

L&R:IB:NEB (48200)

JAN 2 1963

McDonnell Aircraft Corporation
P. O. Box 516
St. Louis 66, Missouri

Attention: Dr. William L. Koster

Gentlemen:

This is in response to your application for byproduct material license dated December 5, 1962.

The application as submitted is deficient in the following respects:

1. The application does not contain any information, nor do we have any prior information, concerning the device containing 6 curies of Hydrogen 3 fuel and described as Lion Research Corp. Model 52-81715-1.
2. Your testing and use of this device is not described in detail so that we may make an evaluation of the possible related radiation hazards.
3. In the absence of knowledge of the device and its proposed testing and use, we cannot consider designating Mr. Conrad as the individual user for a program of development with 240 curies of Hydrogen 3 whom he has no training or previous experience with radioactive materials.

In order to consider your application further we will need information on the device, our program for testing and using it, and the training and instruction to be given to Mr. Conrad.

Sincerely yours,

Robert E. Brinkman
Isotope Branch
Division of Licensing
and Regulation

A/372

OFFICE	L&R:IB				
SURNAME	REBrinkman:dc				
DATE	1/2/63				

JUL 4

MCDONNELL *Aircraft Corporation*
Lambert Saint Louis MUNICIPAL AIRPORT • BOX 516, ST. LOUIS 66, MO.

11 FEB 1963
Ref: USAEC-220-1262

United States Atomic Energy Commission
Washington 25, D. C.

Attention: Robert E. Brinkman
Isotopes Branch
Division of Licensing & Regulation

Subject: Byproduct Material License Application

Reference: (a) L&R:IB:REB(48200), dated January 2, 1963

Enclosures: (1) "Tritium Titanium Foil Use in Gas Detectors."
(2) Detector Drawings

1. As requested in your letter, Reference (a), the following additional information is supplied in support of our request for a Byproduct Material License.
2. The Gemini spacecraft being built at the McDonnell Aircraft Corporation uses a recirculating system to supply breathing oxygen to the astronauts. In this system it is extremely important that the carbon dioxide content of the oxygen be held between specified limits, therefore, a monitor capable of giving a continuous measure of carbon dioxide partial pressure is to be installed into the flow lines.
3. These monitors, the Lion Research Corporation Model 52-88715-1 "Carbon Dioxide Detector" use cylindrical gas-flow ionization chambers to measure the ion current of a gas stream as it passes by a radioactive source consisting of three square inches of tritiated titanium foil, Figure 1. The gas to be measured enters the detector unit where it is split into two streams. One of these passes over air absorbing filter which removes the CO₂, the other enters the ion chamber without prior removal of carbon dioxide. These two gas streams one, treated and one untreated, pass through separate ion chambers where an electric signal is produced. The stream containing CO₂ will typically show a greater degree of ionization than the one with CO₂ removed. The difference voltage between the two chambers can be interpreted as partial pressure of carbon dioxide under proper conditions. 7
4. Each of the two ion chambers makes use of a three curie tritiated titanium foil which is permanently installed by the manufacturer. The foils are installed in such a manner as to be completely inaccessible under normal maintenance and use. Removal of either the filter cover-plate or the electronics compartment cover-plate will not expose the foil (Figure 2).

~~4701170310 82~~

1373

5. A description of the source characteristics is given in Enclosure 1.
6. The device, because it uses a radioisotope which emits extremely low energy beta particles, exhibits no measurable external radiation. Measurements have shown the equilibrium pressure of tritium over these foils to be so low that it presents no hazard as a contaminate to the air supply at the temperatures encountered in a manned vehicle.
7. The installation, testing and maintenance of the monitors will be under the direction of William L. Kester until such time as other persons can be trained to perform these tasks properly and safely.
8. Maintenance, in this case, will be restricted to:
 1. Replacement of absorbing filters.
 2. Calibration by means of "Standard" gases.

In no instance shall the seals on the compartment containing the initiated foil be broken.

9. The device will bear the engraved legend:

CAUTION: THIS EQUIPMENT CONTAINS A RADIOACTIVE SOURCE. DO NOT
OPEN THE UNIT IN CASE OF MALFUNCTION RETURN TO VENDOR.

RADIATION
WARNING
SIGN

10. Because of the tight schedule on the Gemini project we would appreciate your contacting us by telephone should further information be required.

Yours very truly,

MCDONNELL AIRCRAFT CORPORATION

W. L. Kester

W. L. Kester
Scientist
Research Division

WLK:emc



Tritium - Titanium
Foil for Use in
Gas Detectors

1. Tritium source

Tritium decays with a half-life of 12.26 years, emitting a single beta particle in its decay to the stable He^3 nucleus. It has an allowed beta spectrum with a maximum electron energy of 18 keV, the lowest energy beta emitter known.

Tritium recommends itself as a source because the low energy of the electrons and the absence of gamma rays permit very high intensity sources to be used without health hazard. The very soft X rays produced when tritium betas strike the walls of a chamber are absorbed by a few mg/cm^2 of material.

Tritium in its elemental state is a gas. A number of materials, such as the elements zirconium and titanium, display the property of occluding the isotopes of hydrogen. At elevated temperatures, hydrogen diffuses freely through the lattice of the solid zirconium or titanium. As the temperature is reduced, the hydrogen diffuses less rapidly and below some temperature forms a chemical compound with the zirconium or titanium.

Self-absorption limits the number of beta particles emanating per square inch of plaque surface. Typically, using titanium, self-absorption limits the number of beta rays per square inch to an activity corresponding to $0.2 \text{ c}/\text{in}^2$ if the tritium is present in 1:1 atomic ratio with the titanium. Tritium-titanium plaques with measured activities as high as $0.1 \text{ c}/\text{in}^2$ inch have been produced. These plaques were obtained from the Radiation Research Corporation in New York City.

We have investigated the stability of such plaques under vacuum and at elevated temperatures.¹ Our own observation at high vacuum, as well as those of others,² indicates that both titanium and zirconium hydrides are stable at room temperature. Measurements were made on a titanium-tritium plaque over a number of days. The beta rays from the plaque were measured very accurately while the plaque was held at a vacuum of 10^{-5} mmHg. During this time, the beta ray current from the plaque showed no decrease greater than that attributable to the natural radioactive decay of the source.

-
1. G.F.Vanderschmidt and J.C.Simmons, Advances in Vacuum Society and Technology, p. 305 (Pergamon Press, N. Y., 1960).
 2. J.F.Cameron; A.E.R.E.I/M 29, Harwell, England (1953).

CONFIDENTIAL
FOR OFFICIAL USE ONLY

The average energy of the beta rays emitted by tritium is about 5 kV. The spectrum of the radiation from a thick source is considerably modified, the average energy being lower. In addition, a large number of secondary electrons appear at the surface of the plaque with energies of no more than a few electron volts.

2. Correction for Tritium Decay.

In all instruments using a tritium source, a correction must be made to the sensitivity of the instrument to account for the decay of the tritium. Table I gives the necessary increase in sensitivity versus the number of years after initial calibration up to 10 years. Interpolation on a linear basis may be made for any time within one year to an accuracy of better than 1%.

Table I. Sensitivity Adjustment

Year after initial calibration	Increase sensitivity by the factor
0	1.000
1	1.058
2	1.12
3	1.19
4	1.25
5	1.32
6	1.40
7	1.48
8	1.57
9	1.66
10	1.76

3. Safety Measures.

No external radiation is present with instruments using tritium; no special precautions are necessary in handling such instruments. Like all radioactive material, tritium is potentially dangerous if swallowed and fixed in the body. Although the body does not use hydrogen in its metabolism, the tritium sometimes exchanges with the normal hydrogen in water and other body materials, and is re-

tained in this way. The normal retention time of the tritium is thus principally the biological half life of water in the body, a few days.

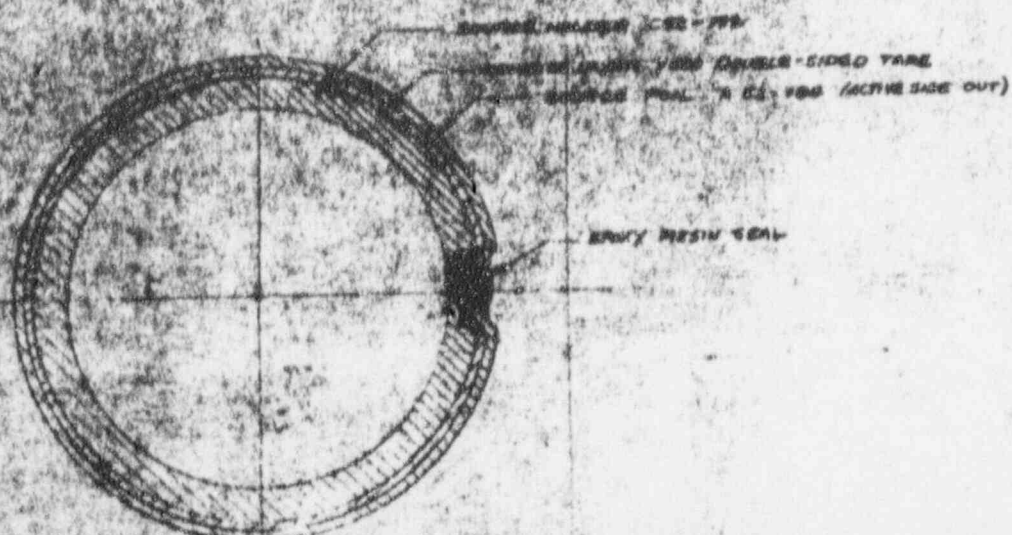
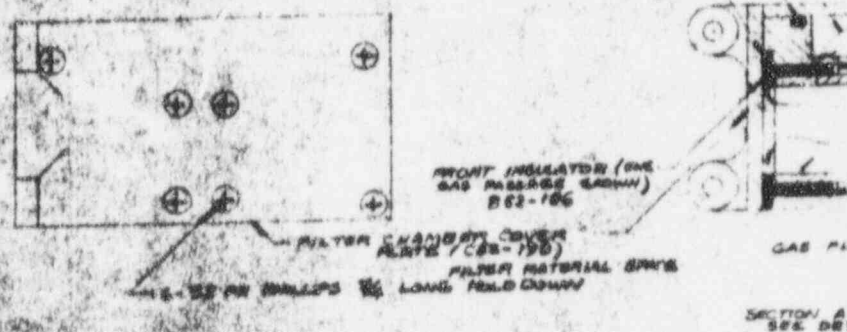
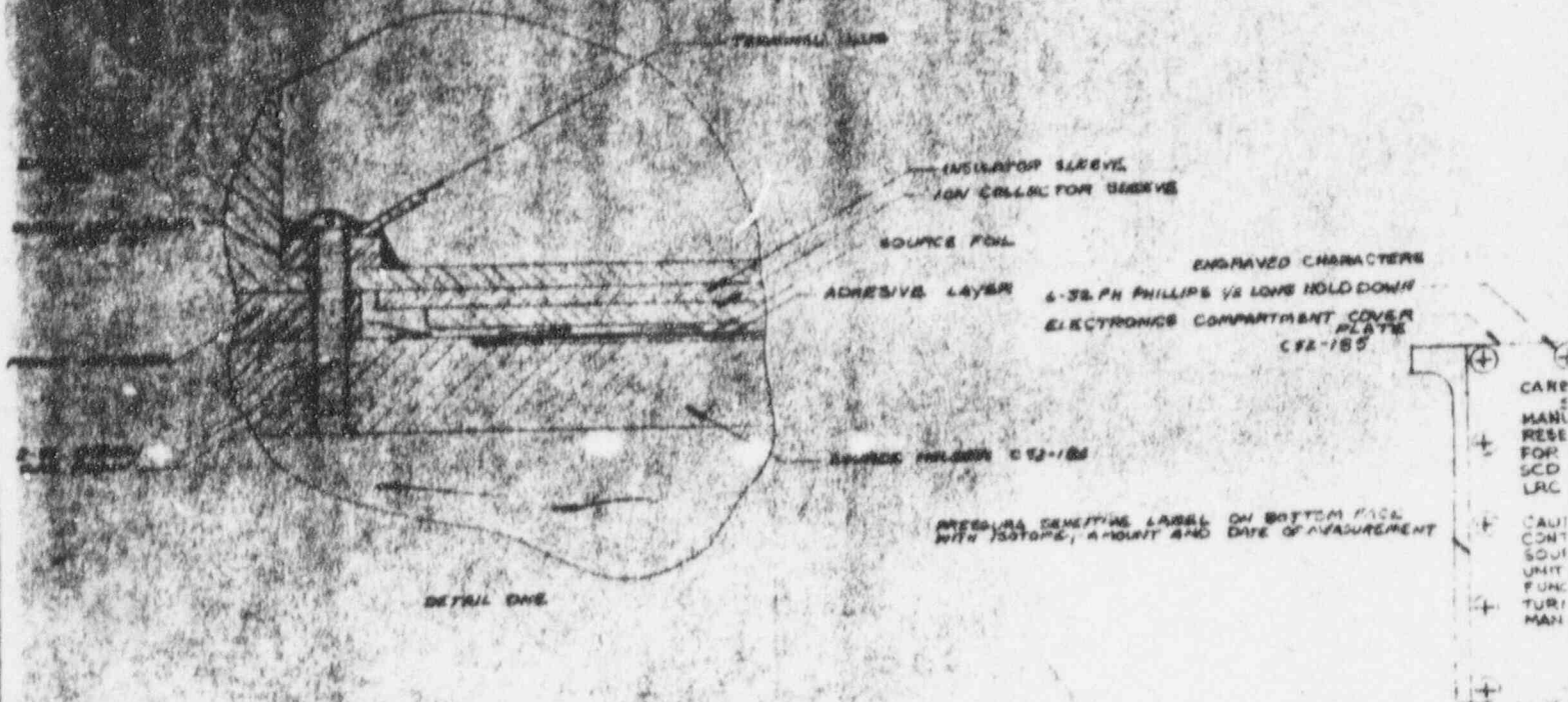
The maximum amount of tritium which may be permanently retained in the body (A.E.C. figure) is 0.010 Curie. Although this figure represents a large amount in comparison with maximum permissible limits for other radioactive materials, the figure represents a small fraction of the tritium contained in a typical instrument foil. As such, special precautions are necessary in cutting and installing the foil. Instruments in which tritium foils are used should be returned to the manufacturer should replacement or repair of foils be required.

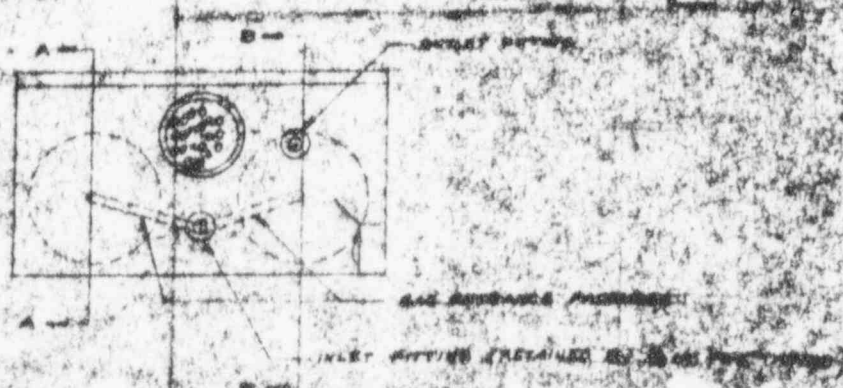
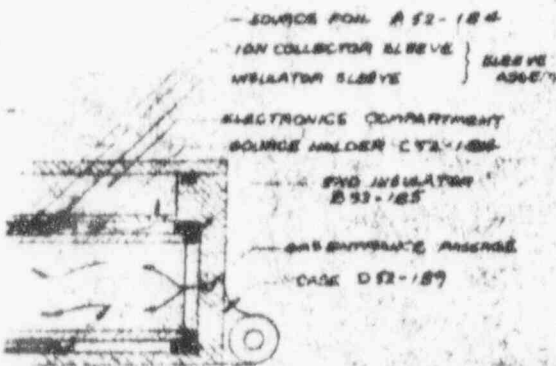
Leakage from the source is negligible at room temperature. Extrapolation of the curves of Mc Quillan³ gives an equilibrium vapor pressure of hydrogen above titanium of 10^{-11} mm Hg at room temperature. This vapor pressure corresponds to a concentration of tritium of the order of 10^{-8} Curie/cc, an amount well below the exempt limit of 5×10^{-6} Curie/cc established by the A.E.C. The measurements described in reference 1 confirm this result inasmuch as the source also must be less than about one per cent per year, the limit of accuracy of the measurement.

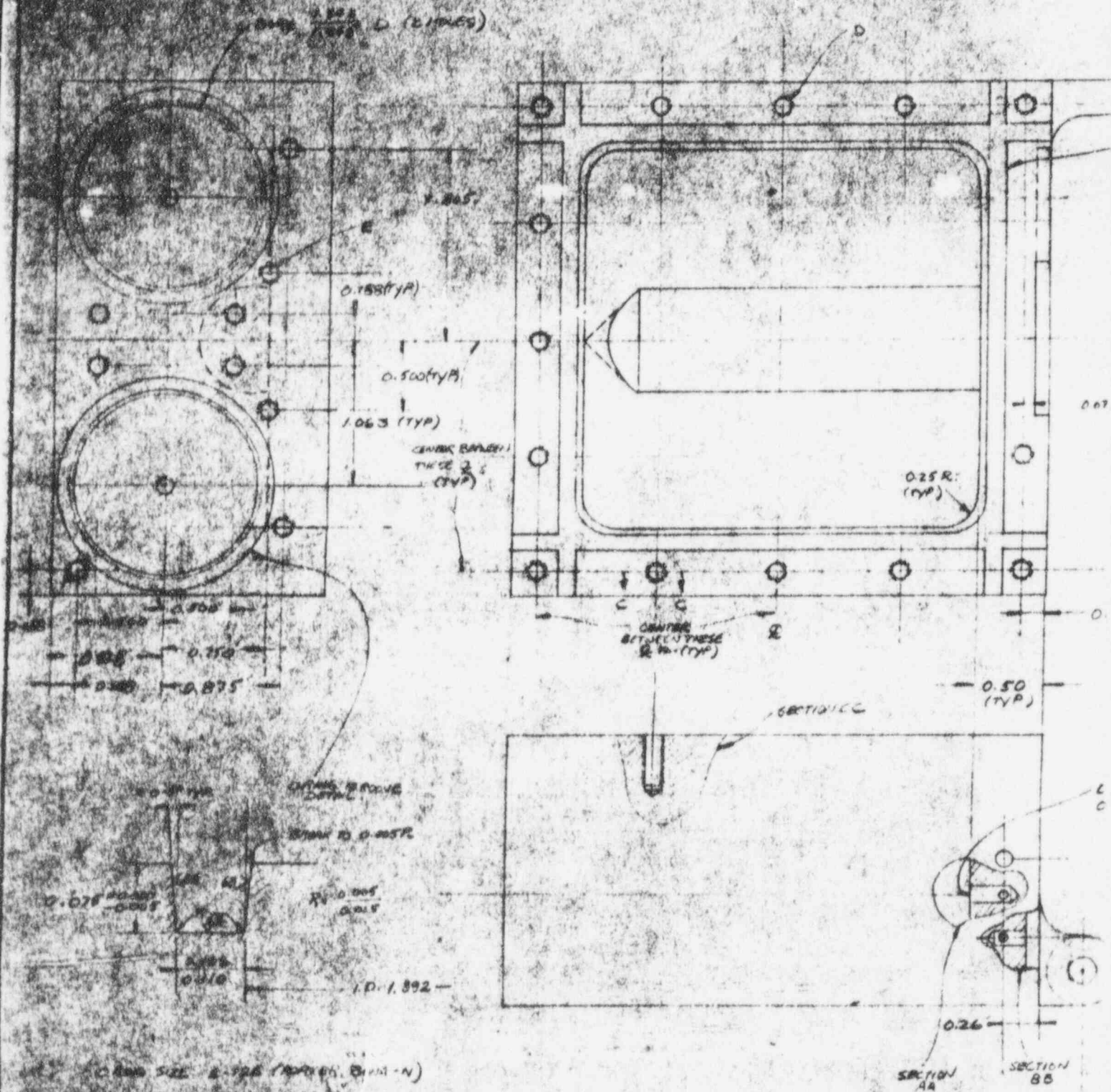
Lion Research Corporation

1/11/63

3. A.D. Mc Quillan, Proc. Roy. Soc. 204A, 309 (1950).

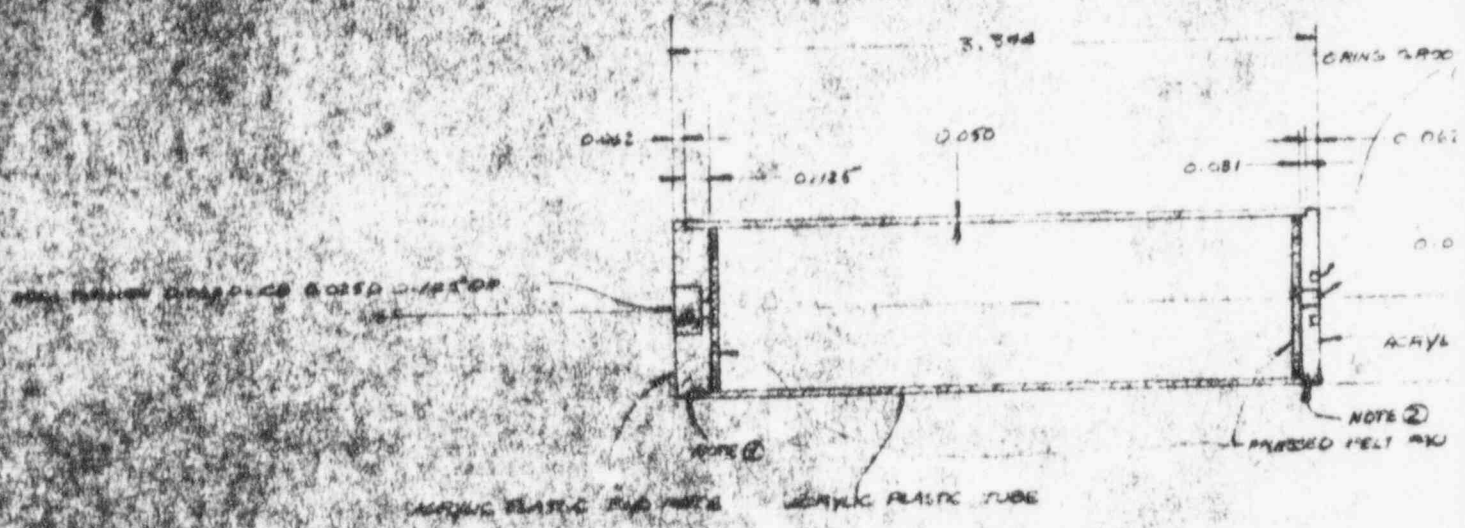






$$0.050 \pm 0.005$$

$$R = \frac{0.005}{0.050}$$



NOTE: CORRECT DIMENSIONS FOR THE FOLLOWING DIMENSIONS

DRY HOLE TO 0.052

0.070 +0.003
-0.000

I.D. 0.176

EC 2-B)

LE THROUGH

SLIDING FIT INTO PART C03-104

PC END HOLE

CK

THIS SIDE OF

PROPERTY		DATE		BY	
1	2	3	4	5	6
7	8	9	10	11	12
13	14	15	16	17	18
19	20	21	22	23	24
25	26	27	28	29	30

MCDONNELL *Aircraft Corporation*
Lambert Saint Louis MUNICIPAL AIRPORT • BOX 516, ST. LOUIS 86, MO.

8 AUG 1963

Ref: USAEC-220-1614

United States Atomic Energy Commission
Washington 25, D. C.

Attention: Director, Division of Licensing & Regulation

Subject: A Modification of Byproduct Material License

Enclosure: Form AEC-313 (3 copies)

Gentlemen:

1. We would like to add 50 microcuries of Americium-241 to the presently authorized materials listed on our Byproduct Material License No. 24-2261-4.
2. The Am-241, to be obtained in quantities of not more than 10 microcuries per source, will be used as alpha standards in our Nuclear Laboratory. These standards will be manufactured by the Nuclear Materials and Engineering Company (NUMEC) of Apollo, Pennsylvania, and will consist of stainless steel discs with the Am-241 electro-deposited on one surface.
3. Three copies of form AEC-313 are here with enclosed.
4. We would appreciate hearing from you as soon as possible should further information be required.

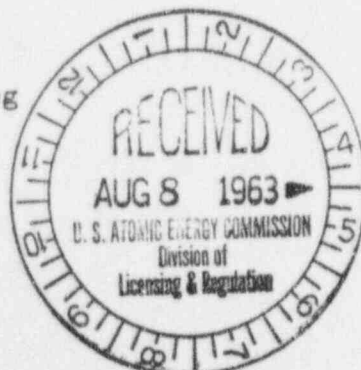
Very truly yours,

MCDONNELL AIRCRAFT CORPORATION

W. L. Kester

W. L. Kester
Scientist
Research Division

WLK:meg



A/275

53281

Q70170338 19

Form AEC-313
(2-57)

ATOMIC ENERGY COMMISSION

APPLICATION FOR BYPRODUCT MATERIAL LICENSE

Form approved.
Budget Bureau No. 38-8027.3.

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

1. (a) NAME AND STREET ADDRESS OF APPLICANT. (Institution, firm, hospital, person, etc.)

McDonnell Aircraft Corporation
P. O. Box 516
St. Louis 66, Missouri

(b) STREET ADDRESS(ES) AT WHICH BYPRODUCT MATERIAL WILL BE USED. (If different from 1 (a).)

Same as 1(a)

2. DEPARTMENT TO USE BYPRODUCT MATERIAL

Nuclear Research

3. PREVIOUS LICENSE NUMBER(S). (If this is an application for renewal of a license, please indicate and give number.)

24-2261-4

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.)

Dr. C. J. Wolf

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.)

T. C. Linck

6. (a) BYPRODUCT MATERIAL. (Elements and mass number of each.)

Americium-241

(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.)

Americium metal 50 microcuries electroplated on stainless steel. Produced by Nuclear Materials & Equipment Corporation; Apollo, Pennsylvania.

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.)

Alpha source to be used for calibration of alpha counters, solid state detectors, ion chambers, and for inducing surface lattice defect in materials.

DUPLICATED
FOR DIV. OF COMPLIANCE

53281

(Continued on reverse side)

9701170339 202

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

B. TYPE OF TRAINING	WHERE TRAINED	DURATION OF TRAINING	ON THE JOB (Circle answer)	FORMAL COURSE (Circle answer)
a. Principles and practices of radiation protection	see previous application		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
		see previous application		

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)

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

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

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

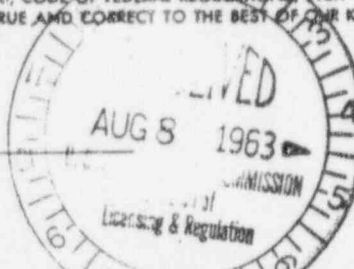
14. RADIATION PROTECTION PROGRAM. Describe the radiation protection program including control measures. If application covers sealed sources, submit leak testing procedures where applicable, name, training, and experience of person to perform leak tests, and arrangements for performing initial radiation survey, servicing, maintenance and repair of the source.

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.

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 2 August 1963



McDonnell Aircraft Corporation

Applicant named in item 4

W. L. Kester

Scientist

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.

MATERIAL LICENSE

Supplementary Sheet

License Number 24-2261-3
(G64)Amendment No. 6Mc Donnell Aircraft Corporation
St. Louis, MissouriAttention: William L. Kester
N. A. Lamb
T. C. Linck
F. C. McCallister, Jr.H. E. Winn
H. K. Weber
C. J. Wolf

In accordance with application dated August 2, 1963, Byproduct Material License Number 24-2261-3 is hereby amended as follows:

To Add:

6. Byproduct material (element and mass number)	7. Chemical and/or physical form	8. Maximum amount of radioactivity which licensee may possess at any one time
V. Americium 241	V. Plated Sources (NUMEC)	V. 5 sources of 10 microcuries each. Total 50 microcuries.

9. Authorized use

V. Calibration of instruments and for inducement of surface lattice defects in materials.

DISCONTINUED
FOR REUSE

A/276

AUG 21 1963

Date

For the U. S. Atomic Energy Commission

Original Signed by
Robert E. Brinkman

by

Isotopes Branch
Division of Licensing and Regulation
Washington 25, D. C.

1. A. W. Kern / hje DWK

REB 8/21/63

A701170341 IP

MCDONNELL *Aircraft Corporation*
Lambert Saint Louis MUNICIPAL AIRPORT • BOX 516 • ST. LOUIS 66, MO.

6 SEP 1963

Ref: USAEC-220-1669



United States Atomic Energy Commission
Washington 25, D. C.

Attention: Director, Division of Licensing & Regulation

Subject: A Modification of Byproduct Material License

Enclosure: Form AEC-313 (3 copies)

Gentlemen:

1. McDonnell Aircraft Corporation plans to acquire a Jarrell-Ash Model 26-700 Universal Chromatograph.
2. This instrument employs radioactive materials in the three sensing elements that we will use; accordingly, completed AEC Forms - 313 are enclosed in application for modification of our present License, No. 24-2261-3.
3. Should you require further information please do not hesitate to contact us.

Very truly yours,

MCDONNELL AIRCRAFT CORPORATION

A handwritten signature in cursive script, appearing to read 'W. L. Kester'.

W. L. Kester
Scientist
Research Division

WLK:emc

A/379

53848

4701170345 1p

APPLICATION FOR BYPRODUCT MATERIAL LICENSE

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.

1. (a) NAME AND STREET ADDRESS OF APPLICANT. (Institution, firm, hospital, person, etc.) McDonnell Aircraft Corporation Box 516 St. Louis, Missouri		(b) STREET ADDRESS(ES) AT WHICH BYPRODUCT MATERIAL WILL BE USED. (If different from 1 (a).) Same as 1. (a) Zip Code 63166	
2. DEPARTMENT TO USE BYPRODUCT MATERIAL Quality Control		3. PREVIOUS LICENSE NUMBER(S). (If this is an application for renewal of a license, please indicate and give number.) 24-2261-3	
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.) N. A. Lamb		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.) T. C. Linck am # 7	
6. (a) BYPRODUCT MATERIAL. (Elements and mass number of each.) A. Sr ⁹⁰ B. Sr ⁹⁰ C. H ³		(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.) A. Jarrell-Ash Company Model 26-751 containing 20 mc of Sr ⁹⁰ , U. S. Radium Corporation #Lab 369. B. Jarrell-Ash Company Model 26-754 containing 20 mc of Sr ⁹⁰ , U. S. Radium Corporation #Lab 369. C. Jarrell-Ash Company Model 26-755 containing 100 mc of H ³ , Radiation Research Corporation T-1	
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.) A. To be used in the Jarrell-Ash Company Model 26-700 Universal Gas Chromatograph for the chromatographic analysis of B. To be used in the Jarrell-Ash Company Model 26-700 Universal Gas Chromatograph for the chromatographic analysis of C. To be used in the Jarrell-Ash Company Model 26-700 etc etc			

DUPLICATED
FOR DIV. OF COMPLIANCE

ACKNOWLEDGED

53848

(Continued on reverse side)

0101170350 200

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

B. TYPE OF TRAINING	WHERE TRAINED	DURATION OF TRAINING	ON THE JOB (Circle answer)	FORMAL COURSE (Circle answer)
a. Principles and practices of radiation protection			Yes No	Yes No
b. Radioactivity measurement standardization and monitoring techniques and instruments	See Previous Application		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
		See Previous Application		

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)
		See Previous Application			

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

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

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

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.

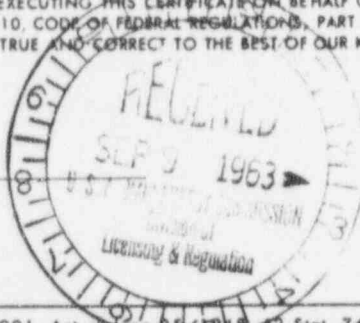
The manufacturer's instructions for radiation safety will be followed.

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.

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 4 September 1963



McDonnell Aircraft Corporation

Applicant named in item 1
By: *[Signature]*

Scientist, Research Division

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.

MATERIAL LICENSE

Supplementary Sheet

License Number 24-2261-3
(G64)Amendment No. 7Mc Donnell Aircraft Corporation
St. Louis, MissouriAttention: William L. Kester
E. A. Lamb
T. C. Linck
F. C. McCallister, Jr.H. E. Winn
H. K. Weber
C. J. Wolf

In accordance with application dated September 4, 1963, License Number 24-2261-3 is amended as follows:

To Add:

6. Byproduct material (element and mass number)	7. Chemical and/or physical form	8. Maximum amount of radioactivity which licensee may possess at any one time
W. Strontium 90	W. Foil (U.S. Radium Corp. Model LAB 369)	W. 20 millicuries
X. Strontium 90	X. Foil (U.S. Radium Corp. Model LAB 369)	X. 20 millicuries
Y. Hydrogen 3	Y. Tritiated foil (Radiation Research Corp Model T-1)	Y. 100 millicuries

9. Authorized use
W. To be used in Jarrell-Ash Company Model 26-751 detector cell as a component of the Jarrell-Ash Company Model 26-700 Universal Gas Chromatograph.
X. To be used in Jarrell-Ash Company Model 26-754 detector cell as a component of the Jarrell-Ash Company Model 26-700 Universal Gas Chromatograph.
Y. To be used in Jarrell-Ash Company Model 26-755 detector cell as a component of the Jarrell-Ash Company Model 26-700 Universal Gas Chromatograph.

Condition 18 C is amended to read:

18. C. If the test reveals the presence of 0.005 microcurie or more of removable contamination, the licensee shall immediately withdraw the sealed source from use and shall cause it to be decontaminated and repaired or to be disposed of in accordance with Commission regulations. A report shall be filed within five days of the test with

(See Page 2)

9704470352 2A

A/378

PRODUCT MATERIAL LICENSE

Supplementary Sheet

License Number 24-2261-3
(G64)

Continued from page one

Amendment Number 7

CONDITIONS

18. C. continued

the Director, Division of Licensing and Regulation, U. S. Atomic Energy Commission, Washington 25, D. C., describing the equipment involved, the test results and the corrective action taken. A copy of such report shall also be sent to the Director, Region III, Division of Compliance, USAEC, Oakbrook Professional Building, Oak Brook Illinois.

Conditions 21 and 22 are added to read:

21. In lieu of using the conventional radiation caution colors (magenta or purple on yellow background) as provided in Section 20.203(a)(1), Title 10, Code of Federal Regulations, Part 20, the licensee is hereby authorized to label detector cells and cell baths, containing byproduct material and used in gas chromatography devices, with conspicuous etched or stamped radiation caution symbols without a color requirement.
22. Detector cells containing Hydrogen 3 foil shall only be used in conjunction with a properly operating temperature control mechanism which prevents foil temperatures from exceeding 225 degrees Centigrade.

Date SEP 17 1963

DUPLICATE
FOR DIV. OF COMPLIANCE

For the U. S. Atomic Energy Commission

Original Signed by
Robert E. Spitzer BranchDivision of Licensing and Regulation
Washington 25, D. C.

1. FCD/VR

FCD

REB 9/17/63

Form AEC-313
(5-58)

ATOMIC ENERGY COMMISSION

Form approved
Budget Bureau No. 38-2027.4

APPLICATION FOR BYPRODUCT MATERIAL LICENSE

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.

1. (a) NAME AND STREET ADDRESS OF APPLICANT. (Institution, firm, hospital, person, etc.)

McDonnell Aircraft Corporation
Box 516
St. Louis 66, Missouri 63166

(b) STREET ADDRESS(ES) AT WHICH BYPRODUCT MATERIAL WILL BE USED. (If different from 1 (a).)

McDonnell Aircraft Corporation

2. DEPARTMENT TO USE BYPRODUCT MATERIAL

PROJECT GEMINI DEPT. 930

3. PREVIOUS LICENSE NUMBER(S). (If this is an application for renewal of a license, please indicate and give number.)

24-2261-3

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.)

C. R. Schumacher
J. A. Schneider
N. W. Rokes

See Attachment

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.)

T. C. Linck - Same as previous license.

6. (a) BYPRODUCT MATERIAL. (Elements and mass number of each.)

Hydrogen-3

(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.)

Tritiated titanium foils (Radiation Research Corp. Model TT-1) as contained in Lion Research Corp. "Carbon Dioxide Detector."

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.)

Active element in Lion Research Corporation "Carbon Dioxide Detector".

DUPLICATED
FOR DIV. OF COMPLIANCE

57127

(Continued on reverse side)

9101170355 3A

A/378

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			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

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)

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

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

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

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.

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.

CERTIFICATE (This form 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 28 January 1964

McDonnell Aircraft Corporation

Applicant named in item 1

By: *A. L. Kuster*

Scientist

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) Sec. 4

The individual users named on the application have no previous training in use of radioactive materials.

The design of the Lion Detector is such that it presents no radiation hazard to personnel. Access to the tritium-containing foils is gained only by first removing a cover plate which is sealed shut. This plate is never removed by McDonnell personnel during inspection, calibration or repair.

Leakage of tritium from the source is undetectable by standard wipe tests; therefore, it is assumed that license requirements can be satisfied by our maintaining a strict accountability of these devices and by guaranteeing that only authorized personnel (Lion Research Corp.) perform those operations requiring access to the byproduct material.

COPIES
FOR DIV. OF COMPLIANCE

57107

2 copies: 1 to only

MCDONNELL *Aircraft Corporation*
Lambert Saint Louis MUNICIPAL AIRPORT • BOX 516, ST. LOUIS 66, MO.

30 JAN 1964

Ref: USAEC-220-1920

United States Atomic Energy Commission
Washington 25, D. C.

Attention: Robert E. Brinkman, Director
Division of Licensing and Regulation

Subject: A Modification of Byproduct Material License # 24-2261-3,
issued to McDonnell Aircraft Corporation

Enclosures: (1) Form AEC-313 (3 copies)
(2) SEDR PIA 320

Gentlemen:

1. Enclosure (1) is being submitted in application for modification of Byproduct Material License # 24-2261-3, issued to McDonnell Aircraft Corporation. This license, as presently written, authorizes possession and use of Hydrogen-3 in the Lion Research Corporation's Carbon Dioxide Detector; however, the license is issued for the St. Louis facility only, and so does not cover any use that may be planned at Cape Kennedy.
2. Enclosure (2) gives the history of a detector from the time it arrives at McDonnell until it is launched from the Cape.
3. Our present authorization is good only up to the time that the Gemini capsules are officially transferred to NASA prior to shipment to Florida via Air Force plane. At that time they must be finished products, and must contain all systems aboard with each system in working order.
4. Upon arrival at the Florida site, the capsules are reassigned to McDonnell for final checkout. At the completion of all necessary tests and inspections, the vehicle is returned to NASA for the final phase of the mission.

57127

A/380

9701170357 2 R

5. It is our understanding that NASA is licensed to possess the Lion detectors at both their Houston facility and at the launch site. What is not clear, however, is whether or not they are authorized to take possession of the detectors during transit from St. Louis to Florida. Mr. Shell Martin, of NASA (Houston), has suggested that if need be, he might assign one of his people to accompany the vehicle during these transfer operations. The person so assigned would serve as a custodian for the radioactive material. This is obviously not a very satisfactory solution to the problem, but it is one which might serve until a workable means can be found for satisfying regulations. There is the possibility that NASA might agree to transport the tritium - containing detectors separately from the capsule. They have made no indication of such an agreement, however.
6. As stated previously, McDonnell does not have authorization to possess radioactive materials at Cape Kennedy, accordingly, we are submitting the enclosed request for modification of our license.
7. We will be happy to receive your suggestions concerning the above problem. Should we be able to furnish any additional information, please do not hesitate to call on us.

Sincerely yours,

MCDONNELL AIRCRAFT CORPORATION



W. L. Kester
Scientist
Research Division

WLK:emc

MCDONNELL *Aircraft Corporation*
Lambert-Saint Louis MUNICIPAL AIRPORT • BOX 516, ST. LOUIS 66, MO.

4 MAY 1964

Ref: USAEC-220-2065

United States Atomic Energy Commission
Washington 25, D. C.

Attention: Isotopes Branch
Division of Licensing and Regulation

Subject: Byproduct Material License Modification

Enclosures: (1) AEC Form 313 (3 copies)
(2) Resume of Radiation Experience, Joseph F. Froechtenigt
(3 copies)

1. Completed forms AEC-313 are enclosed herewith in application for modification of Byproduct Material license No. 24-2261-3.
2. The Promethium-147 is to be used as a beta source for studying the change of surface reflectivity of materials which have been irradiated by low energy electrons.
3. Standard plating techniques will be used to produce layers of promethium on the surfaces to be studied; then, after irradiation, the promethium will be stripped off and recovered for further use.
4. We will be happy to furnish any further information you may require concerning the planned use of this material.

Very truly yours,

MCDONNELL AIRCRAFT CORPORATION

W. L. Kester
W. L. Kester
Scientist
Research Division

WLK:emc

58581

A/381

9704470364 *lp*

Form AEC-313
(5-58)

ATOMIC ENERGY COMMISSION

APPLICATION FOR BYPRODUCT MATERIAL LICENSE

Form approved.
Budget Bureau No. 38-R027.4.

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.

1. (a) NAME AND STREET ADDRESS OF APPLICANT. (Institution, firm, hospital, person, etc.)

McDonnell Aircraft Corporation
Lambert-St. Louis Municipal Airport
Box 516
St. Louis, Missouri 63166

(b) STREET ADDRESS(ES) AT WHICH BYPRODUCT MATERIAL WILL BE USED. (If different from 1 (a).)

Same as 1. (a)

2. DEPARTMENT TO USE BYPRODUCT MATERIAL

General Engineering Division

3. PREVIOUS LICENSE NUMBER(S). (If this is an application for renewal of a license, please indicate and give number.)

24-2261-3

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.)

Joseph F. Froechtenigt
Engineer

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.)

Same as Original Application

6. (a) BYPRODUCT MATERIAL. (Elements and mass number of each.)

Promethium - 147

(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.)

PmCL₃ in HCL solution (20 millicuries)

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.)

To be used in electron induced surface damage studies.
Pm compounds will be evaporated onto the surface of the materials to be studied.
After irradiation, the Promethium will be stripped off and recovered.

ACKNOWLEDGED

59581

(Continued on reverse side)

9701170371 300

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

B. TYPE OF TRAINING	WHERE TRAINED	DURATION OF TRAINING	ON THE JOB (Circle answer)	FORMAL COURSE (Circle answer)
a. Principles and practices of radiation protection	See Attachment 1		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
		See Attachment 1		

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 (nr/hr)	WINDOW THICKNESS (mg/cm ²)	USE (Monitoring, surveying, measuring)

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

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

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
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 test, and arrangements for performing initial radiation survey, servicing, maintenance and repair of the source.
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.

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 30 April 1964

McDonnell Aircraft Corporation
Applicant named in item 1

By: William L. Kester

Chairman Isotope Committee

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.

TRAINING AND EXPERIENCE WITH RADIOACTIVITY

Joseph F. Froechtenigt

8. Type of Training	Where Trained	Duration of Trg.	On the Job	Formal
a. Principles and Practices of Radiation Protection	Naval Research Labs Washington, D.C. Argonne National Lab Chicago, Ill. St. Louis University St. Louis, Mo.	1956 1957 - 1958 1959	yes	no
b. Radioactivity Measurement Standardization and Monitoring Techniques and Instrumentation	Naval Research Labs Argonne National Lab St. Louis University	1956 1957 - 1958 1959	yes	no
c. Mathematics and Calculations Basic to the Use and Measurement of Radioactivity	Naval Research Labs Argonne National Lab St. Louis University	1956 1957 - 1958 1959	yes	no
d. Biological Effects of Radiation	Naval Research Labs Argonne National Lab St. Louis University	1956 1957 - 1958 1959	yes	no

9. Experience with Radiation				
Isotope	Max Amounts	Where Exp. Was Gained	Duration of Experience	Types of Use
Cs ¹³⁷	10 mc	St. Louis University	3 years	Detector Experiments
Hg ²⁰³	10 mc	St. Louis University	3 years	Detector Experiments
Po ²¹⁰		Naval Research Labs	3 months	Study Arrangement of Detectors for Reactor
Au ¹⁹⁸		Argonne National Lab	6 months	Study of Neutron Capture Gamma Rays.
NA ²⁴	20 mc	Argonne National Lab	6 months	Detector Experiments

59581

MATERIAL LICENSE

Supplementary Sheet

License Number 24-2261-3
(G64)
Amendment No. 9

McDonnell Aircraft Corporation
Lambert-St. Louis Municipal Airport
St. Louis, Missouri

Attention: William L. Kester, H. A. Lamb, T. C. Linck,
F. C. McCallister, Jr. H. E. Winn, E. K. Weber,
C. J. Wolf, Joseph F. Freachtanigt.

In accordance with application dated April 30, 1964, License Number
24-2261-3 is amended as follows:

To Add:

6. Byproduct material (element and mass number)	7. Chemical and/or physical form	8. Maximum amount of radioactivity wh licensee may possess at any one time
Z. Promethium 147	Z. Any	Z. 20 millicuries
9. Authorized use		
Z. Surface damage studies.		

Condition 14 is amended to read:

14. Byproduct material shall be used by, or under the supervision of, William L. Kester, H. A. Lamb, T. C. Linck, F. C. McCallister, Jr., H. E. Winn, E. K. Weber, C. J. Wolf, or Joseph F. Freachtanigt. The only person authorized to act as radiographer under this license is F. C. McCallister, Jr. "Radiographer" is defined in Title 10, Code of Federal Regulations, Part 31, "Radiation Safety Requirements For Radiographic Operations", Section 31.3(a).

For the U. S. Atomic Energy Commission

Date MAY 26 1964Original Signed by
Robert E. Brinkmanby Isotopes Branch
Division of Materials Branch
Washington 25, D. C.*1 BWC/mb Lin**REN 5/26/64**A/382**9701170576 240*

U. S. ATOMIC ENERGY COMMISSION
BYPRODUCT MATERIAL LICENSE
Supplementary Sheet

Page 1 of 1 Pages

License Number 24-2261-3
(064)

Amendment Number 8

Mc Donnell Aircraft Corporation
St. Louis, Missouri

Attention: William L. Koster H. E. Winn
 W. A. Lamb H. E. Weber
 T. C. Linck C. J. Wolf
 V. C. McCallister, Jr.

In accordance with application dated January 28, 1964, License Number 24-2261-3 is amended to add Condition 23 as follows:

23. Byproduct material described in Subitem 7 W of this license may also be used at Cape Kennedy, Florida.

MAR 17 1964

Date

DUPLICATE

FOR DIV. OF COMPLIANCE

For the U. S. Atomic Energy Commission

Original Signed by
Robert E. Brinkman

by Isotopes Branch
Division of Licensing and Regulation
Washington 25, D. C.

Form AEC-313
(5-58)

ATOMIC ENERGY COMMISSION

APPLICATION FOR BYPRODUCT MATERIAL LICENSE

Form approved.
Budget Bureau No. 38-R027.4.

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.

1. (a) NAME AND STREET ADDRESS OF APPLICANT. (Institution, firm, hospital, person, etc.)

McDonnell Aircraft Corporation
P. O. Box 516
St. Louis, Missouri 63166

(b) STREET ADDRESS(ES) AT WHICH BYPRODUCT MATERIAL WILL BE USED. (If different from 1 (a).)

Same as 1 (a)

2. DEPARTMENT TO USE BYPRODUCT MATERIAL

Research Division
General Engineering Division
Manufacturing Division

3. PREVIOUS LICENSE NUMBER(S). (If this is an application for renewal of a license, please indicate and give number.)

24-2261-3 (Amendments 1-9)

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.)

See Attachment

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.)

Individual Users and T. C. Linck

6. (a) BYPRODUCT MATERIAL. (Elements and mass number of each.)

See Attachment

(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.)

See Attachment

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

(Continued on reverse side)

970470383 SPO

A1383

01070

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

B. TYPE OF TRAINING	WHERE TRAINED	DURATION OF TRAINING	ON THE JOB (Circle answer)	FORMAL COURSE (Circle answer)
a. Principles and practices of radiation protection	Submitted Previously		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
		Submitted Previously		

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)
		Submitted Previously			

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

Submitted Previously

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

Submitted Previously

INFORMATION TO BE SUBMITTED ON ADDITIONAL SHEETS

13. FACILITIES AND EQUIPMENT. Describe laboratory facilities and remote handling equipment, storage containers, shielding, fume hoods, etc. Explain any sketch of facility is attached. (Circle answer) Yes No Submitted Previously

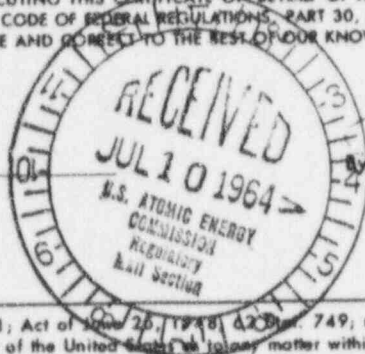
14. RADIATION PROTECTION PROGRAM. Describe the radiation protection program including control measures. If application covers sealed sources, submit leak testing procedures where applicable, name, training, and experience of person to perform leak tests, and arrangements for performing initial radiation survey, servicing, maintenance and repair of the source. Submitted Previously

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. Submitted Previously

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 6 July 1964



McDonnell Aircraft Corporation

Applicant named in item 1

Chairman, Isotope Committee

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 in any matter within its jurisdiction.

4. INDIVIDUAL USERS

William L. Kester
T. C. Linck
F. C. McCallister, Jr.
H. E. Winn
C. J. Wolf
Joseph F. Froechtenigt

(C. S. Sitler and R. G. Plummer at Wallop's Island - Item G)

Individuals "training and experience" data submitted with original application.

- | | |
|--|---|
| 6. (a) BYPRODUCT MATERIAL (Elements and mass number of each.) | (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. |
| A. Cobalt-60 | A. Sealed Sources as described in letter dated 21 May 1962 3,000 curies |
| B. Cesium-137 | B. Sealed Sources (Nuclear Consultants, Inc.) 100 millicuries maximum - not to exceed 4 microcuries per single source. |
| C. Krypton-85 | C. Sealed Sources (U.S. Radium Light sources, model LAB-484-1A) 8 sources of 150 millicuries each, 16 sources of 20 millicuries each. - Total 2 curies. |
| D. Cobalt-60 | D. Sealed Source 200 millicuries. |
| E. Iridium 192 | E. Sealed Sources (Isotopes Specialties Co.; Type 30 - 5 sources not to exceed 2 curies each. Total - 10 curies. |
| F. Cobalt-60 | F. Sealed Sources (Nuclear Chicago - Model RR-60) 2 sources not to exceed 1 curie each. Total - 2 curies. |
| G. Hydrogen-3 | G. Sealed Sources (Radiation Research Corp., Model No. TT-1) 400 millicuries |
| H. Any byproduct material having atomic no. from 3 to 83 inclusive | H. Irradiated samples of metals and crystals - 1 curie total. |
| I. Thallium-204 | I. Any form 20 millicuries |
| J. Cesium-137 | J. Any form 20 millicuries |
| K. Cobalt-60 | K. Any form 20 millicuries |

L. Sulfur-35	L. Any form	20 millicuries
M. Iron-59	M. Any form	20 millicuries
N. Copper-64	N. Any form	20 millicuries
O. Calcium-45	O. Any form	20 millicuries
P. Zinc-65	P. Any form	20 millicuries
Q. Gallium-72	Q. Any form	20 millicuries
R. Arsenic-76	R. Any form	20 millicuries
S. Silver-111	S. Any form	20 millicuries
T. Cadmium-115	T. Any form	20 millicuries
U. Gold-198	U. Any form	20 millicuries
V. Americium-241	V. Plated sources, 5 sources of 10 microcuries each - total 50 microcuries each.	
W. Promethium-147	W. Any form	20 millicuries
X. Hydrogen-3	X. Tritiated titanium foils (Radiation Research Corp., Model TT-1 as contained in Lion Research Corp., Carbon Dioxide Detector - 240 curies not to exceed 6 curies per detector unit.	

7. DESCRIBE PURPOSE FOR WHICH BYPRODUCT MATERIAL WILL BE USED.

- A. To be used in a Notre Dame type Irradiator device for irradiation of materials.
- B. For use in tagging bucking bars and seat ejection safety pins to facilitate detection after manufacture.
- C. For use in aircraft in-flight refueling equipment.
- D. Calibration of instruments.
- E. } "Open-air" handling technique for industrial radiography.
- F. }
- G. Ionization source in NRC Equipment Corporation - Model No. 0714 pressure measuring gauge.
- H. Reactor Irradiation of materials in radiation damage studies.

I, J, K, L, M, N, O,
P, Q, R, S, T, U, V

Calibration of instruments, studies of radiation
damage mechanism, diffusion through crystal lattices,
general solid state theory studies.

W. Surface damage studies.

X. Testing and calibration of Lion Research Corporation, "Carbon Dioxide Detector".

MCDONNELL *Aircraft Corporation*
Lambert Saint Louis MUNICIPAL AIRPORT • BOX 516, ST. LOUIS 66, MO.

7 JUL 1964

Ref: USAEC-220-2174

United States Atomic Energy Commission
Washington, D. C. 20545

Attention: Richard E. Cunningham, Chief
Isotopes Branch
Division of Licensing and Regulation

Subject: Byproduct Material License Renewal

Enclosures: (1) AEC Form 313 (3 copies)

1. Application is herewith made for renewal of Byproduct Material License No. 24-2261-3 issued to McDonnell Aircraft Corporation.
2. Item H of section 6 (a) "Any material with atomic weight between 3 and 83 inclusive" is presently authorized for tool wear studies. It is requested that the authorized use be changed to cover "radiation damage studies" for materials and systems to be used in spacecraft and propulsion systems.
3. Should you require any further information do not hesitate to contact us.

Very truly yours,

MCDONNELL AIRCRAFT CORPORATION

W. L. Kester
W. L. Kester
Scientist
Research Division

WLK:emc

A/384

~~9701170379~~ 1P