

MATERIALS LICENSE

Amendment No. 03

Pursuant to the Atomic Energy Act of 1954, as amended, the Energy Reorganization Act of 1974 (Public Law 93-438), and Title 10, Code of Federal Regulations, Chapter I, Parts 30, 31, 32, 33, 34, 35, 40 and 70, and in reliance on statements and representations heretofore made by the licensee, a license is hereby issued authorizing the licensee to receive, acquire, possess, and transfer by product, source, and special nuclear material designated below, to use such material for the purpose(s) and at the place(s) designated below, to deliver or transfer such material to persons authorized to receive it in accordance with the regulations of the applicable Part(s). This license shall be deemed to contain the conditions specified in Section 183 of the Atomic Energy Act of 1954, as amended, and is subject to all applicable rules, regulations and orders of the Nuclear Regulatory Commission now or hereafter in effect and to any conditions specified below

"OFFICIAL RECORD 0077"

Licensee

1. Victor J. Bortolot, Ph.D.

2. Daybreak Nuclear and Medical Systems, Inc.
50 Denison Drive
Guilford, Connecticut 06437In accordance with application dated
December 24, 1986,3. License number 06-17253-01 is amended in
its entirety to read as follows:

4. Expiration date April 30, 1992

5. Docket or
Reference No. 030-124406. Byproduct, source, and/or
special nuclear material7. Chemical and/or physical
form8. Maximum amount that licensee
may possess at any one time
under this license

A. Strontium 90

A. ICN Pharmaceuticals,
Inc. Sealed Source
Model 75129A. 1 source of
100 millicuries

B. Americium 241

B. Amersham/Searle
Sealed Source
Model AMMB. 1 source not to
exceed 1 millicurie

C. Strontium 90

C. ICN Sealed
reference sourceC. 1 source not to
exceed 1 microcurie

9. Authorized use

A. and B. For use in devices described in application dated December 23, 1981, for
thermoluminescence Sensitivity calibration of ceramic materials in
archaeological dating measurements.

C. For use as an instrument calibration source.

CONDITIONS

10. Licensed material shall be used only at 50 Denison Drive, Guilford, Connecticut.
11. Licensed material shall be used by, or under the supervision of, Victor J. Bortolot.
12. Sealed sources or detector cells containing licensed material shall not be opened or sources removed from source holders or detector cells by the licensee.
13. A(1) Any sealed sources or detector cells specified in Items 7.A. and 7.B. shall be tested for leakage and/or contamination at intervals not to exceed 6 months. Any source or detector cell received from another person which is not accompanied by a certificate indicating that a test was performed within 6 months before the transfer shall not be put into use until tested.

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MLT

MATERIALS LICENSE
SUPPLEMENTARY SHEET

License number

06-17253-01

Docket or Reference number

030-12440

Amendment No. 03

(continued)

CONDITIONS

16. Except as specifically provided otherwise in this license, the licensee shall conduct its program in accordance with the statements, representations, and procedures contained in the documents including any enclosures, listed below. The Nuclear Regulatory Commission's regulations shall govern unless the statements, representations and procedures in the licensee's application and correspondence are more restrictive than the regulations.

- A. Application dated December 23, 1981
B. Application dated December 24, 1986

For the U.S. Nuclear Regulatory Commission
Original Signed By:

Date MAR 19 1987

By

Judith A. Justice

Nuclear Materials Safety and
Safeguards Branch, Region I
King of Prussia, Pennsylvania 19406

CONVERSATION RECORD

TIME

DATE

1/13/87

TYPE

☐ VISIT

☐ CONFERENCE

☒ TELEPHONE

☐ INCOMING

☒ OUTGOING

ROUTING

NAME/SYMBOL

INT

Location of Visit/Conference:

NAME OF PERSON(S) CONTACTED OR IN CONTACT WITH YOU

ORGANIZATION (Office, dept., bureau, etc.)

TELEPHONE NO

John Herkey

NMSS - Hq

814093

SUBJECT

R & D vs other classification for

Science 06-17253-01

SUMMARY

Discussed w/ John whether the subject license was correctly classified as 3P (other) by LPMB. A correctly classified as R & D (03620) by Licensing. It apparently is one of those "gray" areas, but John did not feel uncomfortable with classifying it the same as grayed-out chromatographs, etc. since it was sealed & never in direct being used, which he indicated is different than what is used by museums and art institutions for dating and authenticating art work. He assumed the 3P classification was based on the authentic use which modern calibrations (the museums, etc. are mostly classified as 3P).

ACTION REQUIRED

Calicut 3P removal for but make a note to the review to let us know when review is recommended whether

NAME OF PERSON DOCUMENTING CONVERSATION

SIGNATURE

DATE

J. Jackson

1/13/87

ACTION TAKEN

3P app. processed as 3P, note returned to AD with application for removal to 03620

SIGNATURE

TITLE

DATE

Note: 3P OK for 03620

J. Jackson

1/13/87

50271-101

U.S. G.P.O. 1980-250-500-000

CONVERSATION RECORD

OPTIONAL FORM 271 (12-76)
DEPARTMENT OF DEFENSE

| | | | |
|---|--|---|--|
| FORM NRC-313 I (3-80) 10 CFR 30 | | U.S. NUCLEAR REGULATORY COMMISSION | |
| APPLICATION FOR BYPRODUCT MATERIAL LICENSE INDUSTRIAL | | 1. APPLICATION FOR: <i>(Check and/or complete as appropriate)</i> | |
| 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 1217 H Street, NW, Washington, D. C. or 7915 Eastern Avenue, Silver Spring, Maryland. | | a. NEW LICENSE | |
| | | b. AMENDMENT TO: LICENSE NUMBER | |
| | | c. RENEWAL OF: LICENSE NUMBER x 06-17253-01 | |
| 2. APPLICANT'S NAME (Institution, firm, person, etc.) Victor J. Bortolot, Ph.D. TELEPHONE NUMBER: AREA CODE - NUMBER EXTENSION (203) 453-3299 | | 3. NAME AND TITLE OF PERSON TO BE CONTACTED REGARDING THIS APPLICATION same TELEPHONE NUMBER: AREA CODE - NUMBER EXTENSION | |
| 4. APPLICANT'S MAILING ADDRESS (Include Zip Code) (Address to which NRC correspondence, notices, bulletins, etc., should be sent) Daybreak Nuclear & Medical Systems, Inc. 50 Denison Drive Guilford, CT 06437 | | 5. STREET ADDRESS WHERE LICENSED MATERIAL WILL BE USED (Include Zip Code) 50 Denison Drive Guilford, CT 06437 | |
| (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 <i>(See Items 16 and 17 for required training and experience of each individual named below)</i> | | | |
| FULL NAME | | TITLE | |
| a. Victor J. Bortolot, Ph.D. | | Research Director | |
| b. | | | |
| c. | | | |
| 7. RADIATION PROTECTION OFFICER Victor J. Bortolot, Ph.D. | | 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 | | | |
| L I N E NO. | ELEMENT AND MASS NUMBER A | CHEMICAL AND/OR PHYSICAL FORM B | NAME OF MANUFACTURER AND MODEL NUMBER <i>(If Sealed Source)</i> C |
| | | | MAXIMUM NUMBER OF MILLICURIES AND/OR SEALED SOURCES AND MAXIMUM ACTI- VITY PER SOURCE WHICH WILL BE POSSESSED AT ANY ONE TIME D |
| (1) | Americium 241 | sealed source | Amersham/Searle AMM 1 mCi (1 source) |
| (2) | Strontium 90 | sealed source | ICN model 75129 100 mCi (1 source) |
| (3) | Strontium 90 | wipe test std. | ICN model 77241 .01 microcurie |
| (4) | | | |
| DESCRIBE USE OF LICENSED MATERIAL E | | | |
| (1) | Thermoluminescence sensitivity calibrations of ceramic and other mineral materials | | |
| (2) | for the purpose of archaeological dating, where alpha and beta response must both | | |
| (3) | be determined (see attachments). Daybreak is one of two commercial labs in the | | |
| (4) | world (only in US) doing art authentication, and has over 150 international clients. | | |

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ITEM 9. Source storage.

(1) The Am-241 sealed source is housed and used in the device shown in Figure 1. This has an electrically-operated (solenoid) arm with a fail-safe spring return that carries the source out of the housing over the sample to be irradiated. At all times the active surface of the source is inaccessible to human contact. By use of an alpha absorber, the gamma component alone is available for use as a calibrator for TL personal monitor badges. This source has been standardized against radium using the same TLD material.

(2) The Sr-90 sealed source is stored and used in the shielded device shown in Figure 2. This, like the alpha housing above, is electrically operated. The spring return shutter protects the source against mechanical damage and human contact. When the solenoid is not energized, the shutter remains closed in all orientations, and cannot be opened without disassembly of the device. The shutter is a composite of 1/16" aluminum alloy and 3/16" lead to minimize bremsstrahlung production. As measured with an Eberline RD-1 ionization type survey meter, the closed shutter exit exposure rate is 45 mR/hr and the surface exposure rate on the steel enclosure can is about 10 mR/hr. The device is stored in a fireproof safe on and behind lead brick. In use, the device is placed 2 feet from the TL reader on and behind lead brick. When a sample calibration is to be done, the device is placed on the TL reader glow oven directly over the sample, and the shutter opened by an electronic timer. The exposure on the under surface of the glow oven during irradiations is 20 mR/hr. The source is in use about 200 hours annually. Dose monitoring of the applicant has shown less than 250 mR exposure per year during the term of the current license.

ITEM 11. Calibration of instruments.

1. The scintillation counters used in the TL dating laboratory for alpha activity measurements are used additionally for wipe tests using standards for comparison. The counters consist of a scintillator (Wm. Johnson ZnS alpha screens, or a Nuclear Enterprises NE810 plastic foil beta scintillator), PMT (EMI 9656), and NIM-packaged electronics with pulse amplifiers after Lampton and Primsch (RSI 42, 731 (1971)) and conventional integral discriminators and counters. For additional description, see the page on the Daybreak 580-series counters which are functionally the same (see attachment).

These counters were developed by the applicant while he ran the TL laboratory at Mt. Sinai School of Medicine (New York), and have proven successful for low level alpha measurements in dating, and for both alpha and beta wipe tests. Since all wipe tests are made by comparison with standards, there is no need for absolute calibration.

For alpha wipe tests, the amplifier gain and discriminator level are normally set for 85 per cent detection efficiency of alphas from a 1 per cent Th thick source (NBL analyzed sample #79-A) on a ZnS screen. Typical background is 2 counts/hr. For the purpose of wipe tests, the comparison source is a plated planchet containing 1440 dpm of Pu-239 (approximately 0.001 uCi) standardized at the NRC Health and Safety Laboratory in New York.

Beta wipe tests are performed with the plastic scintillator foil, with the gain increased and discriminator threshold lowered to give approximately 4000 counts/min for the wipe test standard and 200 counts/min background.

2. A description of the TL reader system is given in the Daybreak brochure attached, as it is the prototype model. This is a high performance photon-counting TL system capable of measurements down to 25 uR with $\text{CaSO}_4:\text{Dy}$ phosphor with 12 per cent precision, and 1mR with LiF with 3 per cent precision. This instrument is used for personnel monitoring where the gamma component of the Am-241 sealed source is used for calibration each time a TL phosphor is read out. The gamma calibration is by comparison with exposure to a 10 mg radium source at the Yale-New Haven Radiotherapy Dept. LiF-7 1/8" square dosimeters enclosed in 1/4" delrin wall capsules were placed on the centerline of an Eberline RO-1 survey meter in integration mode during exposure.

ITEM 13. Laboratory facilities.

The laboratory is devoted both to TL authenticity testing and to the development and production of high-performance apparatus for TL dating. It consists of 500 square feet of basement level space in a residential building owned by the applicant, divided into three rooms. The two front rooms house office space, electronics assembly area, and machine shop, while the third contains the TL lab. The equipment here includes a high sensitivity, photon counting TL detection apparatus with vacuum/N₂ purge sample oven, linear temperature rise of 0-50C/sec, xy recorder, scintillation counters for alpha activity measurements and ancillary sample preparation and calibration equipment. A flame photometer measures potassium content for K-40 activity. A Daybreak 9900 computer system will shortly be installed to do data reduction and age computations. The fireproof safe for the sealed sources covered in this application is within a locked cabinet in this room. The door to the lab may be locked.