

PDR

71-4986

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Pacific Northwest Laboratory
P.O. Box 999
Richland, Washington 99352
Telephone (509) 375-2171

April 2, 1980

REG.
ACTION

Mr. C. E. MacDonald, Chief
Transportation Branch
Division of Fuel Cycle and Material Safety
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. MacDonald:

Reference: Docket No. 71-4986

Pacific Northwest Laboratory (PNL) hereby requests that NRC Certificate of Compliance 4986 be amended as described herein.

Certificate No. 4986 authorizes the transport of nuclear fuel manufactured by General Electric Company and Exxon Nuclear Company, Inc. in General Electric's RA-Series packages. The nature of this requested amendment involves the use of RA-3 shipping containers to transport NRU-LOCA Test Trains or test train components.

The enclosed Application for Amendment includes information as outlined in "Packaging of Radioactive Materials for Transport" Part 71 of NRC Rules and Regulations, Title 10, Chapter 1 (10 CFR 71). This data demonstrates the safety of Class I shipments of low enriched UO_2 fueled NRU-LOCA Test Train Assemblies, or their components.

This amendment is necessary to permit PNL to ship nuclear fueled test trains to the NRU Reactor Site at Deep River, Ontario. The tests are being designed, fabricated, and performed under contract to the Fuel Behavior Branch, Division of Reactor Safety, under the office of Nuclear Regulatory Research of the NRC. Since the amendment is being solicited to facilitate NRC funded work, PNL requests that the normal licensing fee be waived.

PNL personnel will be pleased to discuss details of this submittal with you or members of your staff. If there are any questions pertaining to this requested amendment, please contact J. F. Nesbitt on (509) 942-4717 or J. P. Pilger on (509) 942-5603.


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Mr. C. E. MacDonald
Page 2
April 2, 1980

Your timely consideration of this submittal would be appreciated as PNL's contract with the NRC includes a schedule to begin shipments in August, 1980.

Sincerely,

A handwritten signature in cursive script, appearing to read "C. L. Mohr".

C. L. Mohr, Manager
Nuclear Fuels Section

CLM:dc

Enc.

cc: A. L. Kaplan

PROPOSED CHANGES TO NRC CERTIFICATE OF COMPLIANCE 4986
FOR THE GENERAL ELECTRIC RA-SERIES PACKAGES

Presented below is information pertinent for the amendment of the existing certificate to permit the use of RA-3 containers for the shipment of special NRU-LOCA Test Train Assemblies, or Test Train components.

1 (A) Package Identification

- (1) The package is General Electric's Model No. RA-3 as identified in Certificate No. 4986 Revision 5 with a minor change incorporated in the inner container to permit the packaging of the specific test assembly.

(2) Description

Packages are right rectangular boxes consisting of an outer container of wooden construction and a metal inner container separated by cushioning material.

The metal inner container is 11-1/2 inches by 18 inches by 179 inches long for the Model No. RA-3 and it is positioned within an all-wood constructed outer container that is approximately 30 inches by 31 inches by 207 inches long. Cushioning is provided between the inner and outer containers by phenolic impregnated honeycomb and ethafoam, or equivalent. A pressure relief (breather) valve is installed on the inner container, and is set for 0.5 psi differential. Closure is made by bolts, latches, or the equivalent. The total weight of the packaging is either approximately 1400 pounds or 1450 pounds dependent on the type of outer shipping container used.

(3) Drawings

The RA-3 inner container of welded and riveted design is constructed in accordance with the following General Electric drawing numbers:

731E674, Revision 5 or 6
128D5211, Revision 1 or 2
128D5212, Revision 0 or 1
128D5177, Revision 0, 2, 3, or B
128D5178, Revision 1 or 2
117C3979, Revision 2, 3, or 4
159C5372, Revision A
159C5373, Revision A

Also included is the inner liner assembly constructed in accordance with GE Drawing No. 159C5411, Revision 2 that will be modified as shown on PNL Drawing H-3-41798. This modification consists of one 2 inch by 5-3/8 inch notch that is located in one end of the center section of the inner container.

The contents of this particular container will be supported and held in place with saddles and dunnages that mate with the test train or sub-bundle assemblies. These will be fabricated in accordance with PNL Drawings H-3-41798 and H-3-41799.

The RA-3 outer shipping container is constructed in accordance with GE Drawing No. 829E209, Revision 0, 3, 4, or it may be constructed in accordance with GE Drawing Nos. 761E529, Revision 2 or 731E283, Revision 0, 1, 2, 3, or 4.

1 (B) Contents of Package

- (1) The contents for this application consists of an NRU-LOCA Test Train Assembly in accordance with BNW Drawing H-3-41803 "Test Train Arrangement" Rev 1 and the latest revision of the following BNW drawings:

H-3-41804	H-3-41851
05	52
07	58
11	59
12	60
13	61
14	62
15	63
16	64
17	65
H-3-41818	H-3-41867
19	68
20	69
21	70
23	71
24	72
25	73
28	74
29	76

H-3-41830	H-3-41877
32	78
33	80
34	81
35	82
36	83
37	84
38	85
39	86
40	87
41	H-3-42030
42	81
46	
47	
48	

Basically one-half of the test train consists of a support mechanism and service leads while the other half contains the fuel material.

The fuel assemblies are constructed of multiple parallel rods of enriched uranium, clad in Zircaloy-4, held in a modified square array (no rods in the four corner positions) inside of a shroud by means of end fittings and intermediate spaced grids.

An alternate content for this application consists of test bundle subassemblies in accordance with BNW Drawing No. H-3-41814 and H-3-41815. A maximum of eight sub or individual test bundle assemblies are to be arranged as shown in BNW Drawing No. H-3-41799. The rods of the subassemblies are located and held in position by grids spaced along their length. Four subtest bundle assemblies shall be strapped together at three or more locations with steel strappings. The total breaking strength of the strappings shall be at least 30 times the weight of the bound subassemblies.

(2) Type and Form of Material

- (i) A UO₂ fueled NRU-LOCA Test Train Assembly contains a maximum average U-235 enrichment of 2.94% by weight. Assembly rods are clad with a minimum 0.022 inch thickness of Zircaloy and have a maximum fuel pellet outside diameter of 0.3255 inches. Each assembly of 32 rods, 31 of them containing UO₂ fuel, are arranged on a basic 6x6 grid and located on a .502 inch pitch. The fueled rods contain 144 lineal inches of fuel.

- (ii) An arrangement of test bundle subassemblies contain a maximum average U-235 enrichment of 2.94% by weight. Sub-assembly rods are clad with a minimum 0.022 inch thickness of Zircaloy and have a maximum fuel pellet diameter of 0.3255 inches. Each arrangement of 24 rods, 22 of them containing UO_2 fuel, are arranged on a basic 4x8 grid and located on a .502 inch pitch. The fueled rods contain 144 lineal inches of fuel.

(3) Maximum Quantity of Material Per Package

Only one NRU-LOCA Test Train Assembly shall be shipped per container. The maximum weight of an assembly is 450 pounds. A maximum of one subassembly arrangement shown on BNW Drawing No. H-3-41799 shall be shipped per container. The maximum weight of this arrangement, consisting of a total of eight individual test bundle subassemblies is 290 pounds.

- (4) Each test assembly may be unsheathed or it may be enclosed in an unsealed, polyethylene sheath which will not extend beyond the ends of the fuel portion of the assembly. The ends of the sheath shall not be folded or taped in any manner that would prevent the flow of liquids into or out of the sheathed fuel assembly.

2. Package Evaluation

The package covered in this amendment application is the same as the tested General Electric RA-3 shipping container with one exception., (i.e., the 2 inch by 5-3/8 inch notch made in the trailing end of the center section of the inner container). It is the considered opinion of PNL that this change as shown on PNL Drawing H-3-41798 has not affected the structural strength, integrity, or the required function of the RA-3 package in any manner.

The only other difference affecting the ability of the package to meet and withstand the requirements of 10CFR71 is that the weight of the package contents for this applied use will be considerably less than those of normal RA-3 usages. The RA-3 container is designed to hold two BWR type fuel bundles and it has been tested and evaluated with contents weighing up to 1234 pounds. The use of the same basic container to ship a test bundle with a maximum weight of 450 pounds is an operation that will place less severe demands on the package than its present use for all normal transport or for any hypothetical accident conditions.

3. Criticality Safety Analysis

The current contents of the subject certificate have been reviewed and compared to the NRU-LOCA Test Train and it is the considered opinion of PNL that the shipment of NRU-LOCA Test Train Assemblies or Test Train components will be safer from the criticality aspect than the fuel bundles presently identified as contents of the RA-3 shipping container.

Our conclusion and submittal is based on the following. In the GE application for the RA shipping containers⁽¹⁾ the fuel considered in the calculational models had the following properties:

- (1) 3.2 wt% ²³⁵U enrichment maximum
- (2) .032" Zircaloy clad thickness
- (3) fuel pellet OD of 0.410"
- (4) fuel column length of 174"
- (5) 0.640" pitch.

The NRU fuel properties, on the other hand are:

- (1) 2.94 wt% ²³⁵U enrichment maximum
- (2) 0.022" clad thickness
- (3) fuel pellet OD of 0.3255"
- (4) fuel column length of 144"
- (5) 0.502" pitch.

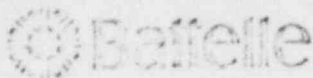
The 3.2 wt% fuel described in the GE analysis complies with requirements of a Fissile Class I shipping container. With reference to data interpolated from DP1014, ⁽²⁾ for unclad arrays of 3.2 wt% fuel rods, full water reflected, the number of rods required for criticality is ≤ 270 rods. The NRU fuel requires >440 rods for criticality. The above analysis takes into account the slightly larger pitches which occur due to including clad thickness and holding the water to fuel ratio constant. It is estimated that even at optimum fuel moderation, the critical number of fuel rods is still ~ 270 rods. Hence, the NRU fuel is less reactive than the GE fuel analyzed and will meet the requirements for a Fissile Class I shipping container.

In the event that geometry control is lost, there are additional features which make the NRU fuel shipment much less reactive than that fuel originally prescribed in the GE analysis. A maximum of 44 pins fixed on a square pitch will be shipped per container. In the GE analysis, two 8x8 bundles were modeled per container. Thus in the GE analysis, 128 pins were shipped per container compared to 44 less reactive pins in the NRU shipment.

4. Procedural Controls

The attached Quality Assurance Program QAP No. MD-1, Revision 0, has been established to control the design, procurement, fabrication, assembly, inspection, and shipment of the NRU-LOCA Test Train Assemblies. The plan is in accordance with Battelle's Quality Assurance Manual PNL-MA-65 which has been established to interpret the requirements of DOE RL's Appendix to Manual Chapter 0820 and Appendix B of 10 CFR50.

- (1) Letter A. L. Kaplan to C. E. MacDonald, "Application for Amendment of NRC Certificate of Compliance 4986," December 20, 1976.
- (2) Clark, H. K. Critical and Safe Masses and Dimensions of Lattices of U and UO₂ Rods in Water. DP-1014, E. I. Du Pont de Nemours & Company, Savannah River Laboratory, Aiken, South Carolina, February 1966.



QA PLAN

Page 1 of 4

Issue Date 5/14/79

QAP No. MD-1

Revision No. 0

☒ R&D Project☐ Service Activity

Project/Service Activity: NRC-LOCA Simulation in NRU

Sponsor: NRC/RSR - D. Hoatson

Authorized By (DOC. No.): EY-76-C-06-1830 (Account No. D1813-11053)

QA Requirement Specification:

RL Appendix to 0820 As interpreted by PNL-MA-65.

Other (Specify)

Approvals:

DATE APPROVED 4/11/79	SIGNATURE (QUALITY ENGINEER) 
DATE APPROVED 5/14/79	SIGNATURE (Q.E. MANAGER) 
DATE APPROVED 4/26/79	SIGNATURE (PROJECT/ACTIVITY MANAGER) 
DATE APPROVED 4/26/79	SIGNATURE (LINE MANAGER) ^(a) 

2. The Sections or selected paragraphs of PNL-MA-65 (as identified by section or paragraph number) designated in this QA Plan are applicable to this Project/Service Activity. Additional information is also provided when useful to provide clarification of the selected requirement.

Distribution: (Project QA Files, QAO, and others as appropriate) R.P. Marshall, C.R. Hann, J.P. Pilcher, R.L. Goodman, S.W. Heaberlin, W.D. Meitzler, G.M. Hesson, L.L. King, R.K. Marshall, L.J. Parchen, R.E. Schrieber, R.L. Shaub, D.E. Ryder, QAO, T.G. Odekirk, C.L. Hout.

^(a) Department or Section Manager as designated by Department Policy or the Project Plan Document.

1. ORGANIZATION

1.1 The relationship of the QAO to other Battelle components is described in Section 1.1 of PNL-PA-65.

Collaborating Organizations:

<u>Organization</u>	<u>Contact/Quality Engineer</u>
AECL, Chalk River, Ontario	C. A. Herriot/None at this time.

2. QA PROGRAM

2.1 The Battelle QA Program shall be applied as described in this QA Plan. The following detail has been included to provide additional information concerning this section.

- 2.1.1 * Subtasks performed by PNL shall be in accordance with the requirements of this document.
- * Additional project control data is furnished in the "Fuels Design & Development Section Quality Control Plan to Cover Hardware Design and Assembly Projects."

3. DESIGN CONTROL & METHOD REVIEW

3.1.2 The project approach and method is reviewed and approved as part of the Project Plan Document.

3.1.3.1 This subsection applies.

3.1.3.3 This subsection applies.

3.1.4.3 Results of investigations, calculations, and experiments will be documented in final or summary reports. When reportable calculations are documented the name and version of the computer code shall be recorded.

3.1.5 This subsection applies.

3.1.6 Design review shall be conducted by a design review team composed of members from PNL designated by the Project Manager.

3.1.7 This subsection applies.

4. PROCUREMENT

4.1 This section applies when a purchase requisition is processed.

5. INSTRUCTIONS, PROCEDURES & DRAWINGS

5.1 This section applies and additional information is provided in the following statements:

5.1.1 Project Manager designated personnel will be responsible for maintaining a list of generated procedures.

5.1.2 This QAP shall be transmitted to other PNL sections or departments when authorized work in support of this project occurs.

6. DOCUMENT CONTROL

6.1 This section shall be applied to the procedures identified in 5.1.1 above.

7. MATERIAL IDENTIFICATION & CONTROLS

7.1 This section applies.

9. INSPECTION & TEST

9.1 This section applies; classification of defects may be utilized for dimensional inspections as directed by the Project Manager.

10. CALIBRATION

10.1 This project involves the use of M&TE that will require the application of the controls described in Section 10.1. Additional information is provided in the following statements:

- The Project Manager will determine, identify and document the calibration level requirements.
- Performance of operational checks and adjustments will be recorded in lab books. Note the procedure/method used and the adjustments made.

10.1.3.2 NRU Reactor/PHL Test Train interface dimensions are considered critical. The Project Manager, or his designee, will be responsible for assuring the M&TE utilized for measurement of these dimensions are within calibration and of sufficient accuracy.

11. HANDLING, STORAGE AND SHIPPING

11.1 This section applies and additional information is provided in the following statement.

- Project Manager, or his designee, shall be responsible for obtaining the export license and shipment of radioactive material to AECL.

12. INSPECTIONS, TEST AND OPERATING STATUS

12.1 This section applies.

13. NONCONFORMANCE & CORRECTION ACTION

13.1 This section applies when one of the described conditions occurs.

14. QA RECORDS

14.1 This section applies and additional information is provided in the following statement.

- The Program Manager shall provide to project personnel a list of those documents that are to be generated and maintained as QA records.

15. QA AUDITS

15.1 Scheduled audits will be conducted once each one-year period as a minimum. The first audit shall be scheduled three months from the issue of this QAP.

1. ORGANIZATION

1.1 The relationship of the QAO to other Battelle components is described in Section 1.1 of PNL-PA-65.

Collaborating Organizations:

<u>Organization</u>	<u>Contact/Quality Engineer</u>
AECL, Chalk River, Ontario	C. A. Herriot/None at this time.

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3.1.7 This subsection applies.

1. ORGANIZATION

1.1 The relationship of the QAO to other Battelle components is described in Section 1.1 of PNL-MA-65.

1- Collaborating Organizations:

<u>Organization</u>	<u>Contact/Quality Engineer</u>
AECL, Chalk River, Ontario	C. A. Herriot/None at this time.

2. QA PROGRAM

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Collaborating Organizations:

<u>Organization</u>	<u>Contact/Quality Engineer</u>
AECL, Chalk River, Ontario	C. A. Herriot/None at this time.

2. QA PROGRAM

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1. ORGANIZATION

1.1 The relationship of the QAO to other Battelle components is described in Section 1.1 of PHL-PA-65.

Collaborating Organizations:

<u>Organization</u>	<u>Contact/Quality Engineer</u>
AECL, Chalk River, Ontario	C. A. Herriot/None at this time.

2. QA PROGRAM

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Collaborating Organizations:

<u>Organization</u>	<u>Contact/Quality Engineer</u>
AECL, Chalk River, Ontario	C. A. Herriot/None at this time.

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

MEMORANDUM FOR: TERA Corp.

FROM: US NRC/TIDC/Distribution Services Branch

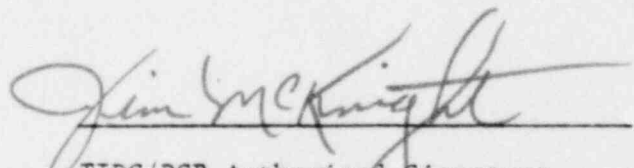
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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

MEMORANDUM FOR: TERA Corp.

FROM: US NRC/TIDC/Distribution Services Branch

SUBJECT: Special Document Handling Requirements

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cc: DSB Files

TIDC/DSB Authorized Signature