring techniques and instruments | Goodyear Atomic Corp. | 5+ years | 1980-1985 | |
| | University of Cincinnati | 2 months | 1984 | 1 week |
| | Mallinckrodt Diagnostics Mallinckrodt Corp. | 4 months | 1986 | 1 week |
| mathematics and calculations basic to use and measurement of radioactivity | Goodyear Atomic Corp. | 5+ years | 1980-1985 | |
| | University of Cincinnati | 2 months | 1984 | 1 week |
| | Mallinckrodt Diagnostics Mallinckrodt Corp. | 4 months | 1986 | 1 week |
| biological effects of radiation | Mallinckrodt Diagnostics Div. | 4 months | 1986 | 1 week |
| | University of Cincinnati | 2 months | 1984 | - |

#7

EXPERIENCE WITH RADIATION

ELAINE M. HOLLAND

| Isotope | Maximum Amount | Where Experience Was Gained | Duration of Experience | Type of Use |
|---|---|---|---|---|
| $^{235}U$ | subcritical | Goodyear Atomic Corporation | 5+ years | Process development and analytical chemistry |
| $^{238}U$ | 100 mCi | Goodyear Atomic Corporation | 5+ years | Process development and analytical chemistry |
| $^{99}Tc$ | 100 mCi | Goodyear Atomic Corporation | 5+ years | Process development and analytical chemistry |
| | 50 mCi | University of Cincinnati | 1 year | Radiopharaceutical research |
| $^{99m}Tc$ | 500 mCi | University of Cincinnati | 2 months | Radiopharaceutical research |
| $^{32}P$ | 7 Ci | Mallinckrodt Diagnostics | 4 months | Radiopharmaceutical research, Production |
| $^{111m}In$ | 8 Ci | Mallinckrodt Diagnostics | 4 months | Radiopharmaceutical research Production |
| $^{59}Fe$ | 2 Ci | Mallinckrodt Diagnostics | 4 months | Radiopharmaceutical research Production |
| $^{57}Co$ | 2 Ci | Mallinckrodt Diagnostics | 4 months | Radiopharmaceutical research Production |
| $^{99}Mo$ | 10 mCi | University of Cincinnati | 2 months | Radiopharmaceutical research |
| $^{125}I$ | 20 mCi | Mallinckrodt Diagnostics | 4 months | Radiopharmaceutical Production |
| $^{131}I$ | 5 mCi | Mallinckrodt Diagnostics | 4 months | Radiopharmaceutical production |

ELAINE M. HOLLAND

In addition to those listed on the preceding pages, Ms. Holland's qualifications as Radiation Officer includes:

1) 5+ years experience as a technician/chemist for Department of Energy contractor, Goodyear Atomic Corporation, at a uranium enrichment facility. This includes experience in environmental and process analytical chemistry of radionuclides and source material.

2) B.S. degree from Ohio University (1978).

3) 5+ years at Goodyear Atomic Corporation in special nuclear materials analytical laboratory.

4) 2 years in collaborative research effort between Goodyear Atomic Corporation and University of Cincinnati on radiopharmaceutical characterization and anaylses.

5) 4 months experience in hot cell laboratory for production of high specific activity radiopharmaceuticals at Mallinckrodt Diagnostics Division of Mallinckrodt Corporation.

6) 5+ years experience with various radiation detection instrumentation including: liquid scintillation, proportional counting, ionization chamber counting, and alpha and gamma spectroscopy.

7) Co-author of research paper (Int. 4, Appl. Rad. and Isot., 1986) on analysis of 99m TC radiopharmaceuticals generator eluants.

ATTACHMENT #1

TYPES OF TRAINING

T. WILL SOLOMON

| | Where Trained | Duration of Training | On the Job | Formal Course Work |
|---|---|---|---|---|
| principles and practices of radiation protection | Oakridge Assoc. University | 2 weeks | - | 2 weeks |
| | Ralston Purina | 1 year | 1 year | - |
| radioactivity measurement standardization and monitoring techniques and instruments | Oakridge Assoc. University | 2 weeks | - | 2 weeks |
| | Ralston Purina | 1 year | 1 year | - |
| mathematics and calculations basic to use and measurement of radioactivity | Oakridge Assoc. University | 2 weeks | - | 2 weeks |
| | Ralston Purina | 1 year | 1 year | - |
| biological effects of radiation | Oakridge Assoc. University | 2 weeks | - | 2 weeks |
| | Ralston Purina | 1 year | 1 year | - |

EXPERIENCE WITH RADIATION

T. WILL SOLOMON

| Isotope | Maximum Amount | Where Experience Was Gained | Duration of Experience | Type of Use |
|---|---|---|---|---|
| $^{55}Fe$ | 50 Millicuries | Ralston Purina | 3 years | Research |
| $^{59}Fe$ | 50 Millicuries | Ralston Purina | 3 years | Research |
| $^{60}Co$ | 10 Millicuries | Ralston Purina | 3 years | Research |
| $^{125}I$ | 10 Millicuries | Ralston Purina | 3 years | Research |
| $^{131}I$ | 10 Millicuries | Ralston Purina | 3 years | Research |
| $^{14}C$ | 10 Millicuries | Ralston Purina | 3 years | Research |
| $^{3}H$ | 150 Millicuries | Ralston Purina | 11 years | Detection Equipment |
| $^{63}Ni$ | 150 Millicuries | Ralston Purina | 11 years | Detection Equipment |
| $^{235}U$ | 150 Millicuries | Envirodyne Engineers | 2 years | Analytical Chemistry |
| $^{238}U$ | 150 Millicuries | Envirodyne Engineers | 2 years | Analytical Chemistry |
| $^{36}Cl$ | 50 Millicuries | Ralston Purina | 3 years | Research |

T. WILL SOLOMON

In addition to those qualifications on the preceding pages, Mr. Solomon's qualifications include:

1. Radiation Protection Officer for Ralston Purina Company, St. Louis, Missouri, from 1981 to 1984.

2. Radiation Protection Officer for Envirodyne Engineers, Inc., St. Louis, Missouri, from 1984 to 1986.

3. Eight years experience in organizing safety training courses, medical surveillance programs and maintaining records and files in compliance with NRC regulations.

ATTACHMENT #1

TYPES OF TRAINING

PAUL HUMBURG

| | Where Trained | Duration of Training | On the Job | Formal Course Work |
|---|---|---|---|---|
| principles and practices of radiation protection | U.S. Army | 4.5 months | - | U.S. Army Training Facility, San Antonio,TX |
| | U.S. Army | 5 years | 1969-1975 | |
| radioactivity measurement standardization and monitoring techniques and instruments | U.S. Army | 5 years | 1969-1975 | 2 weeks, 1971 |
| mathematics and calculations basic to use and measurement of radioactivity | - | - | - | - |
| biological effects of radiation | U.S. Army | 5 years | 1969-1975 | - |

PAUL HUMBURG

Mr. Humburg's experience also includes:

1) Worked in x-ray section from 1969-1975 for the U.S. Army. Responsible for monitoring of personnel for radiation exposure, safe operation of x-ray equipment and proper use of shielding.

2) Assigned to Chemical Biological and Radiological React team for 21st General Hospital. Responsible for decontamination of areas for Army personnel use and monitoring of areas for any contamination during military maneuvers.

3) Health and Safety Officer for Envirodyne Engineers 1978-1986. Responsible for safety aspects of the analytical laboratories, Chairman of the Safety Committee for Envirodyne Engineers from 1983-1986. Worked closely with the R.S.O. in these capacities.

ATTACHMENT #2

# OUTLINE OF INITIAL TRAINING SESSION

I. The need for Radiation training
   A. Radiation cannot be heard, smelled, tasted, felt
   B. Effects may not be immediately apparent
   C. The ALARA Concept

II. The NRC License
   A. NRC regulations
   B. Employee - Right to know
   C. Postings; NRC - Form 3, license and where to find the information

III. Radioactivity - Types and Characterizations
   A. Ionizing vs nonionizing
   B. Alpha particles
   C. Beta particles
   D. Gamma Rays
   E. Radiation Measurements
      1. Rads, Rems - Units of Radiation Dose
      2. Curies, Disintegrations, Counts - Units of Radioactivity

IV. Personnel Exposure
   A. Whole body film badges
   B. Permissible Doses (and the ALARA CONCEPT)
   C. Protection from external radiation exposure
   D. Internal Exposure
      1. Causes
      2. Prevention
      3. Protection

V. Radiation Safety
   A. Laboratory safety manuals
   B. Proper use of survey meters
   C. Signs, tags, labels and warnings
   D. Emergency Procedures
   E. Decontamination of personnel and facilities

VI. Responsibilities
   A. Radiation Safety Officer
   B. Project Managers
   C. Individuals

VII. Waste Disposal
   A. Types of Wastes
   B. Waste Receptacles
   C. Waste Regulations

# INITIAL TRAINING SESSION

I. The Need for Radiation Training:

A. You cannot see, feel, smell, taste or hear radiation.

B. The effects of exposure may not be apparent for 30 years.

C. ALARA - acronym for As Low As Reasonably Achievable
In the past, exposure was to be kept below specified maximum permissible doses. Today, the ALARA concept mandates that exposure is kept as far below the maximum permissible dose as possible. Because ALARA does take into account economic factors, the practice differs from industry to industry. The principle, however, is constant - Keep exposure to personnel and the environment as minimal as practical.

II. The NRC License

A. Any facility involved in the handling, use or analysis of radioactive materials or sources, must be licensed by the Nuclear Regulatory Commission.

B. This license establishes limits on the amount of radioactive materials and/or sources permitted in the facility.

C. The NRC also mandates that we have training on the use, transfer, receipt, disposal, etc. of radioactive materials, and that the procedures established by metaTRACE are followed by all users of radioactive materials.

D. This NRC license also gives employees the following rights:

1) to know your exposure records
2) To see the license and know of any violations or other correspondence with the NRC concerning the license
3) the right to contact the NRC without fear of metaTRACE taking any actions against you immediately or in the future. The NRC will protect you.
4) the NRC can deny to investigate an employee's complaint if they feel it is unwarranted.

## III. Radioactivity - Types and Characteristics

### A. Ionizing vs. non-ionizing radiation

Non-ionizing radiation includes such things as microwaves, radiowaves, visible, infrared or ultra-violet light. It is the propagation and emission of waves that have no apparent biological effects.

Ionizing radiation - According to the NRC definition: alpha, beta, gamma, x-ray, high speed protons, and other atomic particles that, upon exposure, can cause a varying degree of biological affects - acute or chronic.

### B. Alpha particles:

An alpha particle is a highly energetic helium nucleus that is emitted from the nucleus of a radioactive isotope. It is positively charged, massive, and consists of 2 protons and 2 neutrons.

Alpha particles are very limited in their ability to penetrate matter. The dead outer layer of skin is sufficiently thick to absorb all alpha radiations from radioactive materials. Thus, alpha radiation from sources outside the body do not constitute a radiation hazard. Internally deposited alpha emitting isotopes, however, have lost the shielding effect of the skin and the energy of the alpha radiation is dissipated in living tissue. Therefore, alpha radiation is highly toxic when it irradiates the inside of the body from internally deposited alpha-emitting radioisotopes.

Thus, avoidance of practices or situations that could allow the ingestion, inhalation or skin absorption of alpha emitting materials is of paramount importance in the conduct of an effective radiation safety program.

### C. Beta Emission:

A beta particle is an ordinary electron that is ejected from the nucleus of a beta-unstable radio-active atom. The particle has a single negative charge and a very small mass. (1/7000 that of an alpha particle)

Some radioisotopes emit a beta particle and that's all. They are known as pure beta emitters:

III. Radioactivity - Types and Characteristics (Continued)

C. Beta Emission:

$^{32}P$ - The opposite of a pure beta emitter is example beta-gamma emitter. In the case the beta particle is followed instantaneously by a gamma ray. The reason for this is that the daughter nucleus is left in an excited state after the emission of the beta particle and rids itself of the energy of excitation by the emission of a gamma ray.

Beta particles are very small and have the ability to penetrate to varying depths depending on the energy of the beta particle - stopped by a piece of paper or several inches of wood. Therefore, they may pose an external radiation hazard.

Beta particles may also give rise to highly penetrating x-rays called Bremsstrahlung when they are stopped by shielding. Therefore, it is important that shielding is properly designed and that precautionary measures are adopted. Beta emitting isotopes are also potentially hazardous when deposited in the body (although less so than alpha particles). In summary - beta particles are more penetrating than alpha particles but are still easy to shield against. Distance and modest shielding provides effective protection against external sources of beta radiation.

D. Gamma Rays:

Gamma rays are radiations emitted from nuclei of excited atoms following radioactive transformations; they provide a mechanism for ridding excited nuclei of their excitation energy.

Gamma rays differ from alpha and beta in that both alpha and beta have definite ranges in matter and therefore can be completely absorbed while gamma rays can only be reduced in intensity.

Very energetic gamma rays have high penetrating power and are, therefore, a potential external radiation hazard. Proper administrative and engineering practices are aspects of a radiation

III. Radioactivity - Types and Characteristics (Continued)

D. Gamma Rays:

safety program aimed at minimizing the external hazard of gamma emitting materials. The rule of thumb - the denser the material, the better its ability to stop gamma rays.

## RADIATION MEASUREMENTS

### Units of Radiation Dose

1. Rads: The unit of absorbed dose or energy absorbed per gram of material.
   = 100 ergs/gram

2. Rem: Roetgen equivalent man
   = Rad x Relevant Biological Effectiveness RBE = 1 for beta, gamma or x-ray i.e., 1 Rad = 1 Rem

3. Roentgen = a unit of radiation dosimetry to measure ionization.

### UNITS OF RADIOACTIVITY

4. Curie: A standard unit of the rate of decay
   i.e., $3.7 \times 10^{10}$ atoms are transformed per second

5. 1 millicurie = $10^{-3}$ Ci
   1 microcurie = $10^{-6}$ Ci
   1 nanocurie = $10^{-9}$ Ci
   1 picocurie = $10^{-12}$ Ci

6. Becquerel: that quantity of radioactive material in which one atom is transformed per second.
   $3.7 \times 10^{10}$ Bq = 1 Ci

IV. Personnel Exposure

A. Whole body film badges:

Film badge dosimetry is based on the fact that ionizing radiation exposes the silver halide in the photographic emulsion, which results in a darkening of the film. The degree of darkening, which is called the optical density of the film, can be precisely measured and indicates the radiation exposure of the film.

1. wear film badges on the right collar of your lab coat
2. pick up film badge at the RSO desk upon entering the building and drop it off at the end of the day at the same place. DO NOT take them home, store them in your desk, purse, pocket, etc.

B. Permissible Dose:

1. The NRC limits whole body exposure to 1-1/4 REM/quarter
2. A quarter is not less than 12 weeks or more than 14 weeks
3. Whole body film badges will be exchanged on a quarterly basis

C. Protection from External Radiation:

Time, distance, and shielding are the three methods by which exposure to external radiations may be controlled. This is particularly important when working with materials emitting gamma radiation.

D. Internal Exposure:

1. Causes-
   Inhalation
   Ingestion
   Absorption
   Injection

2. Prevention-
   Prevention is good laboratory practices
   - no eating, drinking, smoking, pipetting by mouth, or applying cosmetics in the restricted lab areas
   - wash hands often - especially important when leaving the laboratory area
   - proper technique for removing gloves

IV. Personnel Exposure (Continued)

3. Protection-

If internal exposure of radioactive materials is suspected, the RSO may request a bioassay (usually urinalysis) immediately following the suspected exposure and again the following day

V. Radiation Safety

A. All employees are responsible for becoming familiar with both radiation safety manuals.

B. Learn how to use survey meters and use them often to detect contamination of yourself or the work area.

C. Become familiar with signs, labels, and warnings. These are administrative controls for employees protection and must be shown due respect.

D. Know the emergency procedures outlined in the safety manuals.

- Never hesitate to notify the RSO

- Keep in mind
  1. minimize personnel exposure
  2. localize contamination of work area
  3. stay close by to answer any questions the RSO or Safety Officer may have

* (Take in signs, tags, labels for show; take in a survey meter; demonstrate how to remove gloves).

VI. Responsibilities

A. Radiation Protection Officer

The Radiation Protection Officer (RPO or RSO) has the overall responsibility of radiation safety at a facility. The RPO is responsible for maintaining a license with the NRC and to ensure that the facility and the personnel are acting in compliance with the regulations or limitations of that license.

B. Project Manager

Project Managers, as first line supervision, are responsible for ensuring that any project involving

VI. Responsiblities (Continued)

B. Project Manager (Continued)

radioactive materials is being handled according to corporate policy. The project manager is to oversee all employee actions in the laboratory and work with the RSO in assuring that all employees are acting within the guidelines and regulations governing metaTRACE's license.

C. Individuals

It is the individual's responsibility to act in accordance with all rules and regulations at metaTRACE. Employees are expected to practice the "Safety First" motto. Employees should never hesitate to seek advice or contact the RSO or Safety Officer.

VII. Waste Disposal

A. Types of Waste

1. Organic vs aqueous
2. Burnable vs non-burnable
3. Solids

B. Waste Receptacles

Each laboratory area will be provided with appropriately labeled waste receptacles and employees should segregate waste accordingly.

1. glass disposal boxes
2. burnable radioactive materials
3. non-burnable radioactive materials
4. glass bottles to collect organics
5. completed samples stored in designated areas, receiving area or cooler
6. never flush anything down the drain unless you are sure it is not radioactive

C. Waste Disposal is regulated by:

1. EPA
2. NRC
3. DOT

and can become extremely expensive. It is important to segregate radioactive waste from all other for dual reasons.

ATTACHMENT #3

# SAFETY GUIDLINES FOR

# RADIOACTIVE MATERIALS

# AND SAMPLES

metaTRACE, Inc.
13715 Rider Trail North
Earth City, MO 63045

# SYNOPSIS

These instructions are intended to serve as a safety reference for metaTRACE personnel who are connected with the receipt, use or disposal of radioactive materials. They are designed to complement, but not replace, the instructions of those individuals by The Radiation Protection Officer in the proper handling of radioactive materials.

# INTRODUCTION

MetaTRACE, Inc. receives various environmental samples for analysis that may contain low levels of radioactive materials. These samples, by virtue of their radicactivity, may pose a hazard to personnel depending on the type and size of sample, the types and levels of radioactive materials present and the laboratory manipulations involved in handling and analyzing the samples.

The Nuclear Regulatory Commission (NRC) regulates the use of radioactive materials by industry through licensing procedures for companies like metaTRACE. These licenses specify the types and amounts of radioactive material permitted in the facility, types of uses allowed, permissible waste disposal practices, and recognized safety procedures designed to minimize personnel exposure to radioactive materials. These instructions are designed to briefly outline certain provisions of metaTRACE's NRC license and to guide metaTRACE personnel in the safe handling practices of radioactive materials.

TABLE OF CONTENTS

## I. Receipt of Radioactive Samples

### A. Approval to Receive Samples

Any project manager responsible for the receipt of radioactive samples at metaTRACE must complete a Form I checklist and forward it to the Radiation Safety Officer (R.S.O.) before the samples are shipped to metaTRACE.

### B. Monitoring and Unpacking

The R.S.O. or designate will monitor arriving shipments for external radiation within 3 hours of receipt (if the package is received during normal working hours or 18 hours if the package is received after normal working hours). The results of this survey will be recorded on the Sample Receipt Checklist, Form II. The shipment will be unpacked in an appropriate hood in the receiving area or in the radiological laboratory, checked for internal leaks, verified as to contents, and the packing material surveyed and properly disposed of. These results are also recorded on Form II. During this initial screening, the total weight or volume of each sample will be determined and recorded.

FORM I

Incoming Radioactive Sample Checklist

Project Manager: Date:

Client Name:

Address:

Phone No:

Requested Analysis:

Approximate Sample Size:

Container Type: Size:

Matrix of Samples:

Number of Samples:

Approximate Delivery Date:

Location of Sample Site:

Any known radionuclides present; if so, at what approximate levels?

Any suspected radionuclides present; if so, at what approximate levels?

Have environmental samples been preserved at sample site?_____
If so, how?

Any hazardous materials present:

Do we have an agreement to return excess sample to the client? If not, can we make one? Who do we contact?

Types of suspected activity and approximate levels:

alpha_____

beta_____

gamma_____

Comments:

Date:

Signature:_____

Note: If samples contain known or suspected gamma or high energy beta emitters, consult with R.S.O. and allow enough lead time to make any necessary safety precautions.

FORM II

Sample Receipt Checklist

Date Received: Time:

Number of Samples:

Client Name:

Address:

Phone:

Carrier: Phone:

Shipping Container: Size:

Type:

Condition: Surface reading:

Reading at 1 meter:

Must notify NRC and carrier if surface reading exceed 10mR/hr or 1 meter exceeds 200 mR/hr.

| Sample No. | Total Wt/Vol | Matrix | Rad Level |
|---|---|---|---|

FORM II

| Sample No. | Total Wt/Vol | Matrix | Rad Level |
|---|---|---|---|

Packing material radiation level:

Where was packing material disposed:

Comments:

Signature:_____ Date:

II. Handling of Radioactive Materials

A. Authorized Users

Only those persons who have been formally trained by the Radiation Protection Officer in the safe handling of radioactive materials or have had sufficient formal training and/or on the job experience with radioactive materials (as determined by the NRC) are authorized to work with radioactive materials at metaTRACE.

B. Authorized Work Areas

Radioactive materials and samples can only be taken into or analyzed in rooms clearly exhibiting a "CAUTION: Radioactive Materials" sign on the door, excluding any connecting instrumentation laboratories.

C. Storage of Radioactive Materials

Containers of radioactive materials must be marked with the prescribed "radioactive materials" labels. Radioactive materials must be stored in the designated cooler in the receiving area, in the designated areas in the laboratories cleared for radioactive materials, or in designated areas of sample storage facilities adjacent to the receiving area.

D. Safety Precautions

1. Protective clothing: a laboratory coat, plastic or latex disposable gloves, and eye protection are routinely required in laboratory areas.

2. Whenever practical, work with radioactive materials should be performed in a fume hood as an added safety precaution.

3. In order to minimize the potential for ingestion of radioactive materials the following are <u>expressly forbidden</u> in the laboratory areas:

   3.1 Eating
   3.2 Drinking
   3.3 Smoking
   3.4 Pipetting by mouth
   3.5 Application of cosmetics

III. Monitoring Procedures

A. Personnel Exposure

1. Film Badges: Personnel who routinely work in areas where radioactive materials are present will be issued film dosimetry badges. The film badges are to be picked up at the Radiation Safety Officer's desk prior to entering the laboratory areas. At the end of each work shift, film badges will be returned to the Radiation Safety Officer's desk. Film badges are to be worn on the right side of the laboratory coat collar and should never be stored in pockets, purses, desks, lockers or any place in the laboratory areas. Usually film badges will be exchanged on a quarterly basis.

2. Bioassays: Bioassays, usually urinalysis, are required if the chemical or physical form, level of radioactive materials, or the procedures and equipment used make it possible for radioactive materials to be ingested, inhaled, or absorbed into the body. Bioassays will be performed at the direction of the Radiation Protection Officer in compliance with NRC regulations (Guide 8.9, Acceptable Concepts, Models, Equations and Assumptions for a Bioassay Program).

B. Contamination

1. Survey meters: At appropriate intervals during work with radioactive materials, contamination levels are monitored with a portable survey meter. Survey meters are kept in the Radiological Lab, the Chemical Characterization Lab, the Receiving Area Office and the R.S.O.'s office. These survey meters are used to detect contamination of the work area, laboratory surfaces or personnel. Surveys will be done routinely when working with radioactive materials as a means of contamination control. In the event of a radiochemical accident, these meters can aid in determining the location and degree of contamination.

2. Wipe Test: Routine wipe tests will be conducted by passing a filter paper over a 100 cm2 test area, then determining the extent of contamination by liquid scintillation counting. The project managers or Laboratory supervisors

III. Monitoring Procedures (Continued)

2. Wipe Tests (Continued)

are performed at least monthly in areas where radioactive materials are present. These wipe samples will be counted, the results tabulated and forwarded to the Radiation Protection Officer. The purpose of the monthly wipe test is "in house" contamination control. The results of these surveys will not be recorded.

The Radiation Protection Officer or designated alternate will perform quarterly surveys in areas containing radioactive materials. The wipe test results will be recorded in the Survey Log. In addition to the quarterly survey of Laboratory areas, the R.P.O. will survey unrestricted areas which may have been contaminated by personnel, transport of radioactive materials, or traffic into and out of radioactive laboratories. These surveys will be conducted as described above and recorded in the Survey Log.

IV. Disposal of Radioactive Waste

A. Solids

Waste will be segregated into burnable and non-burnable containers in each laboratory. When sufficient waste is accumulated, it will be stored in the designated area of the shipping and receiving area, awaiting final disposal. The waste will be packaged by the R.S.O. or designate according to applicable NRC and DOT regulations. Final disposal of solid waste will be handled by an NRC licensed broker.

B. Liquids

1. Radioactive liquids that cannot be readily dispersed in water are collected in suitably marked containers in the laboratory areas. When sufficient waste is collected, it will be stored in the RCRA storage area awaiting final disposal. Disposal of non-dispersable liquids will be handled by an NRC licensed broker.

2. Radioactive dispersable liquids will be collected in suitable, marked containers. When sufficient waste is collected, it will be stored in the designated area of the shipping and receiving area. Disposal of radioactive liquid waste will be handled by an NRC licensed broker.

IV. Disposal of Radioactive Waste (Continued)

C. Samples

Whenever possible, it will be the policy of metaTRACE to package and return any excess radioactive materials or samples to the supplying client. This will be accomplished as soon as possible after completion of the final analysis. After analysis is completed and all paper work and reports are finalized, the project manager will inform the R.S.O. of the sample status and location. The R.S.O. or designate will then complete Form III, Sample Return Checklist and package the samples according to applicable NRC and DOT regulations for shipment. The client will be notified when shipment is made.

D. Waste Disposal

Proper waste disposal is an important step in any radiation protection program. It is essential that users dispose of waste in the appropriate locations. Never place potentially contaminated waste in a receptacle for release to unrestricted areas. On the other hand, disposal of radioactive waste is expensive. Therefore, it is equally important that uncontaminated waste is not put in receptacles labeled for radioactive materials. Furthermore, users must apply the same discretion when disposing of dispersable liquids. Under no circumstances are non-dispersable liquids to be flushed down the drain.

FORM III

Sample Return Checklist

Date Packaged: Time:

Date Shipped:

Number of Samples:

Client Name:

Address:

Phone:

Person Contacted:

Notified By:

Time:

Carrier Use: Name:

Address:

Phone:

Shipping container size: Type:

Condition: Surface Reading

Reading at 1 meter

| Sample No. | Weight | Matrix | Rad Level |
|---|---|---|---|

FORM III

Sample Return Checklist

| Sample No. | Weight | Matrix | Rad Level |
|---|---|---|---|

Comments:

Signature:

Date:

V. Emergency Procedures

The order and rapidity with which the following actions are accomplished will vary with the type and extent of the emergency. In all instances, the procedures are designated to:

1) Minimize exposure to personnel and,
2) Prevent the spread of contamination.

A. Confinement of Contamination and notification of R.S.O.

Every effort will be made to confine contamination. This may include the application of absorbents to spills and the taping of openings around exits to prevent the migration of airborne radioactivity to other labs. Notify the R.S.O. immediately and stay in an adjacent area to supply any assistance and limit the spread of contamination.

B. Survey of Personnel

Examination with a survey meter is used to determine the extent of contamination of personnel. This practice should be also routine upon leaving the laboratory area after handling any radioactive material.

C. Decontamination of Personnel

Decontamination is accomplished in an expeditious manner usually by removal of contaminated clothing and repeated washing of affected skin area with soap and water. Care must be taken to avoid damage to the skin. Contaminated clothing should be placed in a plastic bag and labeled as such. If there are any problems in removing contamination from personnel, consult the R.P.O.

D. Assistance

In the event of a radiochemical emergency, a list of persons qualified to assist is posted near the phones in laboratories cleared to handle radioactive samples or materials.

E. Bioassays

Urinalysis of personnel involved in a radiochemical emergency will be done as soon as possible and again the following day to determine if any ingestion of radioactive materials has occurred.

V. Emergency Procedures (Continued)

F. Decontamination of Facilities

The steps required are indicated by the extent and type of contamination. A careful evaluation of the hazards involved is appropriate before beginning decontamination. A thorough decontamination is necessary before the area is placed in operation in order to avoid personnel exposure. Radioactive warning signs will be posted by the R.S.O. until the area is decontaminated to keep unauthorized personnel out.

# EMERGENCY PROCEDURE CHECKLIST

1. Take quick actions to confine contamination

   A. Shut doors
   B. Place towels on spills
   C. Close hoods, etc.

2. Survey personnel

   A. Remove contaminated clothing
   B. Wash contaminated skin

3. Call for assistance

   A. Wait nearby to answer any questions
   B. Stay out of contaminated area
   C. Prevent any other personnel from entering area
   D. Follow instructions of the Radiation Protection Officer