

MARTIN COMPANY

Baltimore,
Maryland
21203

October 28, 1965

Refer to: ACC-440
Internal Mail #845

U. S. Atomic Energy Commission
Division of Materials Licensing
Washington, D. C. 20545

Attention: Mr. Robert Brinkman

Subject: Proposed Amendment to Byproduct License No. 19-1398-33

Gentlemen:

The Martin-Marietta Corporation requests that Byproduct Material License No. 19-1398-33 be amended to permit an advanced research and development program for the Martin Radioisotope-Phosphor-Photovoltaic-Generator (RPPG) utilizing a maximum of 500 curies promethium-147. Attached is Form 313 "Application for Byproduct Material License" and appropriate pages which can be inserted in our application submitted on February 12, 1965.

Very truly yours,

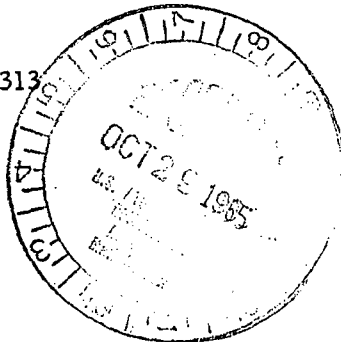
MARTIN-MARIETTA CORPORATION
MARTIN COMPANY, Baltimore Div.

C. W. Keller

C. W. Keller, Nuclear
Accountability & Licensing Rep.

CWK/plm

Attachments: AEC Form 313



B/39

72322

A DIVISION OF
MARTIN
MARIETTA 

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, D.C., 20545. 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.) Martin Marietta Corporation Baltimore, Maryland 21203 Internal Mail No. 845		(b) STREET ADDRESS(ES) AT WHICH BYPRODUCT MATERIAL WILL BE USED. (If different from 1 (a).) Martin Marietta Corporation Middle River, Maryland	
2. DEPARTMENT TO USE BYPRODUCT MATERIAL Nuclear Programs		3. PREVIOUS LICENSE NUMBER(S). (If this is an application for renewal of a license, please indicate and give number.) 19-1398-33	
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.) F. Huffman, Staff Engineer J. Neace, Senior 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.) R.J. Brisson, Supervisor Health Physics Section	
6. (a) BYPRODUCT MATERIAL. (Elements and mass number of each.) Promethium-147		(b) CHEMICAL AND/OR PHYSICAL FORM AND MAXIMUM NUMBER OF MILLCURIES 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.) 500 Curies as Pm Cl₃ in solution or as Pm₂O₃ as powder or compact	

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.)

Please see attached application

72322

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	Please refer to Submission dated Feb. 12, 1965 License 19-1398-33		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 License 19-1398-33 Submission dated 2/12/65				

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 License 19-1398-33 Submission dated 2/12/65					

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

Please refer to License 19-1398-33 Submission dated 2/12/65

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 License 19-1398-33 Submission dated 2/12/65

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

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.

Please refer to License 19-1398-33 Submission dated 2/12/65

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.

Please refer to License 19-1398-33 Submission dated 2/12/65

CERTIFICATE (This item must be completed by applicant)

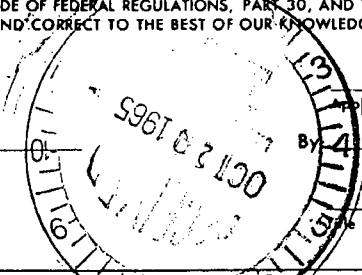
16. THE APPLICANT AND ANY OFFICIAL EXECUTING THIS CERTIFICATE ON BEHALF OF THE APPLICANT NAMED IN ITEM 1, CERTIFY THAT THIS APPLICATION IS PREPARED IN CONFORMITY WITH TITLE 10, CODE OF FEDERAL REGULATIONS, PART 30, AND THAT ALL INFORMATION CONTAINED HEREIN, INCLUDING ANY SUPPLEMENTS ATTACHED HERETO, IS TRUE AND CORRECT TO THE BEST OF OUR KNOWLEDGE AND BELIEF.

Date _____

Applicant named in item 1

By _____

_____ of certifying official



WARNING.—18 U. S. C., Section 1001; Act of June 25, 1948, 62 Stat. 949; 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.

SECTION D

ADVANCED DEVELOPMENT PROGRAM

RADIATION - MICROWAVE - PHOTOVOLTAIC
GENERATOR

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Advanced Development Program

The initial phase in the development of a practical Radioisotope-Phosphor-Photovoltaic-Generator (RPPG) has been completed in compliance with procedures and techniques described in previous sections of this license application. The effort has culminated in the successful fabrication of a one microwatt RPPG prototype which, to date, has been demonstrated and operated for over four months without incident. Leak tests have shown containment of the promethium-147 to be absolute. Experience gained during the initial development program for curie quantity light sources provides the basis for the safe handling of larger amounts of fuel required in the fabrication of higher power generators.

Market analysis has indicated practical applications requiring RPPG outputs from 50 to 100 microwatts. To reach this desired generator output, a development program utilizing a total inventory of 500 curies PM-147 will be needed to improve the RPPG power density and efficiency. We have established a limit of approximately 100 curies of PM Cl_3 in HCl solution which will be open for processing at any one time. Dependent upon RPPG output requirements fuel loadings will vary to a limit of approximately 100 curies PM-147 per generator. A $\pm 10\%$ difference from these processing limits caused by nominal packaging variations is considered within the intent of these limits. Multiple light source-photovoltaic cell sandwiches or a single source in which the intimate promethium oxide-phosphor mixture is encapsulated in polystyrene will provide fuel containment within the generator. The safe handling procedures for this additional research and development program will be essentially identical to those described in previous sections of this license application.

The only significant differences from the hazards evaluation in the original submission are the increased dose rates. The estimated dose rates for the larger fuel quantities (based on available aged fuel irradiated under Hanford conditions with 0.25 ppm PM-146 content) are:

Processing container surfaces:	Approx. 100 R/hr
6 inches from processing container surface (no shielding, typical glass-ware):	Approx. 160 mr/hr

6 inches from processing container surface (typical 1/8 inch lead shielding):	Approx. 3 mr/hr
Surface of plastic light source:	Approx. 200 R/hr
1 inch from surface of plastic light source (typical 1/8 inch tantalum shielding):	Approx. 2 mr/hr
Surface of generator (shield thickness depending on application):	20 to 200 mr/hr
1 inch from surface of generator (shield thickness depending on application):	1 to 20 mr/hr

Special generator applications may require minimization of generator weight and we anticipate surface dose rates with the increased fuel loading to range up to a maximum of 200 mr/hr. However, the compact RFFC approximates a point source and the dose rate drops off rapidly with distance. The increased dose rates, especially during processing, will be mitigated by (1) use of additional movable barrier shielding inside the glove box and (2) increased use of remote handling equipment. Personnel exposures during the initial development program were well within those specified in Title 10 Code of Federal Regulations, Part 20 and we will continue to make every possible effort to maintain the radiation exposure at the lowest practical level.

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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.) John H. Morrison (see attached resume)	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.) R. J. Brisson, Supervisor Health Physics Section
6. (a) BYPRODUCT MATERIAL. (Elements and mass number of each.) Promethium-147	(b) CHEMICAL AND/OR PHYSICAL FORM AND MAXIMUM NUMBER OF MILLCURIES 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.) 3 curies as sealed Pm_2O_3 source in generator.
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.) Transport and demonstration of generator.	

71935

RESUME

NAME: Morrison, John M.

POSITION: Specialist, Nuclear Power Plants, Marketing Department

EDUCATION: BS, U. S. Naval Academy, (b)(6)

Ex. 6

EXPERIENCE: 1962 to Present--Martin Company, Nuclear Division. Specialist on reactor systems for military use. Coordinate efforts of Nuclear Division for modification to existing plants or construction of new power plants. Present and discuss new concepts and data generated from in-house efforts. Temporary leave from Marketing Department from November of 1964 to February of 1965 to act as Operations Manager at PM-3A during training and modifications of plant during that period.

1961 to 1962--Martin Company, Nuclear Division. Design Specialist, Engineering, responsible for primary system fit-up and checkout during stateside testing and plant construction. Acting shift supervisor during construction and initial plant checkout. Planned work procedures and sequence; implemented modifications as necessary.

1960 to 1961--Alco Products, Inc. Plant Superintendent responsible for all testing assembly-disassembly of PM-2A Nuclear Powerplant. Supervisor of operations of PM-2A at Camp Century, responsible for conducting all plant startup tests, operations, criticality, and plant acceptance operation. Remained at Century for nine months to effect shielding modifications necessary for safe power operations. Upon return to CONUS, was safety observer for refueling of SM-1. Conducted plant familiarization course and operations for officer trainees.

1959 to 1960--Alco Products, Inc. Mechanical Section, R & D, assisted in conducting various R & D efforts in the SM-1. Participated in preparing the Controls and Instrumentation Study for SM-1 Nuclear Power Plant (APAL-S2). Wrote test procedures and conducted Loss of Flow Test in SM-1. Assisted in trouble-shooting problems arising in the SM-1, such as removal of broken studs in pressure vessel head, removing jammed spent-fuel chute plug, and replacement of V. C. penetrations.

RESUME - MORRISON, JOHN H.

-2-

1958 to 1959--Alco Products, Inc. Shift Supervisor, SM-1, responsible for safety of operation of plant by military personnel, training new students and shift supervisors, performing unscheduled maintenance, and qualifying reactor operators.

1957 to 1958--U. S. Rubber Company. Field Sales Engineer, responsible for contacting customers and doing engineering work as necessary for conveyor systems, hose-line transport systems, power transmission problems, and rubber lining of chemical tanks.

1953 to 1957--U. S. Navy. Officer, served aboard destroyers as gunnery officer and amphibious vessel as operations officer. Qualified as Command Duty Officer and command of ship in-port or at sea. Resigned in June of 1957.