12-140-4

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SINCLAIR RESEARCH LABORATORIES, INC.

400 EAST SIBLEY BOULEVARD
HARVEY, ILLINOIS

May 16, 1957

U. S. Atomic Energy Commission
P.O. Box E
Oak Ridge, Tennessee
Attention: Isotopes Extension, Division of Civilian Application

Gentlemen:

Attached is a triplicate set of Form AEC-313 in request for a broad byproduct license, including field uses as described in item 10.

We are including a description of our new Radiation Laboratory building plus 3 plan view drawings of the rooms and major equipment in this building since it is impossible to describe this facility in a few brief statements.

In addition, we have included a description of radioisotope committee control over radioisotope procurement and our record keeping procedures. To our knowledge, the functions of the radioisotope committee conform with the requirements for a broad license. If such is not the case, we would appreciate any suggestions you may have.

We would like to know if there is any mechanism whereby radioactive materials can be ordered and used by us in advance of approval of this broad license since we understand that there may be considerable delays in your processing the many forms you will receive.

We would appreciate your handling of this application as soon as possible so that we can commence on the next phase of our radioisotope research shortly.

Yours very truly,
SINCLAIR RESEARCH LABORATORIES, INC.

E. J. Martin

E. J. Martin
Vice President & General Manager

AIS/pj

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RADIOISOTOPE COMMITTEE CONTROL OVER RADIOISOTOPE PROCUREMENT AND RECORD KEEPING

Before establishment of a radioisotope committee, all applications to the AEC for radioactive materials, with the exception of a strontium-90 sealed source, required approval of the Radiological Safety Officer. (The strontium-90 sealed source application was handled by a man with many years of experience in analytical techniques and uses of X-ray equipment). This procedure gave quite firm control over all radioisotope uses and users in this laboratory. With the establishment of a radioisotope committee of six members, essentially the same procedure is to be followed, except that all users will require approval for any specific use by a quorum consisting of at least four members of the Radioisotope Committee. This quorum must always include the Radiological Safety Officer. The personnel of the committee were chosen with the approval of the Technical Manager of this Laboratory. Notice of control of the Radioisotope Committee over procurement of radioactive materials is given by a letter signed by the Technical Manager to all divisions of the laboratory.

The following list includes a description of the responsibilities of the Radioisotope Committee:

(1) The committee will not attempt to evaluate the merit of projects using radioisotopes, but it will pass on the conformity of the request with AEC requirements.

(2) The main safety responsibility rests with the user and the Radiological Safety Officer, and the committee will not carry on day-by-day supervision of safety precautions. Enforcement of radiological safety precautions is the responsibility of the Radiological Safety Officer.

(3) The committee will approve the use of an isotope (or mixture of isotopes) of a certain activity, and under the direction of certain supervisory personnel. If any one of these factors is changed, the committee must be notified, and a new approval requested.

(4) The committee will have the responsibility of determining whether the intended user is sufficiently informed and has set up the proper safeguards to use the requested isotope safely. The committee may ask for periodic oral reports, on any project using radioisotopes, involving the radiological safety of the project.

(5) All business of the committee can be carried on if a quorum of four is present; however, the radiological safety officer must be one of the four.

(6) The committee will pass on the use of all radioactive isotopes, including those at levels below activities requiring AEC approval, excluding the use of uranium and thorium in analytical reagents.

(7) The committee will issue an annual report, and keep minutes of each meeting. All decisions of the committee will be stored in a permanent file.

(8) The functions of the committee outlined here are subject to approval by the AEC.

A record of the location of all radioisotopes, use, disposal and other pertinent information is kept on file in the office of the Plant Safety Supervisor. Film badge and pocket dosimeter readings are sent weekly to the Radiological Safety Officer, then to the user, and finally to the Plant Safety Supervisor where they are filed. Local weekly exposure limits have been set at 100 mr/week by the Radiological

Safety Officer. To date, all film badges but one have indicated weekly exposures below 50 mr/week. The exception gave a reading of 55 mr and we have reason to believe that it was due to a defect in the badge.

All employees involved in or near radioactive work and supervisory personnel are given indoctrination lectures in basic concepts of radiation protection and use of the various radiation measuring instruments that they encounter such as film badges, dosimeters, survey instruments, etc. These indoctrination talks are given before commencement of the work involved.

In a given work area printed regulations pertaining to radiological safety procedures in that area are posted.

Work areas and area effluents are monitored.

Further description of radiological protection procedures is given in other sections of this application.

12-140-4

Form AEC-318 (9-55)

A[illegible]IC ENERGY COMMISSION

APPLICATION FOR BYPRODUCT MATERIAL LICENSE

Form approved. Budget Bureau No. 38-R027.3.

DUPLICATE

INSTRUCTIONS: Complete Items 1 through 19 if this is a new application. If renewal is requested, complete only Items 1 through 11 provided that with respect to the other items there has been no change in the information previously submitted. Mail two copies to: U. S. Atomic Energy Commission, P. O. Box E, Oak Ridge, Tennessee, Attention: Isotopes Extension, Division of Civilian Application. Upon approval of this application, the applicant will receive an AEC Byproduct Material License. General requirements for issuance of an AEC Byproduct Material License are contained in Title 10, Code of Federal Regulations, Part 30.

1. (a) NAME AND SHIPPING ADDRESS OF APPLICANT (Institution, firm, hospital, person, etc.)
Sinclair Research Laboratories, Inc.
400 East Sibley Blvd.
Harvey, Illinois

(b) ADDRESS(ES) AT WHICH BYPRODUCT MATERIAL WILL BE USED (If different from shipping address)
Same as shipping address except for field uses see 10 (a)

2. DEPARTMENT TO USE BYPRODUCT MATERIAL
Any

3. INDIVIDUAL USER (Name and title of individual(s) who will use or directly supervise use of byproduct material) As approved by the radioisotope committee of applicant institution (See attached list for names and experience of radioisotope committee members).

4. RADIOLOGICAL SAFETY OFFICER (Name of person qualified in radiological safety, if other than individual user)
Dr. Adolph I. Snow

5. PREVIOUS LICENSE OR AUTHORIZATION NUMBER (If this is an application for renewal of a license for byproduct material obtained under a prior license or authorization for radioisotope procurement)
This license intended to supersede all previous licenses.

BYPRODUCT MATERIAL OR IRRADIATION SERVICE DESIRED

6. BYPRODUCT MATERIAL (Element and mass number)	7. CHEMICAL AND/OR PHYSICAL FORM (Or catalog number)	8. MAXIMUM AMOUNT OF RADIOACTIVITY IN MILLICURIES THAT YOU WILL POSSESS AT ANY ONE TIME
Any byproduct material between atomic numbers 3 and 83 plus tritium	Any	See attached sheet

9. IF IRRADIATION SERVICE IS DESIRED, STATE PERTINENT DETAILS SUCH AS: CHEMICAL COMPOSITION AND WEIGHT IN GRAMS OF TARGET MATERIAL, RADIOACTIVITY, IRRADIATION TIME IN DAYS, AND NEUTRON FLUX
See data for previous licenses 12-140-3 and amendment 1 to 12-140-3. Other irradiation services may be needed.

STATEMENT OF USE

10. (a) DESCRIBE PURPOSE FOR WHICH BYPRODUCT MATERIAL WILL BE USED. (If material is for "human use" complete Supplement A in lieu of this item. If material is to be used in or manufactured as a "sealed source" complete Supplement B in addition to this item.) RESEARCH AND DEVELOPMENT as defined in Section 11(q) Atomic Energy Act of 1954. (1) Theoretical analysis, exploration, or experimentation; or (2) the extension of the investigative findings and theories of a scientific or technical nature into practical application for experimental and demonstration purposes, including experimental production and testing of models, devices, equipment, materials and processes. (3) Field uses (see attached sheet).

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Byproduct material obtained pursuant to this application will not be used as follows: (a) in human beings; (b) in routine industrial use or commercial resale; (c) in field or other use where long term control of radioactivity might be lost unless well below permissible non-occupational concentrations for air and water above natural background. All uses will be approved in advance by the radioisotope committee and the committee will maintain a record of the action taken in approving each use.

CERTIFICATE

11. The applicant and any official executing this certificate on behalf of the applicant named in Item 1, certify that this application is prepared in conformity with Title 10, Code of Federal Regulations, Part 30, and do solemnly swear (or affirm) that all information contained herein, including any supplements attached hereto, is true and correct to the best of our knowledge and belief.

State of ....
County of ....
Subscribed and sworn to before me this ....
day of ....

....
Notary Public

Sinclair Research Laboratories, Inc.
Applicant named in Item 1

By [signature]

Vice President & General Manager
Title of Certifying Official

May 16, 1957
Date

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.

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(Continued on reverse side)

16—57264-5

Form AEC-313

ATOMIC ENERGY COMMISSION

APPLICATION FOR BYPRODUCT MATERIAL LICENSE

INSTRUCTIONS: Complete Items 12 through 19 if this is a new application. This information may be omitted from subsequent applications provided there is no change in the information previously submitted, and reference is made in Item 5 to the application on which this information appears.

TRAINING AND EXPERIENCE WITH RADIOACTIVITY OF INDIVIDUAL USER NAMED IN ITEM 3

12. TYPE OF TRAINING	WHERE TRAINED	DURATION OF TRAINING	ON THE JOB (Circle answer)	FORMAL COURSE (Circle answer)
1. Principles and practices of radiological health safety	Radiological Safety Officers'		Yes No	Yes No
2. Radioactivity measurement standardization and monitoring techniques and instruments	experience shown on attached sheet.		Yes No	Yes No
3. Mathematics and calculations basic to the use and measurement of radioactivity			Yes No	Yes No
4. Biological effects of radiation			Yes No	Yes No
5. Actual use of radioisotopes in the types and quantities for which application is being made, or equivalent experience			Yes No	Yes No

13. ISOTOPE HANDLING EXPERIENCE

ISOTOPE	MAXIMUM AMOUNT	WHERE EXPERIENCE WAS GAINED	DURATION OF EXPERIENCE	TYPE OF USE
		See attached sheet		

14. If Radiological Safety Officer named in Item 4 is different from individual user named in Item 3, use supplementary sheet to provide equivalent information on "Training and Experience With Radioactivity of Radiological Safety Officer." Supplementary sheet is attached (Circle answer) (Yes) No

PHYSICAL FACILITIES, EQUIPMENT, AND RADIATION INSTRUMENTATION

15. RADIATION DETECTION INSTRUMENTS (*Use separate sheet if necessary*) See attached sheet

TYPE OF INSTRUMENTS (*Include make and model number of each*)	NUMBER AVAILABLE	RADIATION DETECTED	SENSITIVITY RANGE (*mr/hr*)	WINDOW THICKNESS (*mg/cm²*)	USE (*Monitoring, surveying, measuring*)
			See attached sheet		

16. FILM BADGES, DOSIMETERS, AND OTHER PERSONNEL MONITORING DEVICES INCLUDING BIO-ASSAY PROCEDURES

See attached sheet

17. METHOD, FREQUENCY, AND STANDARDS USED IN CALIBRATING INSTRUMENTS LISTED ABOVE (*For film badges specify method of calibration and processing, or name supplier*)

See attached sheet

18. (a) DESCRIBE BRIEFLY REMOTE HANDLING EQUIPMENT, STORAGE CONTAINERS, SHIELDING, AND LABORATORY FACILITIES (*Working areas, fume hoods, etc.*)

See attached sheet

(b) SKETCHES OF SUCH FACILITIES ARE ATTACHED (*Circle answer*) (Yes) No

19. DESCRIBE BRIEFLY RADIATION SURVEYING PROCEDURES AND METHODS OF DISPOSING OF RADIOACTIVE WASTES

See attached sheet

U. S. GOVERNMENT PRINTING OFFICE 16—57264-5

ATTACHMENT TO FORM AEC-313, Page One

3. RADIOISOTOPE COMMITTEE EXPERIENCE

Dr. L. H. Beckberger - Senior Research Technologist
Ph.D. in Chemical Engineering
12 years industrial experience in catalysis research, reaction kinetics, thermodynamics, process design, economic analysis, process development. Attended ORSORT at Oak Ridge, Tennessee for one year in 1951-1952.

(Items in this column are the same as in question 12 of Form AEC-313)

Type of Training	Where Trained	Duration of Training	On the Job	Formal Course
1.	ORSORT, Oak Ridge, Tenn.	1 year	Yes	Yes
2.	"	1 year	Yes	Yes
3.	"	1 year	Yes	Yes
4.	"	1 year	Yes	Yes
5.	"	1 year	Yes	Yes

Dr. Jay S. Curtice - Research Chemist
Ph.D. in Physical-Organic Chemistry
2 years of experience in industrial organic chemistry including catalytic processing, synthetic lubricants, and 1 month of experience handling MTR fuel elements of kilocurie strength.

Type of Training	Where Trained	Duration of Training	On the Job	Formal Course
1.	Sinclair Research Labs. Inc.	6 weeks	Yes	Yes
2.	"	6 weeks	Yes	Yes
3.	"	6 weeks	Yes	Yes
4.	"	6 weeks	Yes	Yes
5.	"	1 month	Yes	No

Mr. M. L. Hamilton - Assistant Director of Engine Laboratories (15 years)
Sinclair Research Laboratories, Inc.
Twenty-three years experience in Sinclair Engine Laboratories
B.S. in General Engineering, Univ. of Illinois 1932.

Type of Training	Where Trained	Duration of Training	On the Job	Formal Course
1.			No	No
2.			No	No
3.			No	No
4.			No	No
5.			No	No

ATTACHMENT OF FORM AEC-313, Page One

3. RADIOISOTOPE COMMITTEE EXPERIENCE (Cont.)

Mr. R. H. King - Assistant Director Research Personnel Services,
Safety Supervisor
B.S. Pre.Med. 1 1/2 years Chem. lab. exp. 5 1/2 yrs. Personnel & Safety

(Items in this column are the same as in question 12 of Form AEC-313)

Type of Training	Where Trained	Duration of Training	On the Job	Formal Course
1.	Sinclair Research Labs.,Inc.	1/2 year	Yes	No
2.			No	No
3.			No	No
4.	Sinclair Research Labs.,Inc.	1/2 year	Yes	No
5.			No	No

Mr. Lionel D. Norris, Jr. - Administrative Assistant and Supervisor of Communications
B.S. (Chemistry).
Presently working for M.B.A. at University of Chicago Business School (Downtown Branch).
1943 - 1948: Metallurgical Laboratories, Univ. of Chicago (Manhattan Project). Transferred to Oak Ridge in Oct. 1943, worked until August 1948 at what is now known as Oak Ridge National Laboratories. Had extensive experience in the preparation and handling of radioactive species. Considerable work in detection equipment, fission chemistry, tracer problems, etc.
1950 - Present: Sinclair Research Labs., Inc. Six years working in field of catalysis reaction kinetics, etc. One year in present position, which is primarily administrative. Major concern at present are with problems in area of personnel adminsitration.

Type of Training	Where Trained	Duration of Training	On the Job	Formal Course
1.	Metallurgical Lab.,Univ. of Chicago; Oak Ridge(X-10)Tenn.	5 years	Yes	No
2.	"	5 years	Yes	No
3.	"	5 years	Yes	No
4.	"	5 years	Yes	No
5.	"	5 years	Yes	No

Dr. Adolph I. Snow - Senior Project Chemist
Radiological Safety Officer, Director, Radiation Laboratory
Ph.D. in Physical Chemistry
Instructor University of Chicago, Two years
4 3/4 years experience on catalysis research and application of physical chemistry to petroleum problems.
Seven years of research at Ames Laboratory of the AEC.

See items 12 and 13 for specific experience involving radioactive materials.

ATTACHMENT TO FORM AEC-313, Page One

8. MAXIMUM AMOUNT OF RADIOACTIVITY IN MILLICURIES THAT YOU WILL PROCESS AT ANY ONE TIME

1,000 mc of each byproduct material between Atomic No. 3 and 83 except for cobalt-60. 25,000 mc of cobalt-60 and iridium-192, respectively. 100,000 mc of tritium.

Total possession limit not to exceed 25 curies of cobalt-60 and iridium-192, respectively, plus 80 curies of byproduct material between Atomic No. 3 and 83 and 100 curies of tritium.

10. PURPOSE FOR WHICH BYPRODUCT MATERIAL WILL BE USED

Field Uses. Leak detection, mixing experiments in refineries and pipelines and the like. Gasoline station tank leaks using tritiated compounds below non-occupational levels. Concentrations of byproduct materials used to be below non-occupational permissible air and water concentrations above natural background except for very short lived activities such as iodine-132 (2.33 hour half-life). Such short lived activities will be contained until their concentration is well below permissible non-occupational levels. All field uses to be under the direct control of qualified trained personnel approved by radioisotope committee.

Sinclair Research Laboratories, Inc.
May 16, 1957
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ATTACHMENT TO FORM AEC-313, Page Two

12. TYPE OF TRAINING

	Where Trained	Duration of Training	On the Job	Formal Course
1.	Ames Laboratory of the AEC	7 years	Yes	No
	Sinclair Research Labs., Inc.	2 years	Yes	No
	University of Chicago	1 year	Yes	No
2.	Ames Laboratory of the AEC	7 years	Yes	Yes
	Sinclair Research Labs., Inc.	2 years	Yes	No
	University of Chicago	1 year	Yes	No
3.	Ames Laboratory of the AEC	7 years	Yes	Yes
	University of Chicago	2 years	Yes	No
	Sinclair Research Labs., Inc.	3 years	Yes	No
4.	Sinclair Research Labs., Inc.	2 years	Yes	No
5.	Ames Laboratory of the AEC (Sinclair Research Labs., Inc. & University of Chicago - includes experience with X-ray and neutron diffraction equipment)	7 years	Yes	No

13. ISOTOPE HANDLING EXPERIENCE

Isotope	Maximum Amount	Where Experience was Gained	Duration of Experience	Type of Use
Uranium and decay products	Many pounds	Ames Laboratory of the AEC	7 years	Metallurgical, X-ray diffraction, preparation of compounds
Thorium and decay products	Many pounds	"		
Cobalt 60	Around 1 millicurie	Sinclair Research Labs., Inc.	6 months	Preparation of demonstration sample
Tantalum 182	Around 200 millicuries of gamma activity	Sinclair Research Labs., Inc.	1 year	Cutting tools for wear tests.
Iron 59	Around 30 millicuries of gamma activity	Sinclair Research Labs., Inc.	1 year	Piston ring wear tests.
Contained fission products (spent MTR Fuel elements)	Kilocuries	Sinclair Research Labs., Inc.	1 month	Radiation Chemistry research.
X-ray diffraction equipment Neutron diffraction equipment		Ames Laboratory of the AEC	7 years	Diffraction studies.

Sinclair Research Laboratories, Ir
May 16, 1957

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15. RADIATION DETECTION INSTRUMENTS

Type of Instruments	Number Available	Radiation Detected	Sensitivity Range	Window Thickness	Use
Nuclear Instrument & Chemical Co. survey Meter Model #2612	2	Alpha, beta, gamma	0.2, 2, and 20 mr/hr	1.4	Surveying
Tracerlab Cutie Pie Model SU1H	1	Beta, gamma	25, 250, 2500 mr/hr Full scale accuracy ± 10% of full scale	2-3	Surveying
Tracerlab Laboratory Monitor Model SU-3C	1	Alpha, beta, gamma	200, 2000, 20,000 Cpm full scale	1.9	Monitoring
Tracerlab Superscaler Model SC-18A	1		Input sensitivity from 0.2 to 0.35 volts.		Detector for measuring
Tracerlab 1-1/2 x 1" long sodium iodide (Tl) crystal connected to P-20 amplifier - Shield 2" of lead	1	Gamma			
Nuclear Instrument and Chemical Co. D-34 detector in Model 3031B 2" lead shield		Beta, gamma		1.4	Detector for measuring
Tracerlab Piston Ring Wear Analyzer consisting of 1-3/4" D x 2" long sodium iodide (Tl) crystal plus SC-34A precision ratemeter plus P-20A scintillation detector, plus SC-51 autoscaler plus SC-SF Tracerlab printing interval time recorder plus Brown recorder.	1	Gamma			Measuring
Philips Model PWH010		Beta, Gamma	1-1.25 mr/hr 0-25 mr/hr		Monitoring
Berkeley SRJ-3 (JUNO)	1	Alpha, Beta, gamma	50, 500 and 5,000 mr/hr	0.45	Surveying
Berkeley HRJ-3 (JUNO)	1	Alpha, Beta, gamma	250, 2500, and 25,000 mr/hr	0.45	Surveying

Sinclair Research Laboratorie
Inc.

May 16, 1957

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ATTACHMENT TO FORM AEC-313, Page Two

15. RADIATION DETECTION INSTRUMENTS (Cont.)

Type of Instruments	Number Available	Radiation Detected	Sensitivity Range	Window Thickness	Use
Nuclear Measurements Corp. Model GS3-CD Survey Meter	1	Beta, gamma	0.5, 5.0 and 50 mr/hr	30 mg/cm^2	Surveying
Nuclear-Chicago D-47 Gas Flow Counter with M-5 Manual Sample Changer	1	Alpha, beta, gamma			Measuring
Nuclear-Chicago DS5-1 Scintillation Probe with 1" x 1" No. I and 1-7/8" x 2-1/4" NaI Well Crystal	1	Beta, gamma			Measuring
Nuclear-Chicago Model 192 Ultrascaler	1		0.1 to 0.8 Input sensitivity		Measuring
Packard Inst. Co. Tri-Carb Liquid Scintillation Counter	1	Alpha, beta, gamma			Detection Measurements Spectroscopy
Nuclear-Chicago Model 1610 Ratemeter	1	Alpha, beta, gamma	300, 3000, 10,000 30,000 and 100,000 Cpm.	1.4	Measuring Monitoring
Nuclear-Chicago Model 1619 Lab. Monitor	1	Alpha, beta, gamma	500, 2,000, 5,000 and 20,000 cpm	1.4	Monitoring
Nuclear-Chicago D-34 Geiger Counter with P-11 Probe	2	Alpha, beta, gamma		1.4	Detection
Fred Henson Co. Lauritsen Electroscope	1	Beta, gamma			Measuring

16. FILM BADGES, DOSIMETERS, AND OTHER PERSONNEL MONITORING DEVICES INCLUDING BIO-ASSAY PROCEDURES

Film badges from Nuclear Instrument and Chemical Co. processed weekly, 24 direct reading pocket dosimeters, Tracerlab model K-112-full scale 200 mr. accuracy ± 5% of full scale. Film badges worn at all times. Pocket dosimeters worn at all times by tracer chemists. Pocket dosimeters worn at starting period of standardized operations such as wear tests to obtain daily readings to form an accurate base line. Also used for maintenance personnel and visitors. Standard sources - (1) Tracerlab 12-7 calibrated gamma source 11.1 x 10^{-1} microcuries covered with 1.3 gm/cm^2 of lead; (2) Nuclear Instrument and Chemical Co. Model R2 uncalibrated source containing 2-3 micrograms of radium in a plastic cylinder 1" x 1/2"; (3) Three 2-milligram samples of radium sulfate, calibrated, sealed.

Physical examinations include initial and semi-annual complete blood counts, urinalysis, chest X-ray plus a routine general physical examination for all personnel handling radioactive materials.

Bioassays will be used if nature of radioactivity such as long biological half life required it or in the event of incidents leading to airborne contamination.

17. METHOD, FREQUENCY, AND STANDARDS USED IN CALIBRATING INSTRUMENTS LISTED ABOVE

Film badges - obtained from and processed by Nuclear Instrument and Chemical Company.

Dosimeters and survey instruments are intercompared by exposure to same source and calibrated against calibrated radium sulfate sources in known geometries. Frequency of calibration - monthly.

18. DESCRIPTION OF REMOTE HANDLING EQUIPMENT, STORAGE CONTAINERS, SHIELDING AND LABORATORY FACILITIES

See attached description of Radiation Laboratory Building plus 3 plan views for description of facilities in Radiation Laboratory.

18 foot deep water well can be used as a storage area for suitably contained radioisotope samples.

Remote Hnadling Equipment - 5 foot long handled tongs, magnetic pickup with 5 foot handle.

Storage containers - Concrete lined holes in floor, stoppered by 16" long concrete plugs in Engine Laboratory and tracer laboratory in Radiation Laboratory building. Special lead storage containers for radioactive piston rings and cutting tools.

Blickman A-1 modified low intensity dry box.

Storage area in special locked room in Engine Laboratory. Counting area in spedial designated location in Engine Laboratory.

Sinclair Research Laboratories, I
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18. DESCRIPTION OF REMOTE HANDLING EQUIPMENT, STORAGE CONTAINERS, SHIELDING, AND LABORATORY FACILITIES

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Other Equipment	Number Available	Use
Interlocking Lead Bricks	60	Shielding
Nuclear-Chicago Model 3035 E Lead Pots	2	Shielding
Tracerlab E-18A Remote Pipettor	2	Pipetting
Atomlab Radiarm, Jr. Long-Handled Tongs	1	Remote handling
RCL Safety Clamping Tongs	1	Transport, handling
RCL Safety Sample Carrier (Long-Handled)	1	Transport

19. BRIEF DESCRIPTION OF RADIATION SURVEYING PROCEDURES AND METHODS OF DISPOSING OF RADIOACTIVE WASTES

Airborne activity measured by drawing known amount of air through a filter and then measuring activity level deposited on filter. Area surveys carried out with appropriate portable survey meters. Surfaces tested by measuring activity of wipes. Clothing, shoe contamination, etc. detected by laboratory monitors or ratemeter.

Laboratory monitors are constantly kept running in areas where significantly active radioactive materials are in use. Hood filters checked for activity buildup on a schedule.

Waste Disposal - Solid waste such as piston rings, cutting tools, contaminated glassware etc. sent to authorized disposal agency. Liquid waste stored in 3,000 gallon tank and then concentrated by distillation and/or ion exchange with activity of effluent measured to be certain it is at a safe level for disposal. The concentrated liquid waste is recycled or sent to authorized disposal agency. Liquid hydrocarbons containing radioactive wear particles (Fe-59 for example) are stored in an isolated marked drum until level has decayed below non-occupational levels and then burned, in calculated small quantities to assure that airborne activity is well below safe levels. Activity or residue monitored. No activity disposed of, in sewer system unless below authorized disposal levels.

TRACER LABORATORY BUILDING

The building layout was selected on the basis of flexibility and recognition was given to basic nuclear laboratory considerations such as surface treatment, waste disposal, radioactive material storage, monitoring, shielding, and air handling treatment and flow. The building is approximately 42 feet wide by 54 feet long. It is divided into two sections for nuclear research; a radioactive tracer section and a radiation section. An office is provided for administrative activities. See attached figure entitled Floor Plan - Radiation Laboratory Building.

The architecture of the building essentially matches that of the other buildings on the site. The building is a single story structure of masonry construction, except for the hot cave which is constructed of reinforced monolithic concrete. Exposed surfaces throughout the interior of the building are designed to be smooth and free of cracks.

The building is air conditioned to obtain clean air and nearly constant temperature conditions which provide for better laboratory test data, better working conditions, and reduced building maintenance. Air discharged from the building from two fume hoods and the radiation cave is filtered thru absolute filters which are 99.95% efficient on particles as small as .000012 of an inch. The filter housings are designed to provide for safe handling of contaminated filters from the housing to a disposable container insuring that radioactive material fallout from the filters during transfer will be held to a minimum.

Air from the building is discharged thru exhaust stacks which extend above the building coping to insure proper distribution and diffusion with no pocketing of the discharged air in the roof area. This affords diffusion of the discharge air from the high level area for all possible wind conditions.

Radioactive Tracer Section

The radioactive tracer section is composed of the counting room, dark room and tracer laboratory. The counting room houses the electronic equipment used in tracer work and also the monitoring equipment used for checking contamination.

The tracer laboratory is equipped with standard laboratory furniture with stainless steel work surfaces. Stainless steel fume hoods are the radio-chemical-type with air foil entrances. Hood bases are of extra sturdy construction which permits loading with heavy shielding material and hood services are arranged for control from the outside. The waste sink is connected to a storage tank for radioactive waste materials which is buried adjacent to the building. Further disposal of radioactive wastes will be made thru the facilities of an authorized private disposal agency.

Removable wall linings are provided in the tracer laboratory where "spills" of radioactive materials might cause contamination requiring replacement of certain areas. This wall lining is constructed of pressed wood attached to furring strips anchored to the masonry wall. All wall joints are masked with tape, and the entire surface is painted with a suitable wall finish.

Item 13

a. Containers - Gamma emitting isotopes are stored and transported in lead pots. Rubber or plastic gloves and aprons are used when appropriate. Auxiliary shielding in the form of lead bricks or steel slabs is used when working with gamma emitters. An area air sampler (MSA FIXT-FLO air samplers) is used when particulate materials containing radioactive isotopes are handled, and a personal air monitor (UNICO Personal Dust Sampler) is also used for personnel.

B. Large quantities of radioactive isotopes are stored in our cave. Access to this room is limited to radiation laboratory personnel. Small quantities of isotopes are stored in two fume hoods in the tracer laboratory. The entire building is locked after normal working hours.

C. Remote handling devices - 12 pairs of 18" tongs, one "mechanical pick-up fingers 48" long."

Item 14

A. Survey Program - At least every 6 months (3 times a year), wipes are made on the floor, bench tops, hood aprons, etc. at 13 locations in N building. The standard procedures which we use are outlined in "Guide for the Safe Use of Radioisotopes" (Handbook 92, U.S. Dept. of Commerce). These wipes are measured on a shielded 2" x 2" sodium iodide crystal scintillation detector attached to a Baird atomic or Nuclear Chicago scaler. In addition to the wipes, an area survey is made at 18 locations in the building with a portable geiger counter, a permanent record of these readings is kept.

Additional surveys are made when handling isotopes in particular forms, the method being suited to the physical form in which the isotope can be released. Area air monitoring with an MSA FIXT FLOW is used with filter paper for particulates. The samples are analyzed in an appropriate counting system.

Air samples are also taken with a UNICO MICRONAIRE air sampling pump equipped with a liquid scrubber for vapor samples, or a filter paper unit for particulates. The micronaire is battery operated, and can be worn by personnel while working, with the intake near the worker's face. The samples are analyzed in an appropriate counting system.

b. Records Management Program

Records of area monitoring and wipe tests are kept as permanent records.

An inventory of all radioactive isotopes is maintained, including receipt, decay changes and uses. An inventory is made annually.

Records of personnel exposures are kept as a permanent record by the Radiation Safety Officer.

Persons responsible for keeping records, G. A. Uhl, L. A. Baillie, J. D. Phelps, person responsible for reviewing records is A. I. Snow.

c. Emergency Procedures

Notification - In case of a fire or spill involving radioactive material, or possible contamination of personnel, immediately notify one of the following persons:

	Home Telephones	Laboratory Telephone
A. I. Snow	[redacted]	509
G. A. Uhl		366
L. A. Baillie		365
J. D. Phelps		366

Exemption 6

Spills - Any spill of radioactive material shall immediately be cleaned up by Radiation Laboratory personnel by use of one or more of the following procedures:

a. Absorption of liquid in paper towels, which shall be placed in a radioactive waste container for later disposal. If the liquid is volatile, the absorbing medium shall be stored in a running hood until volatile materials have evaporated, or shall be placed in a vapor tight container suitable for containing any resultant pressure, and stored in a hood until further processed. The surface shall be cleaned, using solvents if practical, until the surface is free of contamination.

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b. Solids shall be picked up using tongs if possible. In the case of finely divided solids such as fluid catalyst, a vacuum cleaner may be used. The recovered material shall be disposed of properly.

Fires - In case of a fire in N-building, use normal fire fighting procedures except for the following:

a. Immediately notify at least one of the persons listed in "notification" above.

b. Avoid breathing any smoke or gasses from the fire area.

c. Avoid contact with any material that might be contaminated with radioactivity, i.e. from the laboratory areas.

d. Rope off the area until a qualified person can check for radioactive contamination.

Release or loss of Radioactive Material

In case of the accidental release of radioactive material, the radiation safety officer is to be immediately notified. He shall notify the NRC if required by Section 20.403-10CFR.

In case of loss or theft of radioactive material, the radiation safety officer is to be immediately notified. He shall notify the NRC if required by Section 20.402-10CFR.

Accidental Contamination of Personnel

If any contamination of personnel occurs, immediately notify the plant nurse, who will contact the company physician, also notify the radiation safety officer. For minor contamination, use soap and water to clean the area. Check for contamination with a Geiger Counter or wipe tests.

14d. Sealed Source Leak-test Procedures

Sealed sources shall be leak tested at not more than 6 months intervals (3 times a year). The wipes will be analyzed by Radiation Laboratory personnel.

1. Qualifications of personnel are given in Section 8.

2. Sealed sources will be wiped with a water-wetted absorbent paper.

3. Instruments to be used for assay of test samples.

Sealed Source	Type	Manufacturer	Model No.	Measurement Characterist:
Ni-63	End window Geiger tube 1.4mg/Cm^2	Nuclear Chicago	2612	25% Eff.
Sr-90	"	""	2612	40% Eff.
Cs-137	NaI crystal	""	181A	30% Eff.
Am-241	Liq. Scint.	Packard	3214	100% Eff.

4. Instrument Calibration Procedures

Instrument	Source Characteristics	Make	Model
N. C. Geiger	Radium 226	Amersham	184100
N. C. NaI	Radium 226	Amersham	184100
Packard Tricarb	Benzoic-Acid-C	-	-

5. Method used to convert instrument readings to activity

$$\frac{\text{(Wipe CPM - Background CPM)}}{\text{Efficiency} \times 2.22 \times 10^6} = \text{microcuries}$$

Sample calculation - wipe=180 CPM, background=140CPM

$$\frac{(180-140)}{.25 \times 2.22 \times 10^6} = 7.2 \times 10^{-5} \text{uc}$$

Item 15

a. Disposal thru Atomic Disposal Co., Inc.

b. Release of very small quantities into a sanitary sewer system in accordance with 20.303

c. Possibly burial in soil in conformance with 20.304.

d. Release into air or water in conformance with 20.106.

e. Incineration in conformity with 20.305.

Information Required for Commission Approval of Disposal by Incineration

A. The type, quantity and chemical form of byproduct material to be incinerated.

Note: Each of the isotopes listed below is stored in a separate containe:

Hydrogen-3

The tritium is contained in tritiated hydrocarbons. Maximum amount desired to be incinerated per year is 500 millicuries.

Carbon-14

The carbon-14 is contained in the form of hydrocarbons labeled with carbon-14. Maximum amount desired to be incinerated per year is 5 millicuries.

b. Method of measurement of, or estimation of, the concentration of radioactive material in the effluent at the point it leaves the stack.

The means of incineration is the plant boiler system. This system contains a Babcock and Wilcox integral furnace boiler of the water tube type. It contains high pressure (25 to 250 psi) atomizing burners. This furnace operates with a minimum of 50% excess of air over that needed for complete combustion of the fuel with at times an air excess of 200%. Burning rates range from 1000 gallons per day to 6000 gallons depending on the season of the year.

There are two 30,000 gallon storage tanks used to service this furnace system. Inventory is kept above 40,000 to 50,000 gallons. For purposes of this application it will be assumed that all liquid dilutions will be made in a fuel volume of about 20,000 gallons, or 8×10^7 cc which is a safe minimum figure. The material to be incinerated will be pumped into the storage tank from drums while the storage tank is being loaded to insure good mixing.

In order to calculate the concentration of radioactive material at the point where it leaves the stack it is necessary to determine the volume change when one volume of liquid hydrocarbon is burned. The calculation of change in volume on combustion follows.

The hydrocarbon fuel may be regarded as having the formula $(CH_2)_n$. On burning the following chemical reaction occurs

$$(CH_2)_n + 3/2\ n\ O_2 \longrightarrow n\ CO_2 + n\ H_2O$$

A mole of carbon dioxide if formed for each mole of carbon atoms originally present in the liquid. At standard temperatures and pressures one mole of carbon dioxide will occupy a volume of 22,400 cc. Taking the conservative value of 0.7 gm/cc for the density of the fuel burned then every 14 grams or 20 cc of liquid will form 22,400 cc of CO_2 gas, 1 cc of liquid hydrocarbon will form $\frac{22,400}{20}$ or 1120 cc of CO_2. Since air consists of 80% nitrogen then for every volume of oxygen used 4 volumes of nitrogen will be carried in the system. Also since at a minimum a 50% excess of air is used over that needed for complete combustion this excess air also introduces a dilution factor. The total amount of gas emitted from the stack at the point where it leaves the stack is therefore

$$3/2\ (4 + \frac{5}{2})\ 1120 + 1120 = 10\text{-}3/4\ (1120) = 12040\text{cc}$$

Therefore 1 cc of liquid hydrocarbon incinerated will yield 1.2×10^4 cc at the stack.

We now consider the concentration of each isotope, in turn, at the point where it leaves the stack.

1. Tritium. The maximum concentration of tritium activity in the storage tank system is to be set at 10^{-4} microcuries/ml. This liquid concentration leads to a maximum tritium concentration in effluent at the point where it leaves the stack of 8.3×10^{-9} μc/ml. This number is to be compared with Part 20, Appendix B, Table II, Column 1, "unrestricted area" limit of 2×10^{-7} μc/ml. The maximum tritium concentration to be expected is 4.2% of this limit.

It may be of interest to note that the maximum concentration of tritium in the water produced by combustion is 10^{-4} μc/ml which is well below the "unrestricted area" limit of 3×10^{-3} μc/ml for tritium in liquid water.

The concentration of tritium in the hydrocarbons to be added to the 20,000 gallons in the tank will be determined by means of liquid scintillation counting on equipment available at our laboratory. Once this concentration is known it is a simple calculation to determine the maximum volume to be added to the boiler fuel for incineration.

$$\text{Maximum volume to be added in cc} = \frac{(8 \times 10^{7})\ 10^{-4}}{\text{specific activity of material added to boiler fuel in } \mu c/ml}$$

$$= \frac{8000}{\text{specific activity of material incinerated } (\mu c/ml)}$$

$$= \frac{8}{\text{specific activity of material incinerated } (mc/ml)}$$

Carbon-14. The maximum concentration activity of carbon-14 activity in the storage tank is to be set at 10^{-5} $\mu c/ml$. This leads to a maximum concentration at the point where effluent leaves the stack of 8.3×10^{-10} $\mu c/ml$. The "unrestricted area limit" is $1 \times 10^{-7} \mu c/ml$. The maximum carbon-14 concentration expected in the effluent at the point where it leaves the stack is 0.8% of this limit. It may be noted that the limit for C-14 in CO_2 in air is 1×10^{-6} $\mu c/cc$ so that the CO_2 concentrations at the stack exit are .08% of this limit.

The carbon-14 specific activity in the material to be incinerated before dilution will be determined by liquid scintillation spectrometry in equipment available in our laboratory. Following a computation similar to that given for tritium above,

$$\text{maximum volume to be added in cc} = \frac{800}{\text{specific activity in } \mu c/ml \text{ of material added to boiler fuel}}$$

c. Methods of control to insure that particulates and concentrations of radioactive materials are not released which could result in exposures of individuals in excess of the levels set forth in the AEC's "Standards for Protection Against Radiation," Part 20. 88264

The methods of calculation to insure that the maximum concentraof effluents at point of leaving the stack are given above These calculations yield a maximum volume for each isotope to be added to the fuel oil in the storage tanks. Written orders will be given to the pumper involved stating the identity of the waste oil containing drums to be incinerated. His following these orders will be checked. If the maximum volumes given by the calculations are not exceeded then the calculated maximum concentrations at the stack effluent point will not be exceeded.

The question of particulates is next to be considered. In regard to tritium and carbon-14 there is extremely little likelihood of their appearing in particulate matter since the total amount of carbon particles produced in the boiler furnace is an extremely small percentage of the fuel weight that is burned.

D. The height of the incinerator stack, expected dilution factors (if necessary), and the height of and distance to buildings in the surrounding area.

The height of the incinerator stack is 43 feet. A plot plan is attached giving the relative locations, heights of adjacent buildings and other pertinent details.

In regard to dilution factors it should be noted that all air concentrations are given in terms of maximum concentrations of radio-active material in the effluent where it leaves the stack. For all of the isotopes these calculations show that the concentrations are well below any pertinent limits. In actual practice a great deal of further dilution will of course occur as the gas leaves the stack. These dilutions will decrease the concentrations from a very low level to an even lower level.

E. The procedures which will be followed to prevent overexposure of personnel during all phases of the operation-particularly the instructions given to the persons handling the combustibles and the ashes.

All of the material to be incinerated is contained in hydrocarbons. This material is in water insoluble form. Carbon 14 concentrations are in the vicinity of 2.5×10^{-2} µc/ml. Tritium concentrations are always below 10^{-2} µc/ml.

Since all of these waste materials contain the radioactive isotopes before any further dilutions, in such low concentrations in water insoluble form there is little, if any, danger of overexposure of individuals handling these materials. Since only weak beta emitters are involved use of film badges is not necessary.

Radioisotope Committee

All use of radioisotopes under this license must be approved by the Radioisotope Committee. The Committee is not to judge the technical merits of projects, but is responsible for safety in handling radioactive materials. Items for committee considerations include in addition to other considerations type of isotope, chemical form, strength of isotope, half-life, handling of isotopes before introduction into experimental equipment, safety during operation, and handling of effluents to insure that all regulations are met. Minimum practical quantities of radioisotopes are to be used.

Membership is as follows:

A. I. Snow - Chairman
G. A. Uhl
L. A. Baillie