ELEX-0516
3350
Ser 05163-20
19 January 1967

From: Commander, Naval Electronic Systems Command
To: Chief, Isotopes Branch
Division of Materials Licensing
U. S. Atomic Energy Commission
Washington, D. C. 20545

Subj: Application For Cancellation Of AEC Byproduct Material License No. 08-00038-13

Encl: (1) Form AEC HQ-277 dated 19 January 1967

1. It is requested that the AEC Byproduct Material License No. 08-00038-13 be cancelled.

2. Enclosure (1) contains information regarding the disposition of material held pursuant to this license.

Copy to:
NAVSEC 6178B03
(Attn: Mr. Lesnick)

M. G. WILLIAMS
By direction

MCCRACKEN/mitchell
61457 - 1/19/67

FROM: NAVAL SHIP SYSTEM COMMAND

NAME OF ORIGINATOR (Signature)	CODE	ROOM	EXTENSION	DATE
[illegible]	SEC 6178303	4331	65100	1/12/67

NMC ROUTING SYMBOLS (EXTERNAL USE ONLY)

61457

NAVMAT — NAVORD
NAVAIR — NAVSHIP
NAVELEX — NAVSUP
NAVFAC — PM _____

ROUTING PURPOSE SYMBOLS

A - ACTION
Ⓐ - COORDINATING ACTION
C - CONCURRENCE
CR - COMMENT AND RETURN
I - INFORMATION AND RETENTION ~~/RETURN~~ (Cross out one)
O - OTHER
R - PREPARE REPLY/ENDORSEMENT
1 - SECRETARIAL SIGNATURE
2 - CNM SIGNATURE
3 - DIRECT

TO	PURPOSE	DATE	INITIALS
05163	I		
LAST			

REMARKS
(Sign Comments with Last Name, Rank, Code, date and Extension)

DEADLINE DATE | ROUTING DATE | CONTROL NUMBER

NMC EXTERNAL/INTERNAL ROUTE SHEET
NAVMAT 5216/4 (5-66)

U. S. NAVAL RADIOLOGICAL DEFENSE LABORATORY
SAN FRANCISCO, CALIFORNIA 94135

IN REPLY REFER TO:
73[illegible]
JLT/FTF:kmm

14 DEC 1966

From: Commanding Officer and Director
To: Commander, Naval Ship Systems Command, Code 6665.3U

Subj: Radiological Evaluation of ^{147}Pm Activated Boat and Wrist Compasses and Compass Elements; report on

Ref: (a) NSSC ltr SF011-05-04 ser 6665.3U-2101 of 28 Oct 1966

Encl: (1) Radiological Evaluation of ^{147}Pm Activated Boat and Wrist Compasses

1. Reference (a) requested that leak, contamination and profile radiation tests be made to evaluate the radiological hazard presented by ^{147}Pm activated compasses. The results of these tests are submitted as enclosure (1).

a. The tests show that the wrist and boat compasses should present no radiation or contamination health hazard in their assembled condition.

b. The boat compass cards were found to be free of removable contamination; the wrist compass cards were found to be heavily contaminated with removable activity (inside compass bowls and on compass cards).

c. The silicone solution from the boat compasses revealed no significant radioactive material.

d. The radiation profiles of boat and wrist-type magnetic compasses showed a maximum surface radiation level of 5 mr/hr.

2. The following conclusions and recommendations are submitted:

a. The boat compasses showed good containment and adherence characteristics of the self-luminous paint. The wrist compasses showed good containment of the self-luminous paint in its assembled condition; but when disassembled, it was found that the wrist compass cards leaked or were contaminated with loose radioactivity prior to installation. These compasses can present a potential radiological health hazard, when opened or when the cover glass is accidently broken. Therefore, contamination control practices should be continued.

6178

661220-0087

7011-05-04

b. Since the source of the loose radioactivity is not always known, it is recommended that the NSSC require the manufacturer to provide radiological contamination free parts. In addition, the NSSC should be in a position to visually inspect the completed compasses and reject compasses which do not exhibit a glossy ethyl methacrylite finish on the compass card. Those cards found lacking this glossy finish should be suspected of having loose luminous paint.

c. The sealed ^{147}Pm activated compasses should pose no radiation dose rate problem due to the low energy of the emitted radiation.

3. As requested by reference (a) the luminous parts of the wrist and boat compasses will be forwarded to the Minnesota Mining and Manufacturing Company. The remaining parts of the MK 8 boat compass will be forwarded to the NSSC under separate cover in the near future.

N. J. Davis, Jr.
N. J. DAVIS, Jr.
Acting

Radiological Evaluation of ^{147}Pm Activated Boat and Wrist Compasses

Test Method

1. Upon receipt of the compasses, the boat compasses were numbered 1 through 4, and the wrist compasses were numbered 5 and 6.

2. Contact readings with appropriate radiacs and film dosimeters were made to indicate surface radiation dose rates. An AN/PDR-27(J), calibrated per manufacturer's instructions manual was used for β detection. An Eberline gas proportional radiac (PAC-3G) was used for surface alpha detection.

3. The laboratory instruments used for wipe and liquid evaluations were a Berkeley scaler with an end window GM β detector with a ^{147}Pm efficiency of 5.5% and a Nuclear Chicago scaler with a scintillation type α detector with an efficiency of 23.2%.

4. Wipes were made over a 25 cm^2 area and counted for five minutes in each of the laboratory instruments. The 3σ detection limits for the β counter was 7.5 c/m and for the α counter was 1.8 c/m. Any count below 3σ is reported as no detectable activity (NDA).

Part I. Measurements of the Intact Compasses

1. Open window readings using an AN/PDR-27(J) and a PAC-3G radiacs are given in Table I.

2. Wipes of the exterior are also presented in Table I.

ENCLOSURE (1)

TABLE I

MEASUREMENT OF THE INTACT COMPASSES

Radiation Measurements (mR/hr)	Boat Compasses 1	2	3	4	Wrist Compasses 5	6
Top	0.22	0.22	0.25	0.25	5.	1.5
Bottom	0.03	0.03	0.03	0.03	0.45	0.25
Side	0.08	0.08	0.08	0.08	1.5	0.6
Average	0.11	0.11	0.12	0.12	2.32	0.78
PAC-3G (α)	NDA	NDA	NDA	NDA	NDA	NDA
Exterior Wipe Test (d/m/cm^2)						
β Top	NDA	NDA	NDA	NDA	NDA	NDA
β Bottom	NDA	NDA	NDA	NDA	NDA	NDA
β Side	NDA	NDA	NDA	NDA	NDA	NDA
α Top	NDA	NDA	NDA	NDA	NDA	NDA
α Bottom	NDA	NDA	NDA	NDA	NDA	NDA
α Side	NDA	NDA	NDA	NDA	NDA	NDA

3. Conclusion. The tests show that the average radiation dose rate, as measured by the AN/PDR-27(J) was 0.12 mR/hr and 1.54 mR/hr for the assembled boat and wrist compasses, respectively. No radiological contamination was detected on either type of compass.

Part II. Compass Element Test

1. To determine if any loose radioactive material was removable from the compass cards, the previously mentioned compasses were taken apart; the bowls, top, and bottom of the cards were dry wiped and counted separately.

2. It was noted that wrist compass card #5 did not appear to have the ethyl methacrylite coating, and the luminous material was readily removed from the card during wipe testing. Compass card #6 was found peeling and broke under wipe pressure.

3. Results of the compass card wipe testing is presented in Table II.

TABLE II

COMPASS CARD WIPE TEST ($d/m/cm^2$)

	Boat Compasses				Wrist Compasses	
	1	2	3	4	5	6
β						
Top	NDA	2.0	NDA	2.0	5.84×10^4	1.43×10^3
Bottom	NDA	NDA	NDA	NDA	1.76×10^4	515
Inside Bowl	NDA	NDA	NDA	NDA	1.69×10^4	3.03×10^4
α						
Top	NDA	NDA	NDA	NDA	2.77×10^3	NDA
Bottom	NDA	NDA	NDA	NDA	74	NDA
Inside Bowl	NDA	NDA	NDA	NDA	115	NDA

4. Conclusion. The boat-type compass cards did not show any significant removable activity. The maximum removable activity for the wrist compass cards was 5.8×10^4 $d/m/cm^2$ β -- and 2.77×10^3 $d/m/cm^2$ α.

Part III. Silicone Solution Analysis

1. A 100 ml silicone solution from each of the boat compasses was evaporated on a hotplate to dryness and then counted for alpha and beta activity.

2. The results of the analysis is presented in Table III.

TABLE III

SILICONE ANALYSIS (d/m/ml)

	Boat Compass 1	2	3	4
β	NDA	NDA	NDA	4.21
α	NDA	NDA	NDA	0.058

3. Conclusion. No α or β radioactivity was found in the silicone solution of three out of the four boat compasses tested. Compass card #4 exhibited 4.21 d/m/ml β -- and 0.058 d/m/ml α activity.

4. Since each compass contained approximately 600 ml of silicone solution, the detected activity of compass card #4 would represent a total activity of 1.15×10^{-3} uCi β -- and 1.37×10^{-5} uCi α.

Part IV. Radiation Profile

Compass	Boat Compass mR/hr Top	Side	Bottom	Alpha
1	0.22	.08	.03	None
2	0.22	.08	.03	None
3	0.25	.08	.03	None
4	0.25	.08	.03	None
	Wrist Compass mR/hr			
	Top	Side	Bottom	Alpha
5	5	0.45	1.5	None
6	1.5	0.25	0.6	None

There was no detectable α activity on any "as is" exposed surfaces.

NAVAL SHIP ENGINEERING CENTER
WASHINGTON, D. C. 20360

IN REPLY REFER TO

9941/2
Ser 6665.3U-2105

14 OCT 1966

Canrad Precision Industries, Incorporated
630 Fifth Avenue
New York, New York 10020

Attention Dr. Oscar Strongin, Assistant to the President

Dear Dr. Strongin:

Underwater wrist compass parts, each painted with Canrad Precision Industries Tritium-Luminous Compound, forwarded to this Command for evaluation on your invoice of 7 April 1965, are being returned, together with untreated parts of two compasses, under separate cover.

Results of a cursory examination of a compass assembled with tritium-treated parts indicated a luminosity level far short of the requested 65 microlamberts (ul) requested; that subsequent visual comparison tests of dark adapted compasses disclosed values of 8.0 ul and 0.4 ul for the course ring and dial respectively. Photometer measurements made on a light charged compass indicated a decay time constant of approximately 1 minute with the final values as indicated above.

The untreated parts are being forwarded for possible further experiments as per our letter of 1 December 1964.

We would like to thank you for your efforts in this area and your services to us.

Sincerely yours,

FLOYD O. BOND
Head, Navigation & Stabilization Section
Interior Communication, Fire Control
& Navigation Branch
Machinery Division
By direction

Encl:
(1) (SC) Tritium treated parts for two compasses
(2) (SC) One assembled compass with tritium treated parts
(3) (SC) Untreated compass parts for two compasses

8-38-13

Copy to:
ELEX 05162
NAVSEC 6665.3U

J. Michalek, 65100; B. Davis, 10/13/66

DEPARTMENT OF THE NAVY
NAVAL SHIP SYSTEMS COMMAND
WASHINGTON, D.C. 20360

IN REPLY REFER TO

SF011-05-04
Ser 6665.3U-2101

28 OCT 1966

From: Commander, Naval Ship Systems Command
To: Commanding Officer and Director
U. S. Naval Radiological Defense Laboratory
San Francisco, California 94135

Subj: Prototype submersible wrist type and boat type magnetic compasses; authorization to conduct radiological health hazard tests on, Project No. SF011 05 04, Task 6191

Encl: (1) Two wrist-type submersible magnetic compasses and four boat type magnetic compasses

1. This Command intends to request cancellation of its AEC Byproduct License 8-33-13 for evaluation of the subject compasses. However, prior to this intended action, the Laboratory is requested to conduct leakage and contamination test on the subject compasses, enclosure (1), in order to determine the degree/existance of the radiological health hazard and report same. Each of the wrist-type compasses is treated with approximately 15.7 mc of Promethium PM-147 self-luminous material; each of the boat type magnetic compasses is treated with approximately 25.8 mc of Promethium PM-147 self luminous material.

2. Data with respect to the following tests is required in order to verify the containment and adherance characteristics of the self-luminous paints within the compasses:

a. Compass wipe tests - wipes shall be taken over appropriate accessible surfaces of each compass in its as is condition.

b. Liquid analysis (boat compasses) - analyze the liquid for the quantity of radioactive contaminants. The four boat compasses are filled with Silicone in accordance with Military Specification MIL-F-21568.

c. Compass card wipe tests - wipe top and bottom surfaces of each compass card upon removal from compass bowls. In order to remove the compass cards from the wrist compass bowls, separate the course setting ring from the wrist compass proper, then remove the EC 801 cement from the areas between the compass bowl and compass window with a sharp pointed instrument.
Note - The compass cards were painted with a coating of ethyl methacrylite after treatment with self-luminous material. In order to drain the liquid from the boat type compasses, the filling hole screw in the side of the bowl is removed after the bottom cover of the compass is detached.

d. Radiation profile - a radiation profile of the compasses is desired in addition to a description of the test instruments used throughout the compass tests.

3. Upon completion of the required work, the luminous parts of the wrist compasses and boat compasses, in addition to the luminous parts of the wrist compasses, forwarded for tests by BuShips ltr SF011-05-04 Ser 665-43 of 1 Feb 1965, should be sent to Minnesota Mining and Manufacturing Company, to the attention of Mr. R. Colestock, for examination and disposal; the remaining parts of the wrist type compasses shall be disposed of locally while the remaining parts of the MK 8 boat compass shall be returned to this Command for use in future development work.

4. The above mentioned work is chargeable to Allotment 21173/RDT&EN 67.2475, Element 622 26 012 presently held at your activity.

5. The Naval Ship Engineering Center project engineer is Mr. D. R. Lesnick Code 6665.3U, telephone OX 65100.

6. If the assigned work cannot be completed by 15 Dec 1966, this Command shall be advised of the expected completion date.

W. S. BROWN
By direction

Copy to:
Supply System Command X12
CNM 0331
ELEX 05162
ELEX 05163

DEPARTMENT OF THE NAVY
NAVAL SHIP SYSTEMS COMMAND
WASHINGTON, D.C. 20360

IN REPLY REFER TO

SF011-05-04
Ser 6665.3U-2101

28 OCT 1966

From: Commander, Naval Ship Systems Command
To: Commanding Officer and Director
U. S. Naval Radiological Defense Laboratory
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1. This Command intends to request cancellation of its AEC Byproduct License 8-33-13 for evaluation of the subject compasses. However, prior to this intended action, the Laboratory is requested to conduct leakage and contamination test on the subject compasses, enclosure (1), in order to determine the degree/existence of the radiological health hazard and report same. Each of the wrist-type compasses is treated with approximately 15.7 mc of Promethium PM-147 self-luminous material; each of the boat type magnetic compasses is treated with approximately 25.8 mc of Promethium PM-147 self luminous material.

2. Data with respect to the following tests is required in order to verify the containment and adherance characteristics of the self-luminous paints within the compasses:

a. Compass wipe tests - wipes shall be taken over appropriate accessible surfaces of each compass in its as is condition.

b. Liquid analysis (boat compasses) - analyze the liquid for the quantity of radioactive contaminants. The four boat compasses are filled with Silicone in accordance with Military Specification MIL-F-21568.

c. Compass card wipe tests - wipe top and bottom surfaces of each compass card upon removal from compass bowls. In order to remove the compass cards from the wrist compass bowls, separate the course setting ring from the wrist compass proper, then remove the RC 801 cement from the areas between the compass bowl and compass window with a sharp pointed instrument.

Note - The compass cards were painted with a coating of ethyl methacrylite after treatment with self-luminous material. In order to drain the liquid from the boat type compasses, the filling hole screw in the side of the bowl is removed after the bottom cover of the compass is detached.

SF011-05-04
Ser 6665.3U-2101

d. Radiation profile - a radiation profile of the compasses is desired in addition to a description of the test instruments used throughout the compass tests.

3. Upon completion of the required work, the luminous parts of the wrist compasses and boat compasses, in addition to the luminous parts of the wrist compasses, forwarded for tests by BuShips ltr SF011-05-04 Ser 665-43 of 1 Feb 1965, should be sent to Minnesota Mining and Manufacturing Company, to the attention of Mr. R. Colestock, for examination and disposal; the remaining parts of the wrist type compasses shall be disposed of locally while the remaining parts of the MK 8 boat compass shall be returned to this Command for use in future development work.

4. The above mentioned work is chargeable to Allotment 21173/RDT&EN 67.2475, Element 622 26 012 presently held at your activity.

5. The Naval Ship Engineering Center project engineer is Mr. D. R. Lesnick Code 6665.3U, telephone OX 65100.

6. If the assigned work cannot be completed by 15 Dec 1966, this Command shall be advised of the expected completion date.

W. S. BROWN
By direction

Copy to:
Supply System Command Y12
CNM 0331
ELEX 05162
ELEX 05163

8-38-13

WIPE TEST AND DECONTAMINATION DATA SHEET
PRNC-INDMAN-9673/4 (12-62)

RADIAC REPAIR FACILITY

DATE: 4 May 1966

BADGE: 58181

NAME: G. A. Eslin

SERIAL: 76008

TEST EQUIPMENT: R.I.D.L. Model 49-54 Scaler

SERIAL: 979

GEIGER-NULLER TUBE MANUFACTURER: Electronic Products Company

SENSITIVITY FACTOR: 1.02

BACKGROUND COUNTING TIME: 5 MINUTES

COUNT RATE: 49 counts per minute

TOTAL COUNT: 245

SERIAL: Below

EQUIPMENT UNDER TEST: Compasses - Boat Type, Wrist Type

OTHERS:

CASE	HOUSING	SOURCE	UC
SYMBOL	SERIAL	CPM	UC
DECON (1)	CPM	UC	
DECON (2)	CPM		

REMARKS

Submersible Wrist-Type containing 15.7 mc of PM-147

Serial	Base and Side Wipe	Face Wipe
1	+4 net count	-2
	+6 " "	+3

Magnetic Boat-Type containing 25.8 mc of PM-147

Serial	Base and Side Wipe	Face Wipe
1	-3	+4
2	+2	+5
3	+7	+2
4	+5	-1

Enclosure (1)

660518-0030

FORM AEC-374A
(10-61)

U. S. ATOMIC ENERGY COMMISSION

MATERIAL LICENSE
Supplementary Sheet

U-149-65

License Number 8-38-13
(A67)
Amendment No. 8

THIS COPY IS FOR YOUR FILES

Department of the Navy
Bureau of Ships
Washington, D. C. 20360

In accordance with application dated March 15, 1965, License No. 8-38-13 is amended as follows:

Items 6, 7, 8, and 9 are amended 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
D. Hydrogen 3	D. Tritiated Luminous Paint contained in submersible wrist compasses	D. 450 millicuries contained in 3 compasses of 150 millicuries each

9. Authorized use

D. Evaluation of prototype submersible wrist compasses.

For the U. S. Atomic Energy Commission

Nathan Bassin

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

Date MAR 30 1965

ROUTE SLIP AND OFFICE MEMO
NAVSHIPS 50-1 (REV. 1-57)

DO NOT DETACH FROM OFFICIAL CORRESPONDENCE
WRITE OR PRINT LEGIBLY IN INK

ORIGINATING CODE 665 J NAME Michaleh J.L. EXTN. 65100 DATE 3/22/65

*INDICATE ACTION BY USING APPROPRIATE NUMBER
1. APPROVAL
2. COMMENT
3. INFORMATION
4. PREPARE REPLY
5. SIGNATURE
6. FOR OFFICIAL RECORDING (CODE 236)

ROUTE TO CODE	ACTION*	RELEASED INITIAL	DATE MONTH	DAY	YEAR	SUBJECT
665J		[illegible]	3	22	65	The attached copies of a BOSANDA ltr to AEC and Navy license for use of wrist compass are for your files. J.L. Michaleh 65700 665 J
682C						

SIGNATURE, EXTN., CODE AND DATE ARE TO FOLLOW COMMENTS

FILE.—Unless this material is to be further routed, return to file by dating and initialing below.

INITIAL DATE

If additional space is required use REVERSE SIDE

FILE NO. SERIAL NO.

U.S. GOVERNMENT PRINTING OFFICE : 1959 O—498767

U. S. ATOMIC ENERGY COMMISSION
BYPRODUCT MATERIAL LICENSE

Pursuant to the Atomic Energy Act of 1954 and Title 10, Code of Federal Regulations, Chapter [illegible] art 30, Licensing of Byproduct Material, and in reliance on statements and representations heretofore made by the licensee, a license is hereby issued authorizing the licensee to receive, acquire, own, possess, transfer and import byproduct material listed below, and to use such byproduct material for the purpose(s) and at the place(s) designated below. This license shall be deemed to contain the conditions specified in Section 183 of the Atomic Energy Act of 1954, and is subject to all applicable rules, regulations, and orders of the Atomic Energy Commission now or hereafter in effect and to any conditions specified below.

Licensee	
1. Name	Department of the Navy
2. Address	Bureau of Supplies and Accounts Washington, D. C. [illegible]
3. License number	[illegible]
4. Expiration date	March 31, 1967
5. Reference No.	

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
A. Promethium 147	A. Minnesota Mining and Mfg. Co. Model 142A Promethium-activated Luminous Paint contained in [illegible] Wrist Compasses.	A. 27,900 millicuries contained in 1000 compasses of 15.5 millicuries each

9. Authorized use

A. For self-illumination of submersible wrist compasses.

CONDITIONS

10. Unless otherwise specified, the authorized place of use is the licensee's address stated in Item 2 above.

11. Byproduct material may be used throughout the U. S. Navy.

12. The licensee shall comply with the provisions of Title 10, Part 20, Code of Federal Regulations, Chapter 1, "Standards for Protection Against Radiation."

13. A. Each sealed source containing byproduct material, other than Hydrogen 3, with a half-life greater than thirty days and in any form other than gas shall be tested for leakage and/or contamination at intervals not to exceed six months. In the absence of a certificate from a transferor indicating that a test has been made within six months prior to the transfer, the sealed source shall not be put into use until tested.

(See page 2)

U. S. ATOMIC ENERGY COMMISSION

BYPRODUCT MATERIAL LICENSE

Supplementary Sheet

License Number 2-2972-8 (037)

Continued from page one

CONDITIONS

13. continued

B. The test shall be capable of detecting the presence of 0.005 microcurie of radioactive material on the test sample. The test sample shall be taken from the sealed source or from the surfaces of the device in which the sealed source is permanently mounted or stored on which one might expect contamination to accumulate. Records of leak test results shall be kept in units of microcuries and maintained for inspection by the Commission.

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 the Director, Division of Materials Licensing, U. S. Atomic Energy Commission, Washington, D. C., 20545, 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 I, Division of Compliance, USAEC, 376 Hudson Street, New York, New York, 10014.

14. Each capsule shall be labeled to include the following:

1. The radiation caution symbol.
2. The words "Caution - Radioactive Material."
3. The quantity of Promethium 147 in millicuries.
4. The date of manufacture.
5. The Atomic Energy Commission license number.

15. Except as specifically provided otherwise by this license, the licensee shall possess and use byproduct material described in Items 6, 7 and 8 of this license in accordance with statements, representations and procedures contained in application dated October 15, 1964, and amendment thereto dated March 18, 1965.

For the U. S. Atomic Energy Commission

by Lawrence Brunch
Division of Materials Licensing
Division of Licensing and Regulation
Washington 25, D. C.

Date

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

Gentlemen:

Your letter MML:IB:MB (63260) of 13 January 1965 requested additional information to support our application dated 19 October 1964 for Promethium 147 contained in submersible wrist compasses. The following information is submitted:

a. Make and model number of the luminous paint containing Pm-147: 3M brand model No. 1A2A; product specification 3MPS-1A2001, 15 March 1962.

b. Compass fluid meets the requirements of specification MIL-L-5020A(AS0), 6 August 1956.

The liquid is a refined petroleum fraction having a flash point of 90°F (minimum). Distillation range end point 500°F (maximum). Neutral reaction after oxidation: Saybolt color (minimum) original +25; kinematic viscosity centistrokes at 100°F 0.90 to 1.15, at 38°F not more than 2.0 times that at 100°F; aromatics 10% maximum by volume. This fluid is used in aircraft and other instruments.

c. Five compasses were subjected to a submergence test equal to 400 ft. water pressure. After submergence, less than 0.005 microcuries of activity was found on the compass or in the compass fluid. Sample card and course rings have been submerged in the compass fluid for one year. Wipe tests showed less than 0.005 microcuries of removable activity and fluid contained no activity.

d. Five compass cards were bent around a 1" radius steel rod. There was no visible flaking, cracking, or other defects in the paint. The five samples were wipe tested after bending and less than 0.005 microcuries of activity were removed. Each sample card contained 10 microcuries of Pm-147 applied to the compass card as required by the specification.

650320-0529

ER

e. Five sample cards were subjected to 25 cycles per second for one hour followed by immersion in water for 24 hours. No visible flaking or chipping was observed.

f. Six compasses were measured to obtain a radiation profile. Each compass contained 15.5 microcuries Pu-147. The average surface contact reading was: top 0.97 mr/hr; side 0.24 mr/hr; bottom 0.45 mr/hr. Spectral measurements indicated radiation was X-ray in the energy range 30-55 Kev.

The specification has been revised to restrict the loss of Promethium after immersion to 15 maximum. The wipe test requirements have been changed to 0.005 microcuries removable activity. Leak test requirements have been placed in DUSANDA Instruction 3400.4.

Replenishment of the compass fluid will be done in a shop under controlled conditions. The fluid will be placed in the compass with an eye-dropper, therefore, since no contamination of the fluid has been noted in test samples we believe the fluid can be replenished without endangering personnel.

I trust the above information answers the questions raised in your letter of 13 January 1965.

We will continue to have the Naval Radiological Defense Laboratory test production samples as a quality control measure.

It would be appreciated if this matter can be expedited since the compasses are an urgent military requirement.

Sincerely,

G. D. MATTHEW
Head, Safety Branch
Field Industrial Relations Division
By direction of Chief,
Bureau of Supplies and Accounts

650320-0529

Copy to:
[illegible] (Code [illegible])
[illegible]

U. S. NAVAL RADIOLOGICAL DEFENSE LABORATORY
SAN FRANCISCO, CALIFORNIA 94135

IN REPLY REFER TO:

682C

730-21
FTF:jp
15 MAR 1965

From: Commanding Officer and Director
To: Chief, Bureau of Ships (Code 665)

Subj: Prototype Submersible, Wrist-Type, Magnetic Compasses; report on

Ref: (a) BuShips ltr S-F011-05-04 Ser 665-43 of 1 Feb 1965

Encl: (1) Radiological Safety Evaluation of Submersible ^{147}Pm Activated Wrist-Type Compasses (2 copies)

1. In accordance with reference (a) enclosure (1) is forwarded.

2. It is recognized that the silicon filled compass was superior, followed by the free filling, and then the varsol. The silicon filled compass was deemed superior, not only on the basis of the minimal leakage, but also on the merit of separate containment from the environment.

3. In addition, it is recommended that more marking is necessary to meet AEC requirements and handling and storage of the compasses should still be controlled.

4. The problem of alpha contamination was presented and an attempt is being made to investigate this containinant by the use of an alpha spectrometer. Additional time will be required to make this determination and this information should be available by the end of March.

D. C. CAMPBELL

Copy to: (w/encl)
BUSHIPS (Code 682C)

INFORMATION COPY
OFFICIAL COPY TO CODE 665

Radiological Safety Evaluation of Submersible ^{147}Pm Activated Wrist-Type Compasses

1. Six magnetic, unmounted, submersible wrist-type compasses (Mark 1, Model 1) activated with 15.5 mc ^{147}Pm were received for radiological health hazard evaluations.

After receipt each of the compasses were arbitrarily designated with a number. The contents of the compass solution and the numbered compasses are as follows:

1. Varsol
2. Varsol
3. None (free filling)
4. None (free filling)
5. Silicon
6. Varsol

2. Radiation Measurement

Dose rates readings were taken with AN/PDR-27 and photodosimetry film technique. The average dose rates at contact presented by the compasses are as follows:

Top : 0.97 mr/hr
Side : 0.24 mr/hr
Bottom: 0.45 mr/hr

Gamma spectral measurements were taken of the intact compass and the analysis shows an energy range of 30-55 Kev.

3. Contamination Test

A. Test Method

Direct counting was performed whenever possible. Wipes were taken whenever the ^{147}Pm coating would interfere with direct counting. Wipes for alpha and beta-gamma contamination were performed, using dry #1 Whatman filter paper with a diameter of 1-5/8". Each wipe was taken with medium firm pressure once over the area of interest.

The alpha counting system consisted of a scintillation type detector and laboratory scaler at ^{239}Pu counting efficiency of 25%. All counts were of 10 minutes duration with a 0.7 c/m background.

The beta-gamma radiation was counted in an end window GM coupled to a laboratory type scaler. The counting system consistantly gave 27± 3 c/m background and about 10% efficiency for a 204 Tl standard. All samples were counted for 10 minutes.

B. Presubmergence Test

Three separate wipes were taken over the outside of the compasses before the submergence test. The result of the wipes are given in Table 1.

Table 1
Presubmergence Wipe Test

No.	Position	d/m^{α}	$d/m/cm^2$	d/m^{β}	$d/m/cm^2$
1	Top	NDA*	NDA	NDA	NDA
	Side	NDA	NDA	42.2	1.13
	Bottom	NDA	NDA	NDA	NDA
	Total d/m	NDA		42.2	
2	Top	NDA	NDA	NDA	NDA
	Side	NDA	NDA	NDA	NDA
	Bottom	NDA	NDA	NDA	NDA
	Total d/m	NDA		NDA	
3	Top	NDA	NDA	NDA	NDA
	Side	NDA	NDA	NDA	NDA
	Bottom	NDA	NDA	NDA	NDA
	Total d/m	NDA		NDA	
4	Top	NDA	NDA	NDA	NDA
	Side	NDA	NDA	NDA	NDA
	Bottom	NDA	NDA	NDA	NDA
	Total d/m	NDA		NDA	

*No detectable activity.

Table 1 (Continued)

No.	Position	α d/m	α d/m/cm²	β d/m	β d/m/cm²
5	Top	NDA	NDA	NDA	NDA
	Side	NDA	NDA	NDA	NDA
	Bottom	NDA	NDA	NDA	NDA
	Total d/m	NDA		NDA	
6	Top	NDA	NDA	NDA	NDA
	Side	NDA	NDA	NDA	NDA
	Bottom	NDA	NDA	NDA	NDA
	Total d/m	NDA		NDA	

C. Submergence Test

Each compass was placed in a separate container and distilled water was added to the container sufficiently to cover the compass. The compasses were then subjected to 178 psig for eight hours.

Upon retrieval of the compasses liquid bubbles were noted in some of the distilled water. Subsequent visual examination showed that three compass windows fractured during the submergence test. The broken compasses were numbered 1, 2, and 6, all of which were filled with varsol.

D. Post Submergence Test

After the submergence each compass was removed from its container and air dryed on separate 4 inch Whatman paper. The Whatman paper was counted and recorded in Table II.

Table II
Whatman Filter Paper

No.	α d/m	β d/m
1	NDA	1255
2	NDA	NDA
3	NDA	NDA
4	NDA	NDA
5	NDA	NDA
6	109	25300
BLANK	NDA	NDA

Distilled water in which the compasses were immersed was filtered through two filters, a prefilter with a pore size of 10 microns; and a fine (membrane) filter with a pore size of 0.45 microns.* The results of counting the filtered suspenses solids is given in Table III. The filtrate solution was evaporated and counted, recorded, and presented as Table IV. The silicon compass liquid from No. 5 was extracted from the bowl and noted as 5B in Table IV.

Wipes were taken of the outside of the compasses, similar in manner to the presubmergence test; and wipes were taken of the bottom course ring, top surface of the compass card, the bottom surface of the card, and the bowl. The results of these wipes are tabulated on Table V.

Table III
Filtered Suspended Solids

No.	Type of Filters	α d/m	β d/m
1	Prefilter	NDA	79.4
	Fine Filter	NDA	NDA
Total d/m		NDA	79.4
2	Prefilter	NDA	216.
	Fine Filter	NDA	NDA
Total d/m		NDA	216
3	Prefilter	NDA	45.1
	Fine Filter	NDA	NDA
Total d/m		NDA	45.1
4	Prefilter	NDA	45.1
	Fine Filter	NDA	NDA
Total d/m		NDA	45.1
5	Prefilter	NDA	53.3
	Fine Filter	NDA	NDA
Total d/m		NDA	53.3
6	Prefilter	311.	84500
	Fine Filter	NDA	NDA
Total d/m		311	84500
BLANK	Prefilter	NDA	NDA
	Fine Filter	NDA	NDA
Total d/m		NDA	NDA

*Gelman Filter Type XM-10, AM-6.

Table IV

Immersion Liquid

No.	α d/m	β d/m
1	NDA	42.8
2	NDA	NDA
3	NDA	NDA
4	7.43	NDA
5	NDA	NDA
5B*	NDA	NDA
6	10.3	NDA

*Liquid removed from compass bowl.

Table V

Post Submergence Wipe Test

Compass No.	Place Wiped	α d/m	α d/m/cm^2	β d/m	β d/m/cm^2
1	Top	20.8	1.18	2050	116
	Side	NDA	-	NDA	-
	Bottom	NDA	-	NDA	-
	Bottom Ring Cover	64.5	5.38	3080	257
	Compass Card Top	NDA	-	NDA	-
	Compass Card Bottom	56.3	70.9	4430	558
	Inside Bowl	465.	182	9030	354
	Total d/m	606.6		1859	
2	Top	NDA	-	NDA	-
	Side	NDA	-	NDA	-
	Bottom	NDA	-	NDA	-
	Bottom Course Ring Cover	NDA	-	50	6.30
	Compass Card Top	NDA	-	NDA	-
	Compass Card Bottom	NDA	-	114	14.4
	Inside Bowl	NDA	-	NDA	-
	Total d/m	NDA		164	
3	Top	NDA	-	NDA	-
	Sides	NDA	-	NDA	-
	Bottom	NDA	-	NDA	-
	Bottom Course Ring Cover	NDA	-	27.5	2.29
	Compass Card-Top	NDA	-	490	61.7
	Compass Card-Bottom	5.5	0.69	NDA	-
	Inside Bowl	NDA	-	NDA	-
	Total d/m	5.5		517.5	

Table V (Continued)

Compass No.	Place Wiped	α d/m	α d/m/cm^2	β d/m	β d/m/cm^2
4	Top	NDA	-	NDA	-
	Sides	NDA	-	NDA	-
	Bottom	NDA	-	NDA	-
Bottom Course Ring Cover		NDA	-	NDA	-
Compass Card-Top		NDA	-	50.8	6.40
Compass Card-Bottom		NDA	-	266	33.5
Inside Bowl		NDA	-	NDA	-
Total d/m		NDA		316.8	
5	Top	NDA	-	NDA	-
	Sides	NDA	-	NDA	-
	Bottom	8.7	0.49	NDA	-
Bottom Course Ring-Cover		NDA	-	NDA	-
Compass Card-Top		NDA	-	NDA	-
Compass Card Bottom		NDA	-	NDA	-
Inside Bowl		NDA	-	31.0	1.21
Total d/m		8.7		31.0	
6	Top	149	8.46	57000	324
	Side	548	14.5	17000	451
	Bottom	NDA	-	NDA	-
Bottom Course Ring Cover		303	25.2	6520	543
Compass Card-Top		390	49.1	12000	1512
Compass Card-Bottom		NDA	-	NDA	-
Inside Bowl		25.7	1.0	3200	125
Total d/m		1415.7		95720	

Table VI

Summary of All Tests

Test \ Compass No.	1		2		3		4		5		6	
	α d/m	β d/m	α d/m	β d/m	α d/m	β d/m	α d/m	β d/m	α d/m	β d/m	α d/m	β d/m
Presubmerge Wipe	NDA	42.2	NDA	NDA	NDA	NDA	NDA	NDA	NDA	NDA	NDA	NDA
Whatman Drying Paper	NDA	1255	NDA	NDA	NDA	NDA	NDA	NDA	NDA	NDA	109	25300
Filtered Suspended Solids	NDA	79.4	NDA	216	NDA	45.1	NDA	45.1	NDA	53.3	311	84500
Filtered Immersion Liquid	NDA	42.8	NDA	NDA	NDA	NDA	7.43	NDA	NDA	NDA	10.3	NDA
Post-submergence Wipe	606.6	1859	NDA	164	5.5	517.5	NDA	316.8	8.7	31.0	1415.7	95720
TOTAL	606.6	3278.4	NDA	370.	5.5	562.6	7.43	351.9	8.7	84.3	1846.0	205520

E. Test Summary

Table VI is a compilation of the above tests to show the total amount of activity detected. It is noted that the amount of activity detected is not an expression of the total amount of activity leaked or displaced from the radioactive components, since wipe testing is not a qualitative measure.

Listed on Table VII are the compasses in the order of detectable beta activity in microcuries.

Table VII

Observed Detectable Activity

Compass No.	Bowl Liquid	Beta Microcuries
6	Varsol	0.0926
1	Varsol	0.00148
3	Free Filling	0.000253
2	Varsol	0.000167
4	Free Filling	0.000159
5	Silicon	0.0000380

4. Discussion and Conclusions

Radiation profile as measured showed dose rates in the order of 1 mr/hr on the top, 0.25 mr/hr at the sides, and 0.5 mr/hr on the bottom.

Leakage of the radioactive material was an area of concern. To accomplish this check direct counting, when possible, or wipes were taken and then counted.

Leakage detection examinations showed that the compasses were essentially free of contamination before the submergence test. During the pressure test, the window of the varsol filled compasses broke. Why these compass windows broke is unknown, since all the compasses were pressurized at the same time.

After the submergence test it is seen that leakage of the radioactivity had taken place. The amount of alpha detected ranges from 0. d/m to 1800 d/m and the amount of beta activity ranges from 84 d/m to 2.06×10^5 d/m.

Although these compasses exhibited a leakage of the radioactive components, it is noted that the most restrictive body burden of ^{147}Pm is 60 µc. The 2.055×10^5 d/m detected is only $\frac{1}{1500}$ of this 60 µc. In addition, that portion which was transportable onto a water medium was greater than 10 microns in particle size, as shown by the fact that the prefilter removed all suspended solids. In other words, the ^{147}Pm in these microspheres was found to be not readily soluble in water, and would not present a severe body uptake problem if ingested.

The presence of significant alpha particles is an interesting problem. The source of the alpha emitter is not known, but may be due to one of the three postulates:

1. ^{147}Sm, which is the daughter of ^{147}Pm, is an alpha emitter. However, with 2.6 years ^{147}Pm and 1.3×10^{11} years ^{147}Sm, the possibility of counting ^{147}Sm alphas is very unlikely. In fact, if half of the 15.5 mc of ^{147}Pm had decayed to ^{147}Sm, there would only be a total of 43 α/m.

2. Radium could be the source of alpha emission, if these compasses were originally activated with radium.

3. ^{147}Pm contaminant is a possibility. ORNL catalogue listed 2500 c/m alpha per millicure of ^{147}Pm. This alpha emitter is identified as transuranic elements and difficult to separate from Pm. If this be the case, however, the detection of alpha should be insignificant if the ^{147}Pm microspheres were completely coated with an outer layer of ceramic.

5. <u>Recommendations</u>

1. On the basis of these tests, it may be noted that the silicon filled compass is superior, followed by the free filling, and then the varsol. The silicon filled compass is judged superior not only because it showed a minimal leakage of radioactivity, but also because the silicon filled compass has a definite barrier to the environment. This would make the radioactive material doubly sealed.

2. It is questioned whether all the proper AEC markings are present on the compass. Unless a different agreement has been reached with

the AEC, the following additional marking would be necessary.[1]

Caution - Radioactive Material (Radiation Symbol)

Radioisotope ^{147}Pm

Quantity 15.5 mc

Date _____

3. Storage and handling of ^{147}Pm activated compasses should pose only a minimal dose rate problem, due to the low energy of the emitted radiation. As previously recommended the stock area can be monitored to determine the dose rate in a work area. Contamination control practices (i.e., gloves, etc.) as recommended for radium activated compass storage areas, with the exception of the continuous ventilation requirement, should be continued.[2]

(1) Title 10, Code of Federal Regulations, Chapter 1, Part 20.203f.

(2) NRDL ltr 730-55 EJL:ams of 20 Feb 1957 to BuShips (Code 565H).

P-38-13

1. Reports of wipe tests
2. Reports of Present Location

Receipt - 10 wrist - 5 Boat
Transfer
Disposal - 1 Boat
Loss - 2 wrist

Boat Pm-147
2 - N.A.S.L.
2 - Bureau

Pm-147
6 - N.R.D.L.
2 - Bureau.

H-3
3 Wrist Compasses

10330/1
Ser 682C-340

15 MAR 1965

From: Chief, Bureau of Ships
To: Chief, Isotopes Branch
Division of Materials Licensing
U. S. Atomic Energy Commission
Washington, D. C. 20545

Subj: Application For Amendment To AEC Byproduct Material License No. 8-38-13

Ref: (a) Title 10, Code of Federal Regulations, Part 30, Section 30.36

1. Pursuant to reference (a), this is an application to amend license No. 8-38-13 to add 450 millicuries of Hydrogen-3 to be used in three wrist compasses, with no single compass to contain more than 150 millicuries of Hydrogen-3.

Copy to:
Code 665H(Michalek)

R. D. CLUBB
By direction

Am #8
of 30 March 1965

MCCRACKEN/mitchell
61457 - 3/12/65

This Copy is For Your Fi[illegible]

U. S. ATOMIC ENERGY COMMISSIO[illegible]
[illegible]YPRODUCT MATERIAL LICEN[illegible]

U-40-65

8-38-13 (A67)

AMENDMENT NO. 7

Pursuant to the Atomic Energy Act of 1954 and Title 10, Code of Federal Regulations, Chapter 1, Part 30, Licensing of Byproduct Material, and in reliance on statements and representations heretofore made by the licensee, a license is hereby issued authorizing the licensee to receive, acquire, own, possess, transfer and import byproduct material listed below, and to use such byproduct material for the purpose(s) and at the place(s) designated below. This license shall be deemed to contain the conditions specified in Section 183 of the Atomic Energy Act of 1954, and is subject to all applicable rules, regulations, and orders of the Atomic Energy Commission now or hereafter in effect and to any conditions specified below.

Licensee	
1. Name	Department of the Navy
2. Address	Bureau of Ships Washington, D. C. 20360
3. License number	In accordance with application submitted December 16, 1964, 8-38-13 is amended in its entirety to read as follows:
4. Expiration date	January 31, 1967
5. Reference No.	

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
A. Promethium 147	A. Ceramic microspheres contained in submersible wrist compasses	A. 310 millicuries in 10 compasses containing 31 millicuries each

(See Page 2)

9. Authorized use

A. Evaluation of prototype submersible wrist compasses.

CONDITIONS

0. Unless otherwise specified, the authorized place of use is the licensee's address stated in Item 2 above:

1. Byproduct material shall be used and stored only at Main Navy Building, Washington, D. C.; U. S. Naval Weapons Plant, Washington, D. C.; U. S. Naval Radiological Defense Laboratory, San Francisco, California; U. S. Naval Applied Science Laboratory, New York, New York.

2. The licensee shall comply with the provisions of Title 10, Part 20, Code of Federal Regulations, Chapter 1, "Standards for Protection Against Radiation."

. Byproduct material shall be used by, or under the supervision of, the radiological safety officer at each activity specified in Condition No. 11.

. Sealed sources containing byproduct material shall not be opened.

(See Page 2)

FORM AEC-374B (10-61)

U. S. ATOMIC ENERGY COMMISSION

MATERIAL LICENSE

Supplementary Sheet

License Number 8-38-13 (A67)

Continued From Page 1

AMENDMENT NO. 7

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
B. Promethium 147	B. Ceramic microspheres contained in magnetic boat compasses	B. 129 millicuries in 10 compasses containing 25.8 millicuries each
C. Promethium 147	C. Promethium activated luminous paint contained in watches	C. 16 millicuries in 10 watches containing 4 millicuries each

9. Authorized Use

B. Evaluation of prototype magnetic boat compasses.
C. Evaluation of prototype magnetic submersible wrist watches.

CONDITIONS

15. A. Each sealed source containing byproduct material, other than Hydrogen 3, with a half-life greater than thirty days and in any form other than gas shall be tested for leakage and/or contamination at intervals not to exceed six months. In the absence of a certificate from a transferor indicating that a test has been made within six months prior to the transfer, the sealed source shall not be put into use until tested.

B. The test shall be capable of detecting the presence of 0.005 microcurie of radioactive material on the test sample. The test sample shall be taken from the sealed source or from the surfaces of the device in which the sealed source is permanently mounted or stored on which one might expect contamination to accumulate. Records of leak test results shall be kept in units of microcuries and maintained for inspection by the Commission.

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 5 days of the test with the Director, Division of Materials Licensing, U. S. Atomic Energy Commission, Washington, D. C., 20545, 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 I, Division of Compliance, USAEC, 376 Hudson Street, New York, New York, 10014.

(See Page 3)

FORM AEC-374A
(12-57)

U. S. ATOMIC ENERGY COMMISSION
PRODUCT MATERIAL LICE
Supplementary Sheet

License Number 8-38-13
(A67)

AMENDMENT NO. 7

Continued from Page 2:

CONDITIONS

16. Except as specifically provided otherwise by this license, the licensee shall possess and use byproduct material described in Items 6, 7, and 8 of this license in accordance with statements, representations, and procedures contained in application submitted December 16, 1964.

For the U. S. Atomic Energy Commission

Nathan Barsin

by Isotopes Branch
Division of Materials Licensing
~~Division of Licensing and Regulation~~
Washington 25, D. C. 20545

Date JAN 21 1965

10330/1
Ser 6820-981

8-38-13

16 DEC 1964

From: Chief, Bureau of Ships
To: Chief, Isotopes Branch
Division of Materials Licensing
U. S. Atomic Energy Commission
Washington, D. C. 20545

Subj: Application for renewal of AEC Byproduct Material License 8-38-13

Ref: (a) Application for renewal of AEC Byproduct Material License 8-38-13 dated 13 Nov 1964

Encl: (1) Three copies of application for renewal of AEC Byproduct Material License 8-38-13

1. Enclosure (1) is hereby submitted and reference (a) is withdrawn.

2. The training and experience listed in Items 8 and 9 of enclosure (1) are that of James J. McCracken. The training and experience of other users appears in application for Byproduct Material Licenses 8-3179-2 (Industrial Manager, Potomac River Naval Command), 4-487-3 (Naval Radiological Defense Laboratory) and 31-9672-4 (Naval Applied Science Laboratory).

R. D. CLUBB
By direction

Copy to:
BUMED (Code 74)
665J

Amendment #7
Dated 21 Jan. 1965
Copy to 665J

J.J.MC CRACKEN, 61457; S.Neiberger, 12-16-64

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.)

Chief, Bureau of Ships
Department of the Navy
Washington, D. C.

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

Main Navy Bldg., Washington, D. C.
U.S. Naval Weapons Plant, Washington, D. C.
U.S. Naval Radiological Defense Laboratory
U.S. Naval Applied Science Laboratory

2. DEPARTMENT TO USE BYPRODUCT MATERIAL

Department of the Navy

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

S-33-13

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.)

James J. McCracken and individuals names on other AEC Byproduct Material Licenses

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.)

James J. McCracken

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

Pm-147
Pm-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.)

A. Ceramic microspheres 10 units of 15.7mc each
B. Ceramic microspheres 4 units of 25.6mc each

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. Evaluation of prototype submersible wrist compasses
B. Evaluation of prototype magnetic boat compasses

(Continued on reverse side)

Form AEC-313 (5-58) (Use supplemental sheets if necessary)

TRAINING AND EXPERIENCE OF EACH INDIVIDUAL NAMED IN ITEM 4

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	Radioactive Materials Section Bureau of Ships	12 mos.	Yes No	Yes No
b. Radioactivity measurement standardization and monitoring techniques and instruments	Department of Nuclear Engineering Catholic University	200 hrs.	Yes No	Yes No
c. Mathematics and calculations basic to the use and measurement of radioactivity	A.B., Physics, Catholic Univ., 1963	4 yrs.	Yes No	Yes No
d. Biological effects of radiation	Atomic Warfare Section Bureau of Ships	6 mos.	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
Sealed sources	1 mc	Catholic University	60 hrs.	Laboratory Experimentation
Cs-137	120 C	National Bureau of Standards	40 hrs.	Training

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/cm²)	USE (Monitoring, surveying, measuring)
Victoreen EP-271	1	Beta - Gamma	0 - 500	3 - 4	Monitoring surveying

11. METHOD, FREQUENCY, AND STANDARDS USED IN CALIBRATING INSTRUMENTS LISTED ABOVE.
Instrument calibrated by Radiac Repair Facility, PRNC, Washington, D. C., at intervals not to exceed six months.

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

INFORMATION TO BE SUBMITTED ON ADDITIONAL SHEETS

13. FACILITIES AND EQUIPMENT. Describe laboratory facilities and remote handling equipment, storage containers, shielding, fume hoods, etc. Explanatory sketch of facility is attached. (Circle answer) Yes No See AEC D.M.L. # 6-3179-2, 4-487-3, 31-9672-4

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. Leak tests will be performed at intervals not to exceed six months. The Radiation Protection Officer shall be responsible for material.

15. WASTE DISPOSAL. If a commercial waste disposal service is employed, specify name of company. Otherwise, submit detailed description of methods which will be used for disposing of radioactive wastes and estimates of the type and amount of activity involved. See AEC D.M.L. # 4-487-3, 31-9672-4, 6-3179-2

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.

Applicant named in item 1

By: _____

Date _____

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.

U.S. ATOMIC ENERGY COMMISSION
BYPRODUCT MATERIAL LICENSE

[illegible] Title 10, Code of Federal Regulations, Chapter 1, Part 30, [illegible] statements and representations heretofore made by the licensee, [illegible] licensee to receive, acquire, own, possess, transfer and import byproduct [illegible] for the purpose(s) and at the place(s) designated below [illegible] conditions specified in Section 183 of the Atomic Energy Act of 1954, [illegible] regulations, and orders of the Atomic Energy Commission now or hereafter in effect and to any conditions specified below.

Licensee			
1. Name	Department of the Navy	3. License number	8-38-13 (A62)
2. Address	Bureau of Ships Washington 25, D.C.	4. Expiration date	January 31, 1962
		5. Reference No.	

6. Byproduct material (element and mass number)	7. Chemical and/or physical form	8. Maximum amount of radioactivity which licensee may posses at any one time
A. Promethium-147	A. Ceramic microspheres	A. 310 millicuries contained in 10 units of 31 millicuries each.

(See page 2)

9. Authorized use:

A. Evaluation of ceramic microspheres used in luminous markings on prototype submersible wrist compass.

(See page 2)

CONDITIONS

10. Unless otherwise specified the authorized place of use is the licensee's address stated in item 2 above.

11. Byproduct material may also be used at various Naval activities.

12. The licensee shall comply with the provisions of Title 10, Part 20, Code of Federal Regulations, Chapter 1, "Standards for Protection Against Radiation".

13. Byproduct materials shall be used by, or under the supervision of, the radiological safety officer at each Naval activity.

14. Byproduct material as sealed sources shall not be opened.

(See page 2)

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

License Number 8-38-13 (A62)

CONTINUED

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
B. Promethium 147	B. Ceramic Microspheres	B. 100 millicuries contained in 5 units of 20 millicuries each.
C. Promethium 147	C. Ceramic Microspheres	C. 40 millicuries contained in 2 units of 20 millicuries each.

9. Authorized use

B. Evaluation of ceramic microspheres used in luminous markings on prototype magnetic boat compasses.

C. Evaluation of ceramic microspheres used in luminous markings on prototype mechanical clocks.

CONDITIONS

15. A. Each sealed source containing Promethium 147 shall be tested for leakage and/or contamination at intervals not to exceed 6 months. In the absence of a certificate from a transferor indicating that a test has been made within 6 months prior to the transfer, the sealed source shall not be put into use until tested.

B. The test shall be capable of detecting the presence of 0.005 microcurie of removable contamination on the test sample. The test sample shall be taken from the sealed source or from appropriate accessible surfaces of the device in which the sealed source is permanently or semipermanently mounted or stored. Records of leak test results shall be kept in units of microcuries and maintained for inspection by the Commission.

C. If the test reveals the presence of 0.005 microcuries 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 5 days of the test with 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 be sent to the manager of the nearest AEC operations office listed in Appendix D of Title 10, Code of Federal Regulations, Part 20.

D. Sealed sources shall be tested for leakage and/or contamination. (See page 3)

U.S. ATOMIC ENERGY COMMISSION
SUPPLEMENTARY LICENSE

License Number 8-38-13
(A62)

CONTINUED:

CONDITIONS

16. Except as otherwise specifically provided for in the license, the licensee shall possess and use byproduct material described in Items 6, 7 and 8 of this license in accordance with statements, representations, and procedures contained in his application dated December 21, 1960.

For the U. S. Atomic Energy Commission

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

Date January 10, 1961