March 31, 1982

VIA FEDERAL EXPRESS - OVERNIGHT LETTER

Mr. Lloyd Boling
Office of State Programs
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Boling:

Please find enclosed the following information pertaining to the Department's custom selaed source evaluation of Neutron Products, Inc.'s source Drawing Number A200234:

1. Information submitted by Neutron Products, Inc. concerning the custom made sealed source Drawing Number A200234

   a. Letter dated December 30, 1981
   b. Letter dated February 2, 1982

2. Department's clarification letter dated February 12, 1982

3. Neutron Products, Inc. February 17, 1982 response letter.

4. Department's "Draft" custom sealed source evaluation.

5. Neutron Products, Inc.'s March 30, 1982 letter and enclosures

   a. O'Donnell & Associates, Inc. March 22, 1982 letter
   b. O'Donnell & Associates, Inc. March 29, 1982 letter

Your are requested to review the submitted information and make any comments regarding the Department's evaluation and approval.

Thank you for your time and cooperation in this matter.

Sincerely,

Bernard Bevill

Bernard Bevill
Chief of Licensing and Compliance
Radiological Health Section

Encls.

BB:ef

RH-5

ARKANSAS DEPARTMENT OF HEALTH
Radiological Health

RADIOACTIVE MATERIAL LICENSE

Pursuant to Arkansas State Board of Health Regulations, 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 radioactive material listed below; and to use such radioactive material for the purpose(s) and at the place(s) designated below. This license is subject to all applicable rules and regulations of the State Board of Health and orders of the Radiological Health Unit, now or hereafter in effect and to any conditions specified below.

LICENSEE	
1. Name: Process Technology, Inc.	3. License number: ARK-628-BP-6-83
2. Address: North Airport Road Post Office Box 2265 West Memphis, Arkansas 72301	4. Expiration date: June 1, 1983
	5. Telephone number: (501) 732-2362
	7. Type of License: Byproduct

6. Radioactive material (Element and mass number)	8. Chemical and/or physical form	9. Maximum radioactivity and/or quantity of material which licensee may possess at any one time
Cobalt 60	Sealed Sources (AECL Model C-188, Neutron Products, Inc. Models 12-S-3, 12-C-3, 10-S-3, 10-C-3, 12-CC-5 or 24-CC-5, or General Electric Model GEP-916)	2,250,000 curies total. No single source to exceed 12,000 curies.

10. Authorized Use

To be possessed for storage only in a Radiation Technology, Inc. Model 4101 wet source storage irradiator pool.

11. Radioactive material may only be stored at the licensee's address on North Airport Road, West Memphis, Arkansas.

12. The licensee shall comply with the provisions of Section 3, "Standards for Protection Against Radiation" of the Arkansas State Board of Health's Rules and Regulations for Control of Sources of Ionizing Radiation.

13. Licensed material shall be used by, or under the supervision and in the physical presence of, Martin A. Welt, Robert H. Buckley, Theordore Russell, Charles Thomas, Steven Hall, or John Russen.

RADIOACTIVE MATERIAL LICENSE
Supplementary Sheet

License No. ARK-628-BP-6-83

NDITIONS (Continued):

. Each individual user under this license shall be designated in accordance with the training procedures for designation of individual users described in Section L of the Process Technology Radiation Protection Program submitted as Item 14 of the licensee's application dated November 11, 1980.

. A. Each sealed source containing radioactive material 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 used until tested.

B. The tests shall be capable of detecting the presence of 0.05 microcurie of contamination on the test sample. The test sample shall be taken 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 Department.

C. If the test reveals the presence of 0.05 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 Department regulations. A report shall be filed within five days of the test with the Director, Radiological Health, Arkansas Department of Health, Little Rock, Arkansas 72201, describing the equipment involved, the test results, and the corrective action taken.

D. Tests for leakage and/or contamination shall be performed by the licensee in accordance with leak test procedures submitted in letter dated April 23, 1981, or by other persons specifically authorized by the Department, U.S. Nuclear Regulatory Commission, or an Agreement State to perform such services.

6. Written instructions as contained in Process Technology, Inc. Operating Procedures submitted April 23, 1981, shall be followed and a copy of these instructions shall be made available to each individual using or having responsibility for use of radioactive material. Any changes in these instructions shall have the prior approval of the Director, Radiological Health, Arkansas Department of Health.

7. Sealed sources shall be in the original manufactured configuration upon which certification was based unless prior written approval has been granted by the Director, Radiological Health, Arkansas Department of Health.

8. The licensee is authorized to relocate, store, and install source units containing radioactive material licensed above and to perform maintenance and repair of the units which does not involve exposure of sealed sources. Replacement and disposal of sealed sources containing radioactive material shall be performed only by persons specifically authorized by the Department, U.S. Nuclear Regulatory Commission, or an Agreement State to perform such services.

Radiological Health

RADIOACTIVE MATERIAL LICENSE
Supplementary Sheet

License Number ARK-628-BP-6-83

ONDITIONS (Continued):

9. After installation of the irradiator and Cobalt 60 sources and prior to initiation of the irradiation program, a radiation survey shall be conducted to determine the maximum radiation levels in each area adjoining and above the irradiation room. A detailed report of the results of this survey shall be sent to the Director, Radiological Health, Arkansas Department of Health, Little Rock, Arkansas 72201, not later than thirty days following installation of the sources.

). Except as specifically provided otherwise by this license, the licensee shall possess and use radioactive material described in Items 6, 8, and 9 of this license in accordance with statements, representations, and procedures contained in application dated November 11, 1980, signed by Martin A. Welt, Ph.D.; drawings submitted October 20, 1980; letters with enclosures dated November 19, 1980, and April 23, 1981, signed by Robert Buckley; letter with enclosures dated May 18, 1981, signed by Charles M. Thomas; and letters dated June 1, 1981, and June 11, 1981, signed by Robert Buckley.

ate June 12, 1981

by E. F. Wilson
Director, Division of Environmental Health Protection

Date June 12, 1981

by Ruth E. McBurney
Ruth E. McBurney
Chief of Licensing and Compliance

Radiological Health

RADIOACTIVE MATERIAL LICENSE
Supplementary Sheet

License Number ARK-628-BP-6-83
AMENDMENT NO. 1

Process Technology, Inc.
North Airport Road
Post Office Box 2265
West Memphis, Arkansas 72301

Arkansas Radioactive Material License Number ARK-628-BP-6-83 is amended as follows:

Added:

CONDITIONS (Continued):

21. Notwithstanding the authorized use of radioactive material described in Item 10 above, the licensee is authorized to perform initial surveys and measurements as described in Condition 19 of this license, and as necessary for irradiator output inside the irradiator cell.

Date June 19, 1981

by Ruth E. McBurney
Ruth E. McBurney
Chief of Licensing and Compliance

RADIOACTIVE MATERIAL LICENSE
Supplementary Sheet

License Number ARK-628-BP-6-83
AMENDMENT NO. 2

Process Technology, Inc.
North Airport Road
Post Office Box 2265
West Memphis, Arkansas 72301

In accordance with amendment request dated July 2, 1981, Arkansas Radioactive Material License Number ARK-628-BP-6-83 is amended as follows:

Item 10 changed to read:

"Up to 2,000,000 curies to be used in a Radiation Technology, Inc. Model 4101 wet source storage irradiator for irradiation of materials, excluding explosive and corrosive materials. Sources may also be possessed in storage in the receiving pool as necessary to the replacement of the sources in the irradiator unit only."

Item 20 changed to read:

"Except as specifically provided otherwise by this license, the licensee shall possess and use radioactive material described in Items 6, 8, and 9 of this license in accordance with statements, representations, and procedures contained in application dated November 11, 1980, signed by Martin A. Welt, Ph.D.; drawings submitted October 20, 1980; letters with enclosures dated November 19, 1980, and April 23, 1981, signed by Robert Buckley; letter with enclosures dated May 18, 1981, signed by Charles M. Thomas; letters dated June 1, 1981, and June 11, 1981, signed by Robert Buckley; and letter dated July 2, 1981, signed by Martin A. Welt, Ph.D."

Item 21 is hereby deleted.

Date July 7, 1981

by Ruth E. McBurney
Ruth E. McBurney
Chief of Licensing and Compliance

2M 4/81-5886-DP&L CO

ARKANSAS DEPARTMENT OF HEALTH
Radiological Health

RADIOACTIVE MATERIAL LICENSE
Supplementary Sheet

License Number ARK-628-BP-6-83
AMENDMENT NO. 3

Process Technology, Inc.
North Airport Road
Post Office Box 2265
West Memphis, Arkansas 72301

In accordance with amendment request dated September 3, 1981, Arkansas Radioactive Material Licnese ARK-628-BP-6-83 is amended as follows:

Item 8 is changed to read:

Sealed Sources

A. AECL Model C-188
B. Neutron Products, Inc. Model 12-S-3
C. Neutron Products, Inc. Model 12-C-3
D. Neutron Products, Inc. Model 10-S-3
E. Neutron Products, Inc. Model 10-C-3
F. Neutron Products, Inc. Model 12-CC-5
G. Neutron Products, Inc. Model 24-CC-5
H. General Electric Model CEP-916
I. Neutron Products, Inc. Drawing Number A200234-D

Item 9 is changed to read:

2,250,000 curies total.

No single source to exceed 22,000 curies.

Date February 18, 1982

by Bernard Bevill
Bernard Bevill
Chief of Licensing and Compliance

2M-4/81-5886-DP&L CO.

Radiological Health

RADIOACTIVE MATERIAL LICENSE
Supplementary Sheet

License Number ARK-628-BP-6-83
AMENDMENT NO. 4

rocess Technology, Inc.
orth Airport Road
ost Office Box 2265
est Memphis, Arkansas 72301

n accordance with amendment request dated April 2, 1982, Arkansas Radioactive Material icense ARK-628-BP-6-83 is amended as follows:

tem 20 changed to read:

"Except as specifically provided otherwise by this license, the licensee shall possess and use radioactive material described in Items 6, 8, and 9 of this license in accordance with statements, representations, and procedures contained in:

A. Application dated November 11, 1980, signed by Martin A. Welt, Ph.D.

B. Drawings submitted October 20, 1980

C. Letter with enclosures dated November 19, 1980, signed by Robert Buckley

D. Letter with enclosures dated April 23, 1981, signed by Robert Buckley

E. Letter with enclosures dated May 18, 1981, signed by Charles M. Thomas

F. Letter dated June 1, 1981 signed by Robert Buckley

G. Letter dated June 11, 1981, signed by Robert Buckley

H. Letter dated July 2, 1981, signed by Martin A. Welt, Ph.D.

I. Letter dated April 2, 1982, signed by Martin A. Welt, Ph.D.

)ate April 5, 1982

by Bernard Bevill
~~Harold E. Holmes~~ Bernard Bevill
Chief of Licensing and Compliance

2M-4/81-5886-DPAL CO

ARKANSAS DEPARTMENT OF HEALTH
Radiological Health

RADIOACTIVE MATERIAL LICENSE
Supplementary Sheet

License Number ARK-628-BP-6-83
AMENDMENT NO. 5

Process Technology, Inc.
North Airport Road
Post Office Box 2265
West Memphis, Arkansas 72301

In accordance with amendment request dated March 2, 1982, Arkansas Radioactive Material License ARK-628-BP-6-83 is amended as follows:

Item 20 changed to read:

"Except as specifically provided otherwise by this license, the licensee shall possess and use radioactive material described in Items 6, 8, and 9 of this license in accordance with statements, representations, and procedures contained in:

A. Application dated November 11, 1980, signed by Martin A. Welt, Ph.D.

B. Drawings submitted October 20, 1980

C. Letter with enclosures dated November 19, 1980, signed by Robert Buckley

D. Letter with enclosures dated April 23, 1981, signed by Robert Buckley

E. Letter with enclosures dated May 18, 1981, signed by Charles M. Thomas

F. Letter dated June 1, 1981, signed by Robert Buckley

G. Letter dated June 11, 1981, signed by Robert Buckley

H. Letter dated July 2, 1981, signed by Martin A. Welt, Ph.D.

I. Letter dated April 2, 1982, signed by Martin A. Welt, Ph.D.

J. Letter dated March 2, 1982, signed by Robert Buckley

K. Letter dated June 22, 1982, signed by Robert Buckley

Date July 9, 1982

by Greta Dicus Nagle
Greta Dicus Nagle
Acting Chief
of Licensing

EVALUATION

CUSTOM SEALED SOURCE

Manufacturer & Distributor

Neutron Products, Inc.
Dickerson, Maryland 20753

Sealed Source Model Designation

Drawing A200234D

Isotope

Cobalt-60

Maximum Activity

12,000 to 22,000 Curies

Conditions of Normal Use

For use in panoramic gamma irradiators with wet source storage.

Sealed Source Description

The source consists of 4 assembly holders, with each holder containing 25 pairs of alternately stacked Co-60 wafers and spacer rings. There are 2 slits in each holder to minimize self-attenuation. The holders are stacked within a single inner capsule which is sealed within an outer capsule. Both the inner and the outer capsules are fabricated from 321 type stainless steel tubing and rod. All seals are accomplished by tungsten inert gas welding. Each Co-60 wafer is 0.745 inches in diameter and 0.073 inches thick; each assembly holder is 3.825 inches long and 0.812 inches in diameter; the active length of the source is 15.3 inches; the inner capsule is 16.125 ± 0.05 inches long; and the overall length of each source is 18.45 ± 0.05 inches and is 1.0 inches in diameter.

The source is labelled with "NPI-XX" (where XX is the year of fabrication) and the serial number.

Prototype Testing

Prototypes were tested in accordance with standards set forth in ANSI Standard N542 for the classification of sealed sources. The recommended required test levels for these sources are 43424; the actual performance of the prototypes was 53525. There were no failures at any test level.

Quality Assurance and Control

Material selection, inspection, testing and fabrication is the same as the NPI sources in the Source and Device Catalog which includes tubing and end cap shock tests and analysis; evaluation of 5 sequential prototype welds to qualify each weld configuration; preparation and evaluation of a dummy weld after each 10 sources; and, helium bubble and wipe testing of the inner and outer capsules with surface contamination not to exceed 0.05 microcuries for the inner capsule and 0.005 microcuries for the outer capsule.

Source activity is determined by comparing the exposure rate generated by the source with the exposure rate obtained under the same condition generated by a known standard. The procedure used has determined source activities which have been correlated when tested by other procedures and users.

Limitations and/or Other Conditions of Use

A. While not necessarily required, the manufacturer recommends:
   1. Avoiding the following:
      a. prolonged storage in water with a resistance lower than 10,000 ohm-centimeters.
      b. prolonged use or storage in still air.
      c. prolonged storage in the proximity of mild steel, brass or other dissimilar metals.
   2. That sulfuric acid be used in lieu of hydrochloric acid in storage pool demineralizer resin systems.

B. NPI source drawing A200234D is to be distributed only to individuals having a specific license issued by the NRC or an Agreement State.

C. The source is to be tested for radioactive leakage before shipping and at intervals not to exceed 6 months.

D. Installation, dismantling, relocation, repair, initial testing, replacement and/or disposal of the source shall be performed in accordance with the terms and conditions of a specific license issued by the NRC or an Agreement State.

References

A. Letter from Neutron Products, Inc. to Radiation Technology, Inc. dated December 30, 1981 and signed by Marvin M. Turkanis.

B. Letter and enclosures from Neutron Products, Inc. to Radiation Technology dated February 2, 1982 and signed by Marvin M. Turkanis.

C. Neutron Products, Inc. drawing number A200234D dated 12-29-81, sheets 1 of 2 and 2 of 2.

D. Letter from Neutron Products, Inc., to the Arkansas Department of Health dated February 17, 1982 and signed by Marvin M. Turkanis.

Reviewed By _____ Date _____

Concurrence _____ Date _____

ARKANSAS DEPARTMENT OF HEALTH
Bureau of Environmental Health Services
Division of Environmental Health Protection

EVALUATION

CUSTOM SEALED SOURCE

Manufacturer & Distributor

Neutron Products, Inc.
Dickerson, Maryland 20753

Sealed Source Model Designation

Drawing A2002340

Isotope

Cobalt-60

Maximum Activity

12,000 to 22,000 Curies

Conditions of Normal Use

For use in panoramic gamma irradiators with wet source storage.

Sealed Source Description

The source consists of 4 assembly holders, with each holder containing 25 pairs of alternately stacked Co-60 wafers and spacer rings. There are 2 slits in each holder to minimize self-attenuation. The holders are stacked within a single inner capsule which is sealed within an outer capsule. Both the inner and the outer capsules are fabricated from 321 type stainless steel tubing and rod. All seals are accomplished by tungsten inert gas welding. Each Co-60 wafer is 0.745 inches in diameter and 0.073 inches thick; each assembly holder is 3.825 inches long and 0.812 inches in diameter; the active length of the source is 15.3 inches; the inner capsule is 16.125 ± 0.05 inches long; and the overall length of each source is 18.45 ± 0.05 inches and is 1.0 inches in diameter.

The source is labeled with "NPI-XX" (where XX is the year of fabrication) and the serial number.

Prototype Testing

Prototypes were tested in accordance with standards set forth in ANSI Standard N542 for the classification of sealed sources. The recommended required test levels for these sources are 43424; the actual performance of the prototypes was 53525. There were no failures at any test level.

Quality Assurance and Control

Material selection, inspection, testing and fabrication is the same as the NPI sources in the Source and Device Catalog which includes tubing and end cap shock tests and analysis; evaluation of 5 sequential prototype welds to qualify each weld configuration; preparation and evaluation of a dummy weld after each 10 sources; and, helium bubble

and wipe testing of the inner and outer capsules with surface contamination not to exceed 0.05 microcuries for the inner capsule and 0.005 microcuries for the outer capsule. Source activity is determined by comparing the exposure rate generated by the source standard. The procedure used has determined source activities which have been correlated when tested by other procedures and users.

Limitations and/or Other Conditions of Use

A. While not necessarily required, the manufacturer recommends:
   1. Avoiding the following:
      a. prolonged storage in water with a resistance lower than 10,000 ohm-centimeters.
      b. prolonged use or storage in still air.
      c. prolonged storage in the proximity of mild steel, brass or other dissimilar metals.
   2. That sulfuric acid be used in lieu of hydrochloric acid in storage pool demineralizer resin systems.

B. NPI source drawing A200234D is to be distributed only to individuals having a specific license issued by the NRC or an Agreement State.

C. The source is to be tested for radioactive leakage before shipping and at intervals not to exceed 6 months.

D. Installation, dismantling, relocation, repair, initial testing, replacement and/or disposal of the source shall be performed in accordance with the terms and conditions of a specific license issued by the NRC or an Agreement State.

E. Upon routine quality control inspections by Neutron Products, Inc., microcracking in the welds was noted. Further review of this problem indicated that microcracking is a common plenomenon associated with the 321 stainless steel alloy. Tubing made from 316 stainless steel alloy was originally ordered and 316 or 304 would be the alloy of choice to prevent microcracking. Subsequent intensive testing and analysis of the microcracking (Referenced in E-J below) indicated that no significant problems with the observed microcracking should exist during the sources' "working" lifetime. However, due to the unlikely but potential problems associated with the microcracking becoming larger, leading to potential leakage/contamination problems, the Arkansas Department of Health recommends strongly that each source using 321 stainless steel be evaluated on an individual basis (case by case). The analysis of the sources should include a detailed metallurgical engineering evaluation (reference E-J below).

F. Process Technology, Inc., for whom these custom sources were designed, has been authorized to use these sources for a period of 12 months (ending April 2, 1983) after which they are to be returned to Neutron Products, Inc. for reencapsulation of the outer capsules. Upon reencapsulation, the sources must be reevaluated.

References

A. Letter from Neutron Products, Inc. to Radiation Technology, Inc. dated December 30, 1981 and signed by Marvin M. Turkanis.

B. Letter and enclosures from Neutron Products, Inc. to Radiation Technology dated February 2, 1982 and signed by Marvin M. Turkanis.

C. Neutron Products, Inc. drawing number A200234D dated 12-29-81, sheets 1 of 2 and 2 of 2.

D. Letter from Neutron Products, Inc., to the Arkansas Department of Health dated February 17, 1982 and signed by Marvin M. Turkanis.

E. Crack Propagation Analysis dated March, 1982 and prepared by Ray Fasiczka of O'Donnell and Associates, Inc.

F. Memorandum from Julius Heuschkel to Marvin Turkanis through Ray Fasiczka dated March 22, 1982.

G. Letter from O'Donnell and Associates to Marvin Turkanis dated March 29, 1982.

H. Letter from Marvin Turkanis to Ted Russer dated March 30, 1982.

I. Letter from Marvin Turkanis to Bernard Bevill dated April 2, 1982.

J. Letter (and enclosed memorandum dated April 13, 1982) from Donald A. Nussbaumer to E. Frank Wilson dated April 22, 1982.

K. Letter from Martin A. Welt to Bernard Bevill dated April 2, 1982.

Reviewed By Greta D. Nagle Date 8-9-82
Greta D. Nagle, Chief of Licensing, Radiological Health Section

Concurrence Bernard Bevill Date 8-10-82
Bernard Bevill, Chief of Inspections & Compliance, Radiological Health Section