

9-14-59 12-140-4

SINCLAIR RESEARCH LABORATORIES, INC.

400 EAST SIBLEY BOULEVARD
HARVEY, ILLINOIS

September 18, 1959

U. S. Atomic Energy Commission
Washington 25, D. C.

Attention: Division of Licensing and Regulation
Isotopes Branch

Gentlemen:

Attached are three completed copies of Form AEC-313 which request a license to use carbon-14 tagged hydrocarbons in experiments to be conducted at the Sinclair East Chicago refinery catalytic reformer.

It is shown that the maximum amount of radioactivity to be expected in the gasoline is around 7% of the activity level of carbon-14 in living material. A person would have to ingest and absorb around 5700 barrels of the gasoline to reach the body burden of carbon-14. There is, therefore, no public hazard involved.

Approval is requested for a series of twelve of these experiments to be started early in November and to be carried out during 1960 and possibly early 1961.

We believe that these experiments can add greatly to the fund of knowledge concerning catalytic reactions under conditions that cannot be duplicated in the laboratory.

Since we would like to begin this series of experiments in the first week of November we would appreciate an early reply to this application so that we can proceed with further planning. We trust that the information in this application is complete enough for your review. We can at any time furnish any additional information which you may require.

We would appreciate your sending to us several copies of Form AEC-313.

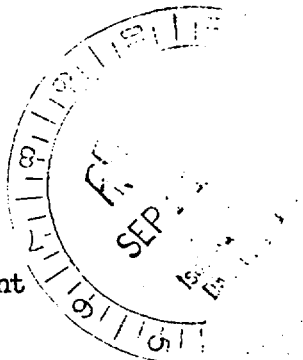
Yours very truly,

SINCLAIR RESEARCH LABORATORIES, INC.

A. I. Snow

A. I. Snow, Chairman
Radioisotope Committee

AIS:ec
Attachment



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Form AEC-313
(5-58)

ATOMIC ENERGY COMMISSION

APPLICATION FOR BYPRODUCT MATERIAL LICENSE

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

INSTRUCTIONS.—Complete Items 1 through 16 if this is an initial application. If application is for renewal of a license, complete only Items 1 through 7 and indicate new information or changes in the program as requested in Items 8 through 15. Use supplemental sheets where necessary. Item 16 must be completed on all applications. Mail three copies to: U. S. Atomic Energy Commission, Washington 25, D. C. Attention: Isotopes Branch, Division of Licensing and Regulation. Upon approval of this application, the applicant will receive an AEC Byproduct Material License. An AEC Byproduct Material License is issued in accordance with the general requirements contained in Title 10, Code of Federal Regulations, Part 30 and the Licensee is subject to Title 10, Code of Federal Regulations, Part 20.

| | | |
|--|--|---|
| <p>1. (a) NAME AND STREET ADDRESS OF APPLICANT. (Institution, firm, hospital, person, etc.)</p> <p>Sinclair Research Laboratories, Inc. 400 East Sibley Boulevard Harvey, Illinois</p> | | <p>(b) STREET ADDRESS(ES) AT WHICH BYPRODUCT MATERIAL WILL BE USED. (If different from 1 (a).)</p> <p>Sinclair Research Laboratories and Sinclair Refining Company East Chicago, Indiana</p> |
| <p>2. DEPARTMENT TO USE BYPRODUCT MATERIAL</p> <p>Radiation Division Sinclair Research Laboratories</p> | | <p>3. PREVIOUS LICENSE NUMBER(S). (If this is an application for renewal of a license, please indicate and give number.)</p> |
| <p>4. INDIVIDUAL USER(S). (Name and title of individual(s) who will use or directly supervise use of byproduct material. Give training and experience in Items 8 and 9.)</p> <p>Dr. A. I. Snow Director, Radiation Division Sinclair Research Laboratories, Inc.</p> | | <p>5. RADIATION PROTECTION OFFICER (Name of person designated as radiation protection officer if other than individual user. Attach resume of his training and experience as in Items 8 and 9.)</p> <p>Dr. A. I. Snow</p> |
| <p>6. (a) BYPRODUCT MATERIAL. (Elements and mass number of each.)</p> <p>Carbon-14</p> | <p>(b) CHEMICAL AND/OR PHYSICAL FORM AND MAXIMUM NUMBER OF MILLICURIES OF EACH CHEMICAL AND/OR PHYSICAL FORM THAT YOU WILL POSSESS AT ANY ONE TIME. (If sealed source(s), also state name of manufacturer, model number, number of sources and maximum activity per source.)</p> <p>See Attachment 1</p> | |

7. DESCRIBE PURPOSE FOR WHICH BYPRODUCT MATERIAL WILL BE USED. (If byproduct material is for "human use," supplement A (Form AEC-313a) must be completed in lieu of this item. If byproduct material is in the form of a sealed source, include the make and model number of the storage container and/or device in which the source will be stored and/or used.)

See Attachment 2

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TRAINING AND EXPERIENCE OF EACH INDIVIDUAL NAMED IN ITEM 4 (Use supplemental sheets if necessary)

| 8. TYPE OF TRAINING | WHERE TRAINED | DURATION OF TRAINING | ON THE JOB (Circle answer) | FORMAL COURSE (Circle answer) |
|--|---|----------------------|-------------------------------|----------------------------------|
| a. Principles and practices of radiation protection | Please refer to application for License 12-140-4 and License 12-140-4(G61). | | Yes No | Yes No |
| b. Radioactivity measurement standardization and monitoring techniques and instruments | | | Yes No | Yes No |
| c. Mathematics and calculations basic to the use and measurement of radioactivity | | | Yes No | Yes No |
| d. Biological effects of radiation | | | Yes No | Yes No |

9. EXPERIENCE WITH RADIATION. (Actual use of radioisotopes or equivalent experience.)

| ISOTOPE | MAXIMUM AMOUNT | WHERE EXPERIENCE WAS GAINED | DURATION OF EXPERIENCE | TYPE OF USE |
|---------|----------------|---|------------------------|-------------|
| | | Please refer to application for License 12-140-4 and License 12-140-4(G61). | | |

10. RADIATION DETECTION INSTRUMENTS. (Use supplemental sheets if necessary.)

| TYPE OF INSTRUMENTS (Include make and model number of each) | NUMBER AVAILABLE | RADIATION DETECTED | SENSITIVITY RANGE (mr/hr) | WINDOW THICKNESS (mg/cm ²) | USE (Monitoring, surveying, measuring) |
|--|------------------|--------------------|------------------------------|---|---|
| Please refer to application for License 12-140-4 and License 12-140-4 (G61). | | | | | |

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

Please refer to application for License 12-140-4 and License 12-140-4 (G61).

12. FILM BADGES, DOSIMETERS, AND BIO-ASSAY PROCEDURES USED. (For film badges, specify method of calibrating and processing, or name of supplier.)

Please refer to application for License 12-140-4 and License 12-140-4 (G61).

INFORMATION TO BE SUBMITTED ON ADDITIONAL SHEETS

| | |
|---|-------------------|
| 13. FACILITIES AND EQUIPMENT. Describe laboratory facilities and remote handling equipment, storage containers, shielding, fume hoods, etc. Explanatory sketch of facility is attached. (Circle answer) Yes No | See Attachment 3. |
| 14. RADIATION PROTECTION PROGRAM. Describe the radiation protection program including control measures. If application covers sealed sources, submit leak testing procedures where applicable, name, training, and experience of person to perform leak tests, and arrangements for performing initial radiation survey, servicing, maintenance and repair of the source. | See Attachment 3. |
| 15. WASTE DISPOSAL. If a commercial waste disposal service is employed, specify name of company. Otherwise, submit detailed description of methods which will be used for disposing of radioactive wastes and estimates of the type and amount of activity involved. | See Attachment 3. |

CERTIFICATE (This item must be completed by applicant)

16. 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 THAT ALL INFORMATION CONTAINED HEREIN, INCLUDING ANY SUPPLEMENTS ATTACHED HERETO, IS TRUE AND CORRECT TO THE BEST OF OUR KNOWLEDGE AND BELIEF.

Date September 18, 1959

Sinclair Research Laboratories, Inc.

Applicant named in item 1

By [Signature]

Vice President

Title of certifying official

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.

Attachment 1

- 6 (b). Chemical and/or Physical Form and Maximum Number of Millicuries of each chemical and/or physical form that you will possess at any one time.

The carbon-14 tagged compounds, which are liquid hydrocarbons, are to be added to the feed to a catalytic reforming unit. The feed consists of a mixture of paraffins and aromatics. It is desired to run 12 tests with the maximum activity of tracer for each test to be set at 4 millicuries. The frequency of tests desired is monthly.

The tagged compounds appear in the product as a mixture of carbon-14 labeled liquid paraffins and aromatics. The tracer compound will be injected as a single pulse. Production from the catalytic reformer varies between 14,000 and 20,000 barrels per day depending on the season of the year with the lower rates in the winter time.

On leaving the catalytic reformer approximately two-thirds of the product is sent to an intermediate storage tank containing at least 30,000 to 40,000 barrels of hydrocarbon. One-third of the product is sent to a tank containing a minimum of 10,000 barrels of hydrocarbon. The products from both of these tanks are blended into gasoline in blending tanks. The products from the catalytic reformer are diluted with at least an equal volume of hydrocarbon, which does not contain carbon-14, in the blending tanks. There is mixing in the intermediate storage tanks due to the pumps that transfer the product to these tanks and from these tanks to the blending tanks. In the blending tanks the various components are mixed with tetraethyl lead solutions to manufacture gasoline. The blending tanks contain stirrers so that one is assured of uniform mixing of the carbon-14 labeled hydrocarbons with the rest of the gasoline.

The calculation of activity level to be expected in the product follows:

$$1 \text{ barrel} = 1.59 \times 10^5 \text{ ml.}$$

4 millicuries will be mixed with 40,000 barrels in the intermediate storage tanks plus 40,000 barrels in the blending tanks. Therefore 4 millicuries of C-14 tagged hydrocarbon will be dissolved in 80,000 barrels of gasoline.

$$\text{Activity in product} = \frac{4000 \text{ microcuries}}{1.59 \times 10^5 \times 80,000 \text{ ml./barrel}} = \frac{4 \times 10^3}{1.222 \times 10^{10}} = 3.3 \times 10^{-7} \mu\text{c/ml}$$

The maximum activity in the product is therefore $3.3 \times 10^{-7} \mu\text{c/ml}$. The body burden for carbon-14 in the newly proposed regulations (Title 10, chapter 1, part 20) is 300 microcuries. Therefore one would have to ingest and absorb inside the body $\frac{300}{3.3 \times 10^{-7}} = 9.1 \times 10^8 \text{ ml.}$ of gasoline to reach this body burden. This is equal to $5.7 \times 10^3 = 5700$ barrels of gasoline, which is obviously impossible.

Let us compare the concentration of carbon-14 in the gasoline with natural carbon-14 concentration. The concentration of carbon-14 activity in the gasoline taking the density of the gasoline as 0.8 is $\frac{3.3 \times 10^{-7}}{0.8} = 4.125 \times 10^{-7}$ and $\frac{2.22 \times 10^6}{(.86)} = 2.58 \times 10^6$

= 1.05 dpm per gram of carbon-14. Dr. Willard F. Libby in his book (Radioactive Carbon Dating, page 10) states that 15.3 dpm per gram is the average for the carbon-14 level of biological materials based on a worldwide assay.

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Attachment 2

radioactive

Therefore, the maximum concentration of carbon to be expected in the gasoline is only around 7% of the carbon-14 level in naturally occurring materials such as food.

There is therefore no public hazard due to the carbon-14 levels in the gasoline since they are well below even natural levels of carbon-14.

Injection of the tracer at the East Chicago refinery and obtaining of samples during these experiments will be supervised by Dr. A. I. Snow.

Attachment 2

7. Describe purpose for which byproduct material will be used.

The purpose of these experiments is research to determine the degree of conversion of particular hydrocarbons to product as a function of catalyst activity. The radioactive tracer method allows us to follow one particular type of feedstock component in the presence of all of the other components which is highly desirable in obtaining meaningful data. Since the activity of the catalyst changes with time a series of tests is necessary rather than just one test. Since the nature of changes in such catalyst activities are different, for a variety of reasons, in a large unit as compared to a small laboratory size unit it is necessary to obtain the data on the large commercial unit.

The samples obtained will be analyzed at Sinclair Research Laboratories, Inc.

Attachment #3

Questions 13)
14) For the information required please refer to applica-
15) tions for Licenses 12-140-4 and 12-140-4(G61) which
give complete descriptions.