FORM NRC-313 (3-80) 10 CFR 30

U.S. NUCLEAR REGULATORY COMMISSION

APPLICATION FOR BYPRODUCT MATERIAL LICENSE
INDUSTRIAL

1. APPLICATION FOR: (Check and/or complete as appropriate)

X a. NEW LICENSE

b. AMENDMENT TO: LICENSE NUMBER

c. RENEWAL OF: LICENSE NUMBER

See attached instructions for details.

Completed applications are filed in duplicate with the Division of Fuel Cycle and Material Safety, Office of Nuclear Material Safety, and Safeguards, U.S. Nuclear Regulatory Commission, Washington, DC 20555 or applications may be filed in person at the Commission's office at 1717 H Street, NW, Washington, D. C. or 7915 Eastern Avenue, Silver Spring, Maryland.

2. APPLICANT'S NAME (Institution, firm, person, etc.)

General Dynamics

TELEPHONE NUMBER: AREA CODE – NUMBER EXTENSION

714-620-7511 Ext. 3824

3. NAME AND TITLE OF PERSON TO BE CONTACTED REGARDING THIS APPLICATION

James G. Kulleck, Radiation Safety Officer

TELEPHONE NUMBER: AREA CODE – NUMBER EXTENSION

714-620-7511 Ext. 3036

4. APPLICANT'S MAILING ADDRESS (Include Zip Code) (Address to which NRC correspondence, notices, bulletins, etc., should be sent.)

1675 W. Mission Blvd.; M.Z. 2-16
Pomona, CA 91769

5. STREET ADDRESS WHERE LICENSED MATERIAL WILL BE USED (Include Zip Code)

1675 W. Mission Blvd.
Pomona, CA 91769

(IF MORE SPACE IS NEEDED FOR ANY ITEM, USE ADDITIONAL PROPERLY KEYED PAGES.)

6. INDIVIDUAL(S) WHO WILL USE OR DIRECTLY SUPERVISE THE USE OF LICENSED MATERIAL
(See Items 16 and 17 for required training and experience of each individual named below)

FULL NAME		TITLE
Richard L. Lareau	Rec'd [illegible]	Group Engineer
John J. Baker	Date 2/5/85	Manufacturing Engineer
	Log [illegible]	
	By [illegible]	

7. RADIATION PROTECTION OFFICER

James G. Kulleck

Rec'd. To [illegible]
Action Compl. 2/7/85

Attach a resume of person's training and experience as outlined in Items 16 and 17 and describe his responsibilities under Item 15.

8. LICENSED MATERIAL

LINE NO.	A ELEMENT AND MASS NUMBER	B CHEMICAL AND/OR PHYSICAL FORM	C NAME OF MANUFACTURER AND MODEL NUMBER (If Sealed Source)	D MAXIMUM NUMBER OF MILLICURIES AND/OR SEALED SOURCES AND MAXIMUM ACTIVITY PER SOURCE WHICH WILL BE POSSESSED AT ANY ONE TIME
(1)	Krypton 85	Gas	N.A.	50,000 mci
(2)	Applicant 19806			
(3)	Check No. [illegible] Amount/Fee Category 1A 230/3P - 4230 refunded 11/20/85			
(4)	Type of Fee AMEND Fee Check Rec'd 2/5/85 Received By [illegible]			

E DESCRIBE USE OF LICENSED MATERIAL

(1) Leak testing of components in a TRACER-flo Model 30010, storage in Dept. of

(2) Transportation approved shipping containers and loading into the TRACER-flo unit.

(3)

(4)

FORM NRC-313 (3-80)

70155

FORM NRC-313 I (3-80) 10 CFR 30

U.S. NUCLEAR REGULATORY COMMISSION

APPLICATION FOR BYPRODUCT MATERIAL LICENSE
INDUSTRIAL

1. APPLICATION FOR: *(Check and/or complete as appropriate)*

X	a. NEW LICENSE
	b. AMENDMENT TO LICENSE NUMBER
	c. RENEWAL OF LICENSE NUMBER

See attached instructions for details.

Completed applications are filed in duplicate with the Division of Fuel Cycle and Material Safety, Office of Nuclear Material Safety, and Safeguards, U.S. Nuclear Regulatory Commission, Washington, DC 20555 or applications may be filed in person at the Commission's office at 1717 H Street, NW, Washington, D. C. or 7915 Eastern Avenue, Silver Spring, Maryland.

2. APPLICANT'S NAME *(Institution, firm, person, etc.)*

General Dynamics

TELEPHONE NUMBER: AREA CODE – NUMBER EXTENSION

714-620-7511 Ext. 3824

3. NAME AND TITLE OF PERSON TO BE CONTACTED REGARDING THIS APPLICATION

James G. Kulleck, Radiation Safety Officer

TELEPHONE NUMBER: AREA CODE – NUMBER EXTENSION

714-620-7511 Ext. 3036

4. APPLICANT'S MAILING ADDRESS *(Include Zip Code)*
(Address to which NRC correspondence, notices, bulletins, etc., should be sent.)

1675 W. Mission Blvd.; M.Z. 2-16
Pomona, CA 91769

5. STREET ADDRESS WHERE LICENSED MATERIAL WILL BE USED *(Include Zip Code)*

1675 W. Mission Blvd.
Pomona, CA 91769

(IF MORE SPACE IS NEEDED FOR ANY ITEM, USE ADDITIONAL PROPERLY KEYED PAGES.)

6. INDIVIDUAL(S) WHO WILL USE OR DIRECTLY SUPERVISE THE USE OF LICENSED MATERIAL
(See Items 16 and 17 for required training and experience of each individual named below)

FULL NAME	TITLE
Richard L. Lareau	Group Engineer
John J. Baker	Manufacturing Engineer

7. RADIATION PROTECTION OFFICER

James G. Kulleck

Attach a resume of person's training and experience as outlined in Items 16 and 17 and describe his responsibilities under Item 15.

8. LICENSED MATERIAL

LINE NO.	A ELEMENT AND MASS NUMBER	B CHEMICAL AND/OR PHYSICAL FORM	C NAME OF MANUFACTURER AND MODEL NUMBER *(If Sealed Source)*	D MAXIMUM NUMBER OF MILLICURIES AND/OR SEALED SOURCES AND MAXIMUM ACTIVITY PER SOURCE WHICH WILL BE POSSESSED AT ANY ONE TIME
(1)	Krypton 85	Gas	N.A.	50,000 mci
(2)				
(3)				
(4)				

	E DESCRIBE USE OF LICENSED MATERIAL
(1)	Leak testing of components in a TRACER-flo Model 30010, storage in Dept. of
(2)	Transportation approved shipping containers and loading into the TRACER-flo unit.
(3)	
(4)	

FORM NRC-313 I (3-80)

70155

9. STORAGE OF SEALED SOURCES

LINE NO.	A. CONTAINER AND/OR DEVICE IN WHICH EACH SEALED SOURCE WILL BE STORED OR USED.	B. NAME OF MANUFACTURER	C. MODEL NUMBER
(1)	500 ml Gas Cylinder	Trio-Tech International	Shipping Container #480354
(2)			
(3)			
(4)			

10. RADIATION DETECTION INSTRUMENTS

LINE NO.	A. TYPE OF INSTRUMENT	B. MANUFACTURER'S NAME	C. MODEL NUMBER	D. NUMBER AVAILABLE	E. RADIATION DETECTED (alpha, beta, gamma, neutron)	F. SENSITIVITY RANGE (milliroentgens/hour or counts/minute)
(1)	Survey Meter	Technical Associates	480195-3	1		0-100 mr/hr
(2)	Pencil Dosimeter	Victoreen	541R	6		0-200 mr
(3)						
(4)						

11. CALIBRATION OF INSTRUMENTS LISTED IN ITEM 10

☒ a. CALIBRATED BY SERVICE COMPANY Semi-Annually

NAME, ADDRESS, AND FREQUENCY
I.C.N. Pharmaceutical, Inc.
Life Science Group
Irvine, CA 92664 Lic. #182830

☐ b. CALIBRATED BY APPLICANT

Attach a separate sheet describing method, frequency and standards used for calibrating instruments.

12. PERSONNEL MONITORING DEVICES

A. TYPE (Check and/or complete as appropriate.)	B. SUPPLIER (Service Company)	C. EXCHANGE FREQUENCY
☒ (1) FILM BADGE ☐ (2) THERMOLUMINESCENCE DOSIMETER (TLD) ☐ (3) OTHER (Specify): _____	R.S. Landauer, Jr. & Co. Division of Tech/OPS, Inc. Glenwood Science Park Glenwood, ILL 60425	☒ MONTHLY ☐ QUARTERLY ☐ OTHER (Specify):

13. FACILITIES AND EQUIPMENT (Check were appropriate and attach annotated sketch(es) and description(s).

☒ a. LABORATORY FACILITIES, PLANT FACILITIES, FUME HOODS (Include filtration, if any), ETC.
☒ b. STORAGE FACILITIES, CONTAINERS, SPECIAL SHIELDING (fixed and/or temporary), ETC.
☐ c. REMOTE HANDLING TOOLS OR EQUIPMENT, ETC.
☐ d. RESPIRATORY PROTECTIVE EQUIPMENT, ETC.

SEE ATTACHED DOCUMENTATION

14. WASTE DISPOSAL

a. NAME OF COMMERCIAL WASTE DISPOSAL SERVICE EMPLOYED
N.A.

b. IF COMMERCIAL WASTE DISPOSAL SERVICE IS NOT EMPLOYED, SUBMIT A DETAILED DESCRIPTION OF METHODS WHICH WILL BE USED FOR DISPOSING OF RADIOACTIVE WASTES AND ESTIMATES OF THE TYPE AND AMOUNT OF ACTIVITY INVOLVED. IF THE APPLICATION IS FOR SEALED SOURCES AND DEVICES AND THEY WILL BE RETURNED TO THE MANUFACTURER, SO STATE.

SEE ATTACHED DOCUMENTATION

FORM NRC-313 I (3-80)

70155

INFORMATION REQUIRED FOR ITEMS 15, 16 AND 17

Describe in detail the information required for Items 15, 16 and 17. Begin each item on a separate page and key to the application as follows:

15. RADIATION PROTECTION PROGRAM. Describe the radiation protection program as appropriate for the material to be used including the duties and responsibilities of the Radiation Protection Officer, control measures, bioassay procedures *(if needed)*, day-to-day general safety instruction to be followed, etc. If the application is for sealed source's also submit leak testing procedures, or if leak testing will be performed using a leak test kit, specify manufacturer and model number of the leak test kit.

16. FORMAL TRAINING IN RADIATION SAFETY. Attach a resume for each individual named in Items 6 and 7. Describe individual's formal training in the following areas where applicable. Include the name of person or institution providing the training, duration of training, when training was received, etc.

    a. Principles and practices of radiation protection.

    b. Radioactivity measurement standardization and monitoring techniques and instruments.

    c. Mathematics and calculations basic to the use and measurement of radioactivity.

    d. Biological effects of radiation.

17. EXPERIENCE. Attach a resume for each individual named in Items 6 and 7. Describe individual's work experience with radiation, including where experience was obtained. Work experience or on-the-job training should be commensurate with the proposed use. Include list of radioisotopes and maximum activity of each used.

18. CERTIFICATE

(This item must be completed by applicant)

The applicant and any official executing this certificate on behalf of the applicant named in Item 2, 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.

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.

a. LICENSE FEE REQUIRED *(See Section 170.31, 10 CFR 170)* $230.00	b. CERTIFYING OFFICIAL *(Signature)*
	c. NAME *(Type or print)* C.L. McMillan
(1) LICENSE FEE CATEGORY: Part 170 (3P)	d. TITLE Vice President, Industrial Relations
(2) LICENSE FEE ENCLOSED: $ 230.00	e. DATE 1-24-85

FORM NRC-313 I (3-80)

70155

ITEM 14

FORM NRC–313(I) ITEM 14-WASTE DISPOSAL

Based on actual operating experience documented by Trio-Tech International of Burbank, CA, vendor of the TRACER-flo user operating with one shift per day discharges at a uniform rate a total of about 20 curies or 7.4×10^{11} Bq of Kr-85 per year. A very busy user operating 3 shifts per day discharges about 50 curies or 1.85×10^{12} Bq of Kr-85 per year. The TRACER-flo unit is equipped with a blower at 1750 cubic feet per minute capacity. In a typical installation with a 14" diameter vent pipe, 15 meters total length with 390 degree bends max., the actual discharge rate is about 1200 cu. ft. per minute. The annual volume of air discharged is thus:

$$1200 \frac{\text{cu. ft.}}{\text{min.}} \times 525{,}600 \frac{\text{min.}}{\text{yr.}} \times 2.83 \times 10^{-2} \frac{\text{cu.m}}{\text{cu.ft.}} = 1.78 \times 10^{7} \frac{\text{cu.m}}{\text{yr.}}$$

The average concentration at point of discharge is thus:

$$C = \frac{1.85 \times 10^{12} \text{ Bq/yr}}{1.78 \times 10^{7} \text{ cu.m/yr}} \times \frac{1 \text{cu.m}}{10^{6} \text{ ml}} = 0.104 \text{ Bq/ml}$$

In view of the 10.7 year halflife, holdup tanks for decay before release are not practical. Under the provisions of 10CFR20.106 it is permissible to include dilution and dispersion from the point of release in calculating the concentrations to which persons in unrestricted areas might be exposed. In order to estimate this concentration for Kr-85 releases, the following assumptions are made:

1. Atmosphere dispersion can be described by the "Constant Mean Wind Direction Model" of NRC Regulatory Guide 1.111.
2. Effective release height = 0; i.e., ground level release.
3. Vertical plume spread is not increased by the building wake (worst case).
4. Nearest full time occupancy is 50 meters down wind from the point of release.
5. The midpoint of the windspeed class is 5 miles per hour = 2.2 m/sec.
6. Atmospheric stability is assured to be a constant Pasquill Class E (stable).

Under the above asumptions, the average effluent concentration normalized by source strength is:

$$\frac{\bar{X}}{Q} = \frac{2.032}{R\bar{u}\sigma_z}$$

Where $\frac{\bar{X}}{Q}$ = Average effluent concentration, $\bar{X}$, (Bq/cm^3) normalized by source strength, Q, (Bq/yr) at distance R in a downwind direction

R = 50 meters = 5000 cm

70155

$\bar{u}$ = Windspeed = 2.2 m/sec = 220 cm/sec

σ_z = Vertical deviation of material in a plume
= 2m (from Fig. 1, Regulatory Guide 1.111 for 50m distance and Pasquill Class E stability)

2.032 = $\left(\frac{2}{\pi}\right)^{1/2}$ divided by the width in radius of a 22.5° sector

$$\bar{X} = \frac{2.032 \times 1.85 \times 10^{12} \text{ Bq/yr}}{5000\text{cm} \times 220\text{cm/sec} \times 200\text{cm} \times 3.17 \times 10^{7} \text{ sec/yr}}$$

= 5.42×10^{-4} Bq/ml, or about 6% of permissible Table II value of Kr-85 of 1×10^{-2} Bq/cm^3

Using equation 11 of NRC Regulatory Guide 1.109, the annual skin dose from this ground release to a person constantly 50 meters downwind from the point of release is:

$$D^S = 1.11\, S_F [\bar{X}\, DF^B + \bar{X}\, DFS]$$

Where:

D^S = Annual skin dose due to immersion in a semi-infinite cloud, cSv/yr

S_F = Attenuation factor for shielding by structures. For no shielding assumed, $S_F = 1$

$\bar{X}$ = Average effluent concentration = 5.42×10^{-4} Bq/cm^3 = 5.42×10^{2} Bq/m^3

$DF\gamma$ = Gamma dose factor, for Kr-85 is 1.72×10^{-5} mrem-m^3/pCi-yr or 4.65×10^{-7} cSv-m^3/Bq-yr

DFS = Beta dose factor, for Kr-85 is 1.34×10^{-3} mrem-m^3/pCi-yr or 3.65×10^{-5} cSv-m^3/Bq-yr

For the case at hand:

$$D^S = 1.11 \times 1\ [\ 5.42 \times 10^{2} \times 4.65 \times 10^{-7} + 5.42 \times 10^{2} \times 3.62 \times 10^{-5}\ ]$$

= 0.022 cSv/yr

The dose to the whole body, computed similarly is about 0.0003 cSv/yr.

FORM NRC–313(I) ITEM 15–RADIATION PROTECTION PROGRAM

A. SURVEY PROGRAM

The TRACER-flo unit is equipped with an alarming radiation monitor to measure radioactivity in the effluent released to the ventilation stack and blower. Due to the high 1750 cubic feet feet per minute capacity of the roof-mounted blower, a relatively large negative pressure gradient exists between the TRACER-flo room and adjacent areas. The monitor operates continuously when power is supplied to the TRACER-flo.

Normally, two portable survey meters calibrated to read Kr-85 beta dose rate to the skin at a depth of 7mg/cm^2 will be available. These will be sent to the outside calibration laboratory at staggered 6 month intervals so one will always be available. These instruments will be issued in the event of unusual readings of the TRACER-flo radiation monitor and once a month for a routine survey in the vicinity of the operating TRACER-flo unit.

Physical measurements will be made continuously to determine compliance with Appendix B of 10CFR Part 20. An environmental radiation badge will be placed in the vent stack airstream at the point of release on the roof, and 4 other radiation badges will be placed at the 4 compass points at the nearest boundary of the roof line with unrestricted areas. These dosimeters will be sent for processing on a monthly basis.

B. RECORDS MANAGEMENT PROGRAM

Written records of monthly radiation surveys in the vicinity of the TRACER-flo unit, environmental dosimeter monthly reports, monthly radiation dose records from the personnel badge supplier, inventory records of receipts, use and disposal of Kr-85 cylinders will be kept under the direct supervision of the Radiation Protection Officer. *Sample forms used for inventory records are attached.* The Radiation Protection Officer is responsible for periodic review of the records to determine whether any further steps should be taken to maintain radiation exposures ALARA.

C. INSTRUCTIONS TO PERSONNEL

The Radiation Protection Officer will be responsible for instructing personnel in radiation safety procedures. In addition to formal and/or informal on the job instruction, each person working with radiation will receive a copy of the "Kr-85 Radiation Safety Manual". A copy is attached with this section.

D. DUTIES OF RADIATION PROTECTION OFFICER

Ensure that the following are completed:

1. Perform, or cause to be performed, monthly radiation surveys of the TRACER-flo unit.

2. Send, at 6 month intervals, the portable beta dose rate meters to an authorized calibration laboratory for recalibration.

3. Collect and send for processing, the personnel radiation badges and environmental radiation badges at the end of each calendar month.

4. Keep current the logbook of receipts, uses and shipment of Kr-85 gas cylinders.

5. Keep current a file of monthly radiation surveys of personnel and environmental radiation dose reports.

6. Perform a quarterly review of the radiation survey and dose records to determine whether additional steps need to be taken to maintain radiation exposures ALARA.

7. Provide on-the-job training in radiation safety procedures to radiation workers commensurate with their radiation duties.

8. Provide and post all necessary radiation signs, labels, and notices and procedures.

9. Periodically confirm that radiation workers are wearing required radiation badges and following prescribed safety procedures.

10. Initiate applications for amendments to the radioactive materials license as conditions warrant.

11. File/or cause to be filed, at least 30 days prior to the expiration of the radioactive materials license a renewal application.

12. Approve all purchase orders for radioactive materials prior to placing the order to assure that purchase is within the conditions of the radioactive materials license.

FORM NRC-313(I) ITEMS 16 AND 17 - FORMAL TRAINING AND EXPERIENCE

D.M. Valdepena - Manufacturing Supervisor
Leroy Gaines - Test Supervisor
Gail Massoll - Manufacturing Devel. Engineer
Richard Larean - Group Engineer

FORMAL COURSEWORK IN RADIATION SAFETY:

One week training course titled "TRACER-flo Safety and Operations Course", will be taught at General Dynamics, Pomona, CA by licensed instructors from Trio-Tech International, Burbank, CA. at the time of installation of the Tracer-flo unit. The course will include 4 hours in principles and practices of radiation protection, 28 hours in radioactivity measurements, standardization, and monitoring techniques and instruments, 4 hours in mathematics and calculations basic to the use of radioactivity, and 4 hours in the biological effects of radiation. In each topic, the emphasis will be on the radioisotope KR-85. A course outlinge is attached.

Experience and training are listed on the individual resumes. (attached)

70155

FORM NRC–313 (I) ITEM 16–FORMAL TRAINING IN RADIATION SAFETY

"TRACER-flo® SAFETY AND OPERATIONS COURSE"

OUTLINE OF LECTURES AND DEMONSTRATIONS

I. Radiation Safety Course Lecture (Monday a.m.)

- A. Introductory Comments
- B. Fundamentals of Radiation Safety
  - (1) Units of Radiation Exposure
  - (2) Biological Effects of Radiation
  - (3) Characteristics of Krypton–85 and Dose Estimates
  - (4) Controlling and Limiting Radiation Dose
  - (5) Time, Distance, and Shielding Estimates
- C. Summary

II. Radiation Safety Course Lecture (Monday p.m.)

- A. Radiation Monitoring Instrumentation
  - (1) Survey Instruments
  - (2) Personnel Instruments
    - (a) Film Badges
    - (b) Pocket Dosimeters
    - (c) Thermoluminescent Dosimeters
- B. Regulations and Licensing Summary
  - (1) Radiation Exposure Limits
    - (a) Radiation Workers
    - (b) General Population Group
  - (2) Radioactive Materials Licenses
  - (3) Record Keeping and Reporting Requirements
  - (4) Company Radiation Safety Program
- C. Summary

70155

III. Radiation Safety Manual (Tuesday a.m.)

A. Introduction

B. Radiation Exposure Standards

C. Control of Radiation Exposure (Area Designation)

D. Warning Signs, Symbols, Barriers

E. Transportation of Radioactive Material

F. Radiation Spills

G. Questions and Answeres Concerning First Three Lectures

IV. Quiz and Demonstration (Tuesday p.m.)

A. Quiz covering Radiation Safety (15 Minutes)

B. Demonstration of Radiation Monitoring Instruments

(1) GM Tube Survey Meter
(2) Scintillation Detector with Ratemeter
(3) Typical Smear Counting Instrumentation Setup

C. Demonstration of a Typical Laboratory Radiation Survey

V. TRACER-flo Leak Detection Equipment Lecture (Wednesday a.m.)

A. Introduction

B. Theory of Operation

C. Safety Aspects

D. Summary

VI. Demonstration of Equipment Checkout Procedures (Wednesday p.m.)

VII. TRACER-flo Leak Detection Equipment Lecture (Thursday a.m.)

A. Leak Rate Determination

B. Transfer System Description

C. Operating Procedures

VIII. **Demonstration of Equipment Operation Procedures (Thursday p.m.)**

A. Nitrogen Admission Procedure

B. Krypton–85 Charging Procedures

C. Krypton–85 Sampling Procedures

D. "K" Factor Determination Procedure

IX. **Final Examination and Equipment Demonstration (Friday a.m.)**

A. Final Examination Concerning Radiation Safety (2 hours)

B. Second Demonstration of Equipment Operation Procedures

C. Class Participation in Equipment Operation

X. **Equipment Demonstration Review (Friday p.m.)**

A. Individual Participation in Equipment Operation

B. Final Checkout of Equipment