

UNITED STATES ATOMIC ENERGY COMMISSION
APPLICATION FOR BYPRODUCT MATERIAL LICENSE

INSTRUCTIONS—Complete items 1 through 16 if this is an initial application or an application for renewal of a license. Information contained in previous applications filed with the Commission with respect to items 8 through 15 may be incorporated by reference provided references are clear and specific. Use supplemental sheets where necessary. Item 16 must be completed on all applications. Mail two copies to: U.S. Atomic Energy Commission, Washington, D.C., 20545, Attention: Materials Branch, Directorate of Licensing. 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, and the license fee provisions of Title 10, Code of Federal Regulations, Part 170. The license fee category should be stated in item 16 and the appropriate fee enclosed. (See Note in Instruction Sheet).

1. (a) NAME AND STREET ADDRESS OF APPLICANT. (Institution, firm, hospital person, etc. Include ZIP Code and telephone number.) (b) STREET ADDRESS(ES) AT WHICH BYPRODUCT MATERIAL WILL BE USED. (If different from 1(a), include ZIP Code.)

HAMILTON WATCH COMPANY, INC.
941 Wheatland Avenue
Lancaster, Pa. 17604

SAME

2. DEPARTMENT TO USE BYPRODUCT MATERIAL

ASSEMBLY AREA

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

37-03572-6

License #37-03572-02E

Refer to Supplement #3

4. INDIVIDUAL USER(S). (Name and title of individual(s) who will use or directly supervise use of byproduct material. Give training and experience in items 8 and 9.)

Bernard Cattin, V.P. Director of
Operations
Park McKinney, Production Manager
Olivier Barrelet, Research and
Development Manager

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.)

Olivier Barrelet

Refer to Supplement #5

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

Tritium
(Hydrogen 3)

- (b) CHEMICAL AND/OR PHYSICAL FORM AND MAXIMUM NUMBER OF MILLICURIES OF EACH CHEMICAL AND/OR PHYSICAL FORM THAT YOU WILL POSSESS AT ANY ONE TIME. (If sealed source(s), also state name of manufacturer, model number, number of sources and maximum activity per source.)

Tritium as a gas in sealed borosilicate glass sources manufactured by American Atomics Corporation (M/N 60307), 60297 up to 6,290 Ci/³H at any one time (no single source to contain more than 100 mCi/³H).

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Time 2:00 PM
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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.)

Tritium filled tubes to be placed behind a liquid crystal display within a digital watch, permitting reading of time in low ambient light. For sale and distribution of Hamilton Watch to persons as authorized by Sec. 32.22, 10 CFR 32. HAMILTON LCD watches will be manufactured under California Radioactive Material.

8512050445 851024
REG1 LIC30
37-03572-06 PDR

"OFFICIAL RECORD COPY"

ML10

Applicant.....
Check No. 24252 89127
Amount \$2000-3A
Date of Check 8-5-77
Date Check Rec'd 8-8-77
Received By WLS

(Continued on reverse side)

Aug 77 P-9

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	AMERICAN ATOMICS		<input checked="" type="radio"/> Yes <input type="radio"/> No	<input checked="" type="radio"/> Yes <input type="radio"/> No
b. Radioactivity measurement standardization and monitoring techniques and instruments	Training with Radiologic monitor equipment		<input checked="" type="radio"/> Yes <input type="radio"/> No	<input type="radio"/> Yes <input type="radio"/> No
c. Mathematics and calculations basic to the use and measurement of radioactivity			<input checked="" type="radio"/> Yes <input type="radio"/> No	<input type="radio"/> Yes <input type="radio"/> No
d. Biological effects of radiation			<input checked="" type="radio"/> Yes <input type="radio"/> No	<input type="radio"/> Yes <input type="radio"/> 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
^3H		AMERICAN ATOMICS CORP. SUNCRUX	COURSE ON THE JOB	Handling ^3H

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)
Tritium air monitor (Overhoff & Assoc.) Betatec Mod. 210	1	Tritium	5 $\mu\text{Ci}/\text{m}^3$ to 2000 $\mu\text{Ci}/\text{meters}$		SURVEY

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

REFER TO SUPPLEMENT # 11

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

REFER TO SUPPLEMENT # 12

INFORMATION TO BE SUBMITTED ON ADDITIONAL SHEETS IN DUPLICATE

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

REFER TO SUPPLEMENT # 13

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.

REFER TO SUPPLEMENT # 14

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.

AMERICAN ATOMICS CORP. REF. #15

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.

License Fee Category \$ 510.00

Fee Enclosed \$ 510.00

HAMILTON WATCH CO., INC.

Applicant named in item 1

By:

Olivier D. Barrelet
Manager, Research & Development

Title of certifying official

Date July 29, 1977

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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.

HAMILTON WATCH CO., INC.

LANCASTER, PENNSYLVANIA 17604, U S A. (717) 394 7161

SUPPLEMENT TO ATOMIC ENERGY COMMISSION FORM 313

SUPPLEMENT SECTION 3

This license is in reference to license 37-035-72-02E, 37-03572-6 for the use of Tritium.

SUPPLEMENT SECTION 5

Olivier D. Barrelet had former training by American Atomics Corporation in Tritium and sealed Tritium Luminous Sources and has studied documents related to Tritium and had training with Radiologic Monitors with Overhoff and Associates.

SUPPLEMENT SECTION 11

Betatec Model 210 is calibrated in accordance with instruction supplied by Overhoff and Associates.

SUPPLEMENT SECTION 12

All employees or individuals working in or frequenting a portion of a controlled area will be informed as to the presence of sources of radiation. The persons involved in these areas will be instructed in safety problems associated therewith and in precautions or procedures to minimize exposure for their protection. Every individual working in or frequenting the controlled area will be required to supply a urine sample on a regular basis.

If an individual is known to or suspected to have received an exposure to tritium gas exceeding permissible values, he will be removed from the working area and an immediate bio-assay performed.

SUPPLEMENT SECTION 13

The handling of tritium luminous sources will be performed with a Tritium Safe Hood. Each hood will exhaust a minimum of 200 CFM and is monitored by a Tritium Air Monitor.

SUPPLEMENT SECTION 14

The Radiation Protection Program at Hamilton will be based on use of a tritium air monitor (BETATEC Mod. 120). Receiving stores and assembly areas are monitored and have safe hoods for assembly and inspection. All parts containing tritium sources will be stored in cabinets that are exhausted and monitored.

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Leak tests will be made in accordance with 32.110 (b) (8). Liquid scintillation counting will be done by American Atomics Corporation or by an approved testing laboratory.

SUPPLEMENT SECTION 15

Waste source material will be returned to American Atomics Corporation or other authorized disposal agent.

This request will reference our initial application dated January 26, 1977, for Research and Development License.



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SUMMARY

1. The description of the product and its intended use.
2. Type and quantity of by-product materials.
3. Chemical and Physical Form.
4. Solubility in water and body fluids of the forms of the by-product material.
5. Maximum External Radiation.
6. Degree of Access.
7. Details of construction and design.
8. Total quantity of by-product material expected to be distributed in the product annually.
9. Expected life of the product.
10. Method of Labeling.
11. Procedures for prototype testing.
12. Results of prototype tests.
13. List of Part Numbers.
14. External Radiation Dosage and Dose Commitments.
 - 14.1. Individual User.
 - 14.2. Dose Commitment, Inhalation and Absorption of T_2O .
 - 14.3. Skin Dosage T_2 .
15. Distribution, Handling and Storage.
 - 15.1. Dose Commitment, Inhalation and Absorption of T_2O .
 - 15.2. Skin Dosage T_2 .
16. Retail Sales.
 - 16.1. Dose Commitment, Inhalation and Absorption of T_2O .
 - 16.2. Skin Dosage T_2 .

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17. Effectiveness of Containment.
18. Disposal.
19. Dose Probabilities.
 - 19.1. Individual User.
 - 19.2. Dose Commitment, Inhalation T_2O and Absorption.
 - 19.3. Skin Dosage T_2 .
20. Handling and Storage of Quantities of Watches.
 - 20.1. Dosage Commitment, Inhalation and Absorption T_2O .
 - 20.2. Skin Dosage T_2 .
21. Quality Control procedures to be followed.
22. Receiving and Stores.
23. Module Repair.
24. List of Photographs.
25. List of Prints.



HAMILTON WATCH CO., INC.

LANCASTER, PENNSYLVANIA 17604, U.S.A. (717) 394-7161

July 29, 1977

SUBJECT: Information Required per Sec. 32.22 for Use Under 30.19, 10 CFR 30.

1. The description of the product and its intended use.

The Hamilton Watch part number, see Point 13, are multifunction liquid crystal display (LCD) digital watches. The time is continuously displayed and may be viewed in high ambient light or in the dark without the need to depress a button. This leaves the user's both hands free for such required things as driving.

Each cased liquid crystal display module contains two gaseous tritium light sources, (GLTS) having a maximum tritium content of 100 mci, or one tritium luminous glass source having a maximum tritium content of 200 mci. The gaseous glass source will be placed in a metal tray per American Atomic drawing 60307, 60297, as shown in Photograph 6. This is used for the illumination of the display. (See Photograph 1).

The 24 mm module consists of three basic parts:

- 1.1. The clamp (made of a high temperature blue nylon) that retains the display, polarizers, translector, connector and source holder (GTLD). (Photograph 5,7,8).
- 1.2. The Printed Circuit Board that contains the encapsulated integrated circuit and associated electronic components. (Photograph 11,12).
- 1.3. The backplate (made of stainless steel) holds the four threaded stand-offs that hold the printed circuit board and nest together by four screws. (See Photographs 9,10).

2. Type and quantity of by-product materials.

Each watch module will contain a gaseous tritium light device (GTLD) that carries one or two gaseous tritium light sources (GTLS). Each GTLS, Liquid Crystal Display, LCQ I and LCQ II module has a maximum of 100 mCi/³H or a total maximum of 200 mCi³H per watch module.

3. Chemical and Physical Form.

The tritium is obtained having a catalog purity of 99+% as elemental tritium. During the manufacturing process, every care is taken by the manufacturer to insure that the tritium oxide is present at the lowest possible level. The tritium has a half life of 12.3 years resulting in decay product Helium³. No other changes should occur in the light source (GTLS).



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4. Solubility in water and body fluids of the forms of the by-product material.

Elemental tritium gas has a solubility in water and body fluids similar to that of Hydrogen. Tritium Oxide has been found to be readily absorbed in water and body fluids as noted in ICRP Committee II Report.

5. Maximum External Radiation.

The maximum energy of the tritium beta radiation is 18 KEV which is absorbed within the glass wall of the tritium luminous source (GTLS). Therefore, there is no significant external radiation at 5 cm from any surface of the watch module as measured by an ion chamber. Further shielding is provided by the addition of the case.

6. Degree of Access.

The watch cases for use with Suncrux module are all designed to prevent access to the tritium luminous source. The module is held in the case by a tight interference fit rendering removal without special tools very difficult. The case backs used will be either snap backs or screw backs and may or may not have battery hatches. However, removal of the case back to replace the battery (should no battery hatch be present) should only have to be done every two years. Back removal by anyone other than a jeweler or authorized Hamilton Watch Co. service personnel is unlikely. Even upon removal of the case back, the interference fit of the module in the case makes removal very difficult. Should the module sub-assembly be removed from the case, further disassembly is unlikely as described in Section 7.

Similar to cases used with our presently used modules, it is not possible to remove the watch crystal with the module subassembly in place. Should the crystal be removed or broken, it is not possible to remove the module through the crystal opening.

7. Details of construction and design.

The Liquid Crystal Display module LCQ I and LCQ II, containing a tritium light source has been designed to safely nest the source panel (GTLS) within a nylon carrier and a stainless steel backplate. The two tritium tubes (ref. 60307, 60297) are supplied to Suncrux bonded into a plastic source holder (see Photographs 5,6,7). The supplier (American Atomics Corporation, Tucson, Arizona) mounts



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the matched tritium light sources into the source holder with a silicon RTV adhesive. Each batch will be accompanied by a certificate of compliance with a radiation test report.

The source holder then is assembled into the nest (see Photographs 7, 8 and Dwg. SK 71177), along with the display and connectors. The circuit board is held in place between the nest and backplate with four threaded stand-offs and screws, one battery is placed into the module and held in place by a battery clip, completing the module. The module is shipped to Hamilton for incoming inspection and casing. The back is attached to the case. A specially designed tool is required to remove the watch back for battery replacement. (Photograph 19).

8. Total quantity of by-product material expected to be distributed in the product annually.

Hamilton Watch Company expects that it will distribute a maximum of 20,000 LCD watches with tritium illumination per calendar year. At 200 mCi per watch, a maximum of 4000 Ci of tritium will be distributed.

9. Expected life of the product.

The expected life of the watch is 8-10 years.

10. Method of Labeling.

The back of the watch case will be marked with the symbol (^3H) and the name of the watch company supplying to the general public.

11. Procedures for prototype testing.

Five complete prototypes, each of LCQ I and LCQ II watches were submitted to performance test to American Atomics Corporation.

12. Results of Prototype tests.

The five prototypes of each Liquid Crystal Display watch were found to meet the performance test levels of 1444444, therefore the LCQ I and LCQ II have a performance classification of T2GC1444444. Thus under normal conditions of watch usage, the release of tritium from the watch is highly unlikely. (See test results from American Atomics enclosed).

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