UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

Ref: SA/LAB

JUL 29 1983

Mr. Robert E. Corcoran, Chief
Division of Radiation Control
Department of Health and
Mental Hygiene
201 West Preston Street
Baltimore. Maryland 21201

RECEIVED
AUG 3 1983
DIVISION OF
RADIATION CONTROL

Dear Mr. Corcoran:

We have received your letter of June 20, 1983, requesting technical assistance on a Neutron Products amendment.

Our engineering staff has reviewed the submittal, however, they did not have adequate information to permit a suitable analysis. We need additional information on the following items:

1. A more detailed description of the source, include procedures and standards required for fabrication and examination of the source.

2. Descriptions of the operating conditions intended for the source including any limitations (environment, temperature, cycles, etc.).

3. Maximum stress levels expected and maximum number of cycles in design life of source. How does the enclosed O'Donnell & Associates, Inc. report apply to the change?

4. Are any operating restrictions being recommended for the amended license by the applicant or being considered by the State that should be considered in an analysis?

5. Was ANSI N538 or DOT Special Form testing performed on the source? If not, please provide data that shows the source will meet these requirements. The source should be evaluated to the new, July 1983, DOT Special Form testing requirements.

We will continue our review upon receipt of the above information. If you have any questions, please let us know.

Sincerely,

Donna A. Nussbaumer
Assistant Director for
State Agreements Program
Office of State Programs

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NOV 17 1983
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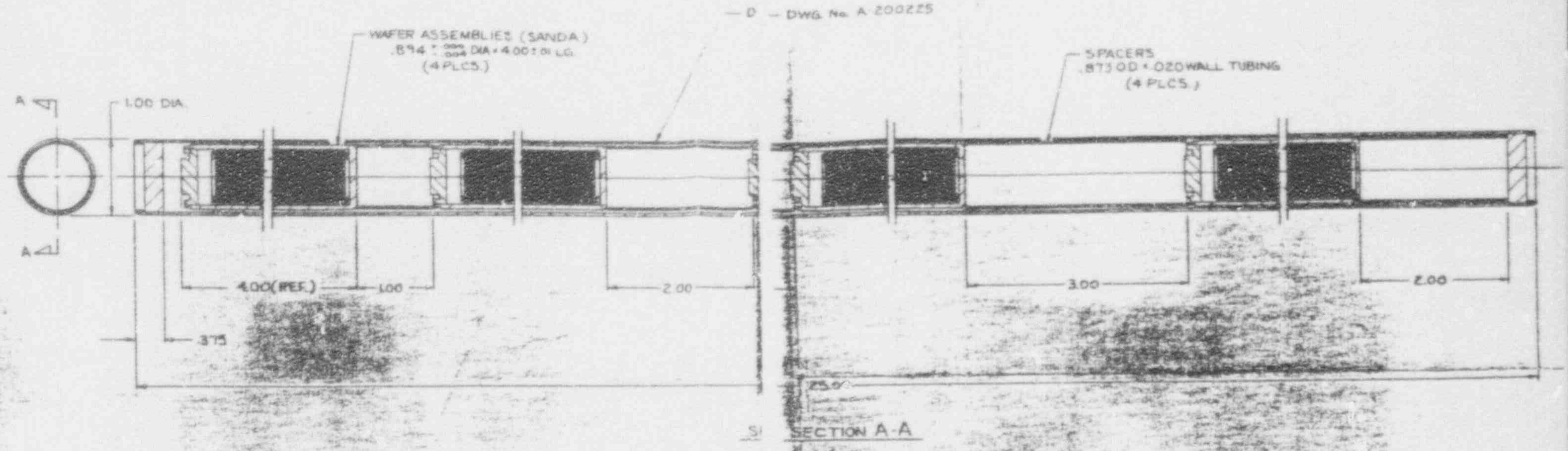
ENCLOSURE 1 TO
LETTER OF 11/14/83, C. SMEDIRA
TO R. CORCORAN



ENCLOSURE 4 TO LETTER 11/14/83
C. SAEDIRA TO R. CORCORAN

NOV 14 1983

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DIVISION OF
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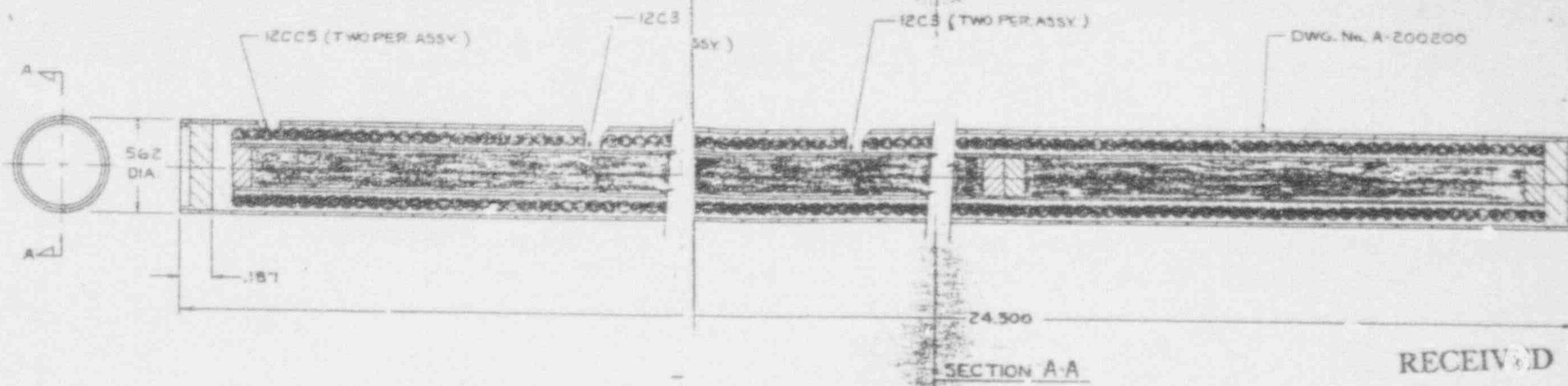
NEUTRON PRODUCTS inc
DWG. NO. 200275



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ENCLOSURE 5 TO LETTER 11/14/83
C. SMEDIRA TO R. CORCORAN

NOV 14 1983

THIS DOCUMENT, AND ALL DATA CONTAINED HEREIN, IS THE PROPERTY OF NEUTRON PRODUCTS, INC., AND IS SUPPLIED IN CONFIDENCE ONLY UNDER THE EXPRESS CONDITIONS THAT IT BE USED ONLY FOR THE PURPOSE INTENDED, THAT IT WILL NOT BE REPRODUCED OR TRANSMITTED TO OTHERS WITHOUT WRITTEN AUTHORIZATION, AND THAT IT IS TO BE RETURNED UPON DEMAND.

neutron products inc Dickerson, Maryland

TITLE: ARRANGEMENT $\frac{9}{16}$" x 24 $\frac{1}{2}$" SOURCE

DRAWN: MEK 11-4-83
CHECKED: CWS 11-4-83
APPROVED: CWS 11-4-83

APPROVED: CWS ISSUED DATE: 11-4-83
SIZE: B DWG. NO. 200276
SCALE: 2X

Code #____/____

INVENTORY RECORD

Q. C.

Vendor _____ P. O. _____ Quantity _____

Material _____

Size _____

Certification _____

C	Cr	Ni	Mn	P	Si	S	Mo	Co		

Shape _____

Check Analysis _____

Vendor _____ P. O. _____ Date _____

Date	Bin	TA	Use	+ Quantity	Balance

Stock No. _____

Code #____/____

INVENTORY RECORD

Q. C

Vendor _____ Q. _____ Quantity _____

Material _____

Size _____

Certification _____

C	Cr	Ni	Mn	P	Si	S	Mo	Co		

Shape _____

Check Analysis _____

Vendor _____ P. O. _____ Date _____

Date	Bin	TA	Use	+ Quantity	Balan

RECORD OF NONCONFORMANCE

NCR # _____

I. Determination

1. Component/system/structure with the nonconformance (NC)

2. Nature of the NC (reference the appropriate specification, criteria, or drawing)

3. Who discovered the NC?

4. When was the NC discovered?

5. How was the NC discovered?

6. Cause of the NC.

Part I Author: Signature _____ Date _____

Complete Parts II and III, as appropriate. Route to QA Manager.

II. Significance

Part II Author: Signature _____ Date _____

Complete Part III as appropriate. Route to appropriate Vice President or QA Manager.

Vice President or QA Manager Acknowledgement: Signature _____

Corrective Action Assigned: _____

III. Recommended Corrective Actions

1. Recommended repair

2. Inspection/testing requirements of fix

ATTACHMENT B TO NPJ SPEC P-

3. Hold points during repair

4. Determination of repair needed referred to

5. Design review required

6. Repair requires approval of

Part III Author: Signature _____ Date _____

Route to appropriate Vice President.

Vice President Approval: Signature _____

QA Manager Approval: Signature _____

IV. Corrective Action Documentation

1. Component/system structure with the nonconformance (...)

2. Design review date

3. Inspection or tests of repairs required

4. Corrective action taken

5. Repair performed by

6. Repair date

7. Inspection or test (of repair) date

Part IV Author: Signature _____ Date _____

Route to QA Manager.

Action Completed: QA Acknowledgement: Signature _____

1st END FABRICATION RECORD

References: Job No: _____ Lot No. _____ No. of Tubes _____ End Cap _____
Drawing Nos: _____
Manufacturing Procedure No. _____
Welding Procedure _____

Released for production by _____, Date _____

Serial Numbers to be assigned: NPI 71-____ through NPI71-____

Cleaning

	Tubing Initial	Tubing Date	End Cap Initial	End Cap Date
Degrease				
Freon T.F.				
Acetone				
Pickle				
Passivate				
Package				

Inspection for Cleanliness & Surface Condition

	Tubes	End Cap	By	Date
Number accepted	_____	_____	_____	_____
Number not accepted	_____	_____	_____	_____

Welding by _____

See Welding Log Dated _____

Marking by _____ date _____

Inspection

	accepted	not accepted* Initial	Date
Leak Test	_____	_____	_____
Visual examination	_____	_____	_____
weld color	_____	_____	_____
weld contour and uniformity	_____	_____	_____
surface condition	_____	_____	_____
Metallographic	_____	_____	_____
penetration	_____	_____	_____
voids, inclusion	_____	_____	_____

*See disposition on REMARKS below

Records received by and _____ assemblies accepted by _____ Date _____

REMARKS _____

CAPSULE COMPONENT CHECK LIST

1st / 2nd ENCAPSULATION

Customer _____ TA _____ Date _____

Quantity This Order _____

TUBE

Lot No. _____

Material _____ Stock No. _____ Part No. _____

Machined by _____ P. O. No. _____

Q. C. Check of _____ Random Samples. Diameter _____ Length _____

End Condition _____ Surface _____ Other _____ Quantity _____

( ) Indicates all samples measure within Tolerance shown on Drawing _____

Preclean and Degrease _____ By _____ Date _____

Pickle _____ Date _____ Passivate _____ Date _____

Ultrasonic _____ Date _____ Package _____ Date _____

Checked by _____ Released to Hot Cell for Assembly _____

REMARKS _____

END CAP

Lot No. _____

Material _____ Stock No. _____ Part No. _____

Machined by _____ P. O. No. _____

Q. C. Check of _____ Random Samples Diameter _____ Length _____

End Condition _____ Surface _____ Other _____

( ) Indicates all samples measure within Tolerance shown on Drawing _____

Preclean and Degrease _____ By _____ Date _____

Pickle _____ Date _____ Passivate _____ Date _____

Ultrasonic _____ Date _____ Package _____ Date _____

Checked by _____ Released to Hot Cell for Assembly _____

REMARKS _____

Add serial numbers _____ to _____

FINAL ACCEPTANCE _____ DATE _____

[illegible] ff

FROM: Carmine Smedira Carmine

DATE: October 27, 1983

SUBJECT: Dickerson II Source Plaque Analysis

As part of our internal review of the "Analysis of Permissible Activity for the Dickerson II Irradiator", prepared for the Maryland DHMH, I performed independent calculations of the anticipated external source temperatures. My analysis confirmed that the analysis submitted in your letter of June 3, 1983 to DHMH is conservative.

The fundamental conclusions of my calculations are that there is no practical significance to limiting the total activity in a source; that a more significant specification is the activity per unit length; and that a license limit of 30,000 ci/ft for any size source is sufficient to assure that the surface temperature of any practical irradiator source will not exceed 629°F.

In addition it is worth noting that a typical 9/16" diameter NPI irradiator source of the present design will have a cobalt loading not exceeding 150 gms/ft. Thus a 30,000 ci/ft source would require the use of 200 ci/gm material which is nearly twice as high as anything we are likely to use for radiation processing sources.

It is possible however to put about 270 gms/ft in a 9/16" diameter source which would require a specific activity on the order of 100 ci/gm for a 30,000 ci/ft source. The surface temperature of this source would not exceed 613°F, and the internal temperature gradient would be of no importance because in such a source the inner capsule would essentially contain a single solid rod.

Enclosed you will find the details and results of my calculations.

CS/kmw

ENCLOSURE 7 TO
LETTER 11/14/83
C SMEDIRA TO R CORCORAN

Radiation Processing Source Temperature Calculations

Calculations of the external temperatures of irradiator sources were performed as follows:

1. Determine the total heat generated in a source, Q_T, from:

   a. Gamma ray self attenuation = $Q_{\delta SA}$

   b. Beta ray self attenuation = Q_{BSA}

   c. The absorbed gamma dose from the other soruces in the plaque = Q_{PA}

Hence: $Q_T = Q_{\delta SA} + Q_{BSA} + Q_{PA}$

2. Use natural convection with 100°F air and radiation to 100°F surfaces in the irradiator cell to remove the heat.

Hence:

$$Q_T = \sigma \varepsilon A \left(\left(\frac{T}{100}\right)^4 - 983 \right) + hA\,(T-560)$$

Radiation Heat Transfer for source of temperature (T) in °Rankine to 100°F surfaces

Natural convection heat transfer for source of temperature (T) in °Rankine with 100°F Air

σ = Stephan Boltzman Constant = .173 Btu/hr-ft^2-°R^4

ε = emissivity; assumed to be = .3

A = source surface area in ft^2

h = natural convection heat transfer coefficient = $.27 \left(\frac{T-100^\circ F}{D}\right)^{.25}$ Btu/hr-ft^2 where T is in °F, D is the source diameter in feet.

Solve the above equations for T.

Note that this method ignores the fact that there is a forced flow of air through the irradiator cell. It also ignores any heat transfer by conduction which may take place from the source to the racks to the pool water.

DETERMINATION OF RADIATION PROCESSING SOURCE TEMPERATURES

	Source Diameter	1"	1"	9/16"	9/16"	3/8"
ASSUMPTIONS	Gamma self absorption	25%	20%	15%	10%	9%
	Beta self absorption	100%	100%	100%	100%	100%
	Loading (gms/ft)	850	500	270	150	100
	Curies/foot	30,000	30,000	30,000	30,000	30,000
	Specific activity (Ci/gm)	35	60	111	200	300
	Plaque dose rate MR/hr	10	10	10	10	10
CALCULATIONS	Heat from gamma Absorption (Btu/hr)	375	300	225	150	135
	Heat from beta Absorption (Btu/hr)	57	57	57	57	57
	Heat from plaque Exposure (Btu/hr)	81	47	19	10	10
	Total Heat (Btu/hr)	513	404	301	217	202
	Heat transferred by Thermal radiation (Btu/hr)	178	129	93	60	57
	Heat transferred by Natural convection (Btu/hr)	335	275	208	157	145
	External Source Temp. (F)	629	552	613	511	590