

REGISTRY OF RADIOACTIVE SEALED SOURCES AND DEVICES
SAFETY EVALUATION OF DEVICE

NO: NR-250-D-101-S

DATE: JUL 5 1983

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DEVICE TYPE: Sample Irradiator

MODEL: 801

MANUFACTURER/DISTRIBUTOR:

Daybreak Nuclear and Medical Systems, Inc.
50 Denison Drive
Guilford, CT 06437

MANUFACTURER/DISTRIBUTOR:

SEALED SOURCE MODEL DESIGNATION:

Isotope Products Laboratories Model BF 90 Ti

ISOTOPE: Strontium-90

MAXIMUM ACTIVITY: 100 millicuries

LEAK TEST FREQUENCY: 6 months

PRINCIPAL USE: (T) Thermoluminescence Authentication

CUSTOM DEVICE: ☒ YES ☐ NO

CUSTOM USER:

Detroit Institute of Arts
Research Laboratory
5200 Woodward Avenue
Detroit, MI 48202

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DEVICE TYPE: Sample Irradiator

DESCRIPTION:

The Model 801 is a combination thermoluminescence reader and multiple sample irradiator which can expose up to 20 samples sequentially at exposure time intervals ranging from 0-9999 seconds. The source housing is constructed of formed lead which is mounted onto an aluminum source holder. The units are equipped with a shutter mechanism which is automatically closed by a return spring when a power failure occurs.

The samples are placed onto a rotating sample tray. Access to the tray is gained by a loading door located at the front of the device. The user cannot put his body into the beam path when loading or unloading the samples.

The Model 801 is used to authenticate ceramic samples by a thermoluminescence technique much like that used for thermoluminescence dosimeters. The principal of operation is based on the fact that the ceramic crystalline structures act as a matrix which absorb the energy from natural radiation. This energy excites the crystalline structure and they remain in this state until they are heated to a temperature that causes the structure to return to its normal state with the emission of a light photon. The amount of light emitted is proportioned to the energy absorbed and therefore also the dose that the ceramic has received. Once the dose is determined, the sample is irradiated, using the Sr-90 source, to the specified dose. This standardization process allows for correction of energies that were recently absorbed. These doses are due to increase in the natural background of the environment that the ceramic is now exposed to. This information is then used to calculate, within $\pm 10\%$ the date of the ceramic.

LABELING:

The device is labeled in accordance with Section 20.203, 10 CFR Part 20.

DIAGRAM:

See attachments 1 and 2.

CONDITIONS OF NORMAL USE:

The device is used in a laboratory that is climatically controlled and is used by trained laboratory technicians. The device is in a controlled access room which contains smoke detectors and fire suppression equipment.

PROTOTYPE TESTING:

Since this is a custom device, the manufacturer did not perform actual testing on the unit. However, they did submit an ANSI N538 classification of 12-785-785-121. Additionally, the manufacturer considered the events that would occur during a fire and has determined that the melted lead would flow around the source thus maintaining shielding integrity.

EXTERNAL RADIATION LEVELS:

The following dose rates in millirem per hour were reported by the manufacturer:

	Top	Front	Left Side	Right Side	Back	Bottom
Surface	1.1	0.45	0.70	0.70	1.2	2.0
30 cm	0.2	0.10	0.17	0.20	0.25	0.25
1 m	0.04	0.02	0.03	0.04	0.04	0.05

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DEVICE TYPE: Sample Irradiator

QUALITY ASSURANCE AND CONTROL:

This device was built to meet Daybreak specifications under the direct supervision of Mr. V. J. Bortolot, President of Daybreak Nuclear and Medical System, Inc.

LIMITATIONS AND/OR OTHER CONSIDERATIONS OF USE:

- o This device shall be distributed to Detroit Institute of Arts.
- o The device shall be leak tested at six (6) month intervals using techniques capable of detecting 0.005 microcurie of removable contamination.
- o Handling, storage, use, transfer, and disposal: To be determined by the licensing authority.
- o This registration sheet and the information contained within the references shall not be changed or transferred without the written consent of the NRC.
- o The licensing reviewer should note that due to the apparent commercial distribution of this device, no more units will be considered as custom devices.

SAFETY ANALYSIS SUMMARY:

Based on our review of the information and test data cited below, the fact that the device will be used by persons trained in radiation protection and that a similar device manufacturer by Daybreak was previously deemed acceptable for licensing purposes by the NRC and the Agreement States. We conclude that the Model 801 multiple sample irradiator is acceptable for custom licensing purposes.

Furthermore, we conclude that this device would be expected to maintain its containment integrity for normal conditions of use and accidental conditions which might occur during uses specified in this certificate.

REFERENCES:

The following supporting documents for the Model 801 sample irradiator are hereby incorporated by reference and are made a part of this registry document:

- o Detroit Institute of Arts letters dated February 14, 1983 and May 11, 1983 and enclosures thereto.

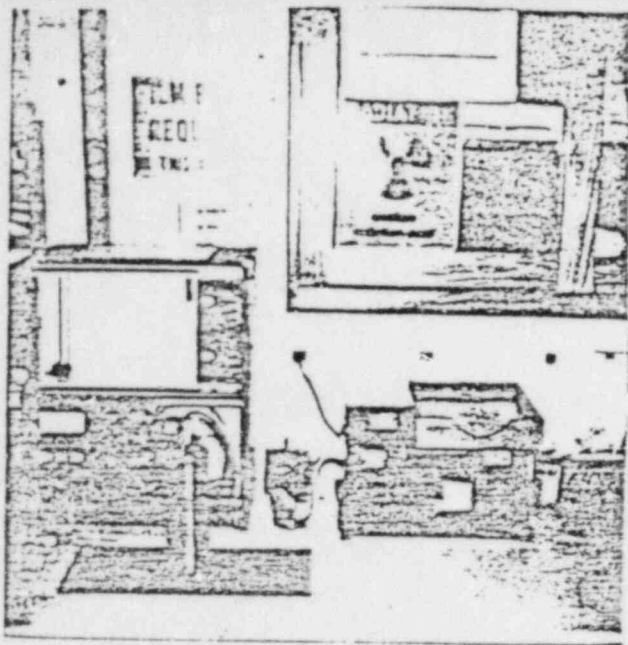
ISSUING AGENCY: U.S. Nuclear Regulatory Commission

Date: JUL 5 1983

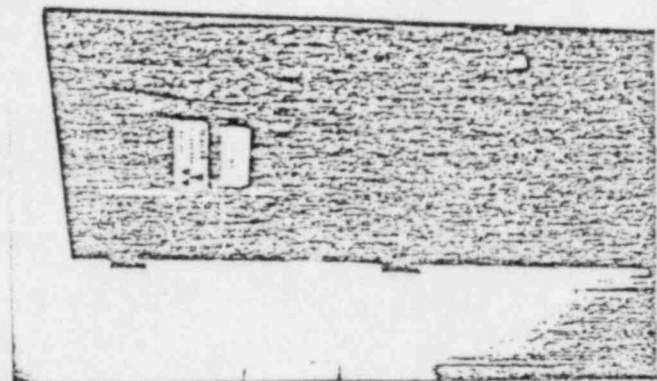
Reviewer:

Date: JUL 5 1983

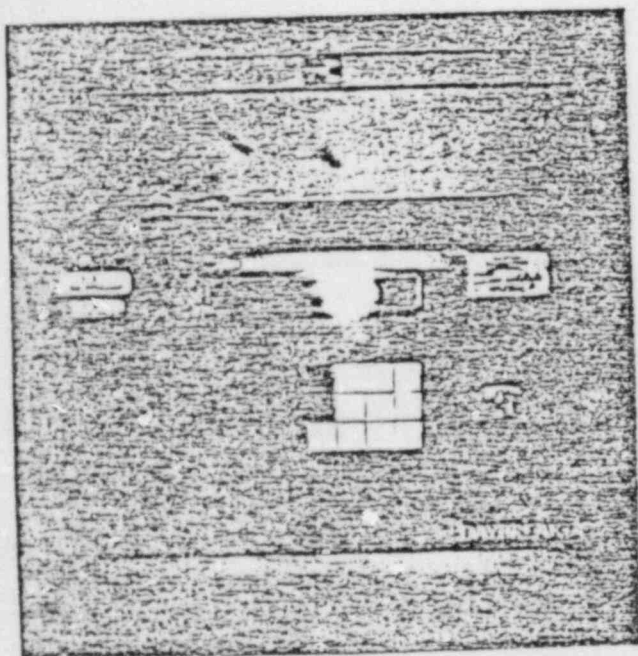
Concurrence:



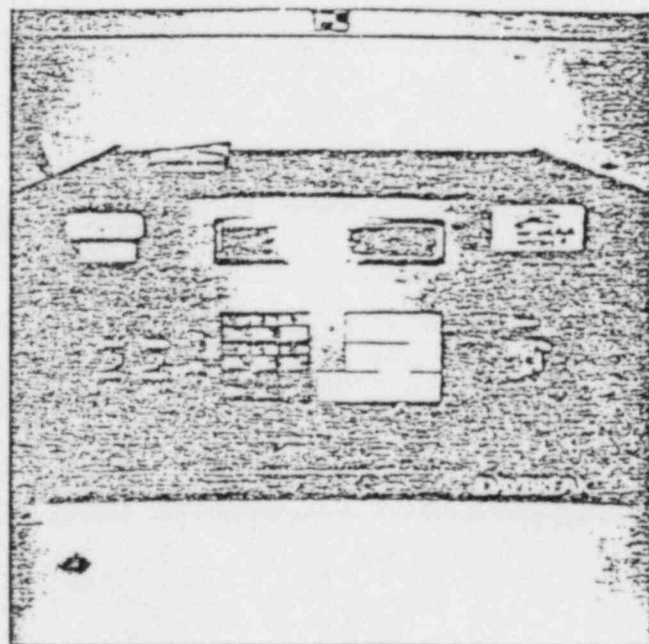
II.6. photo 2



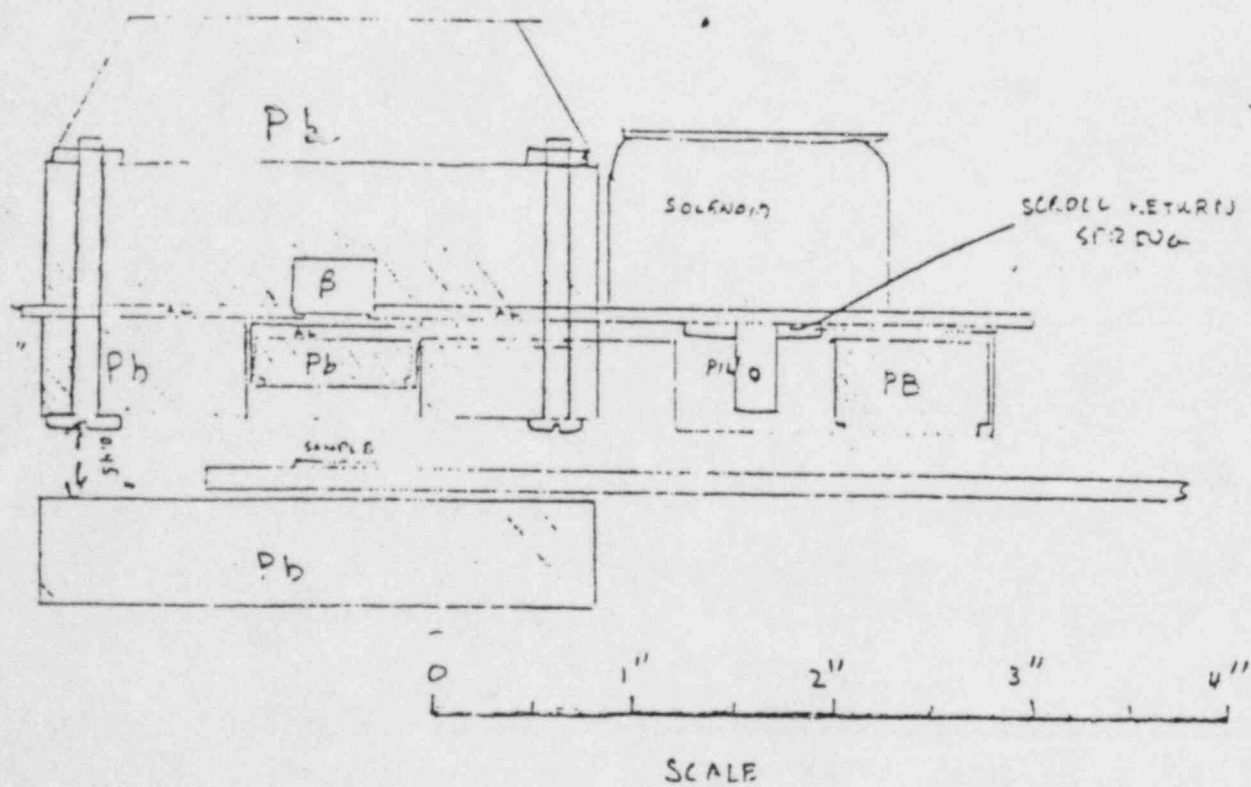
II.6. photo 1



II.6. photo 3



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Side View