

OM1A: PAP-1309
 Page: 1
 Rev.: 0

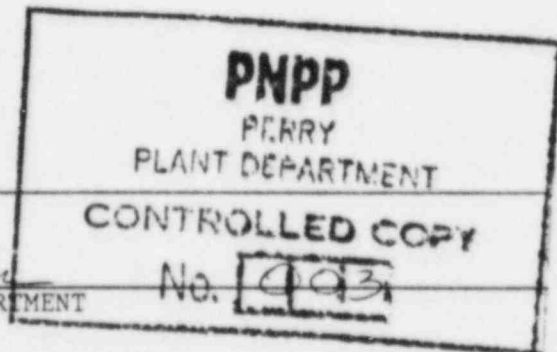
THE CLEVELAND ELECTRIC ILLUMINATING COMPANY
 PERRY NUCLEAR POWER PLANT OPERATIONS MANUAL

TITLE: SHIPMENT OF RADIOACTIVE WASTE FOR DISPOSAL

REVISION: 0 EFFECTIVE DATE: 9-2-85

PREPARED: C. Reiter

SUBMITTED: *Robert A. Statman*
 PERRY PLANT TECHNICAL DEPARTMENT



SUBMITTED: N/A
 PERRY PLANT OPERATIONS DEPARTMENT

REVIEWED: *B. G. Galt* 7-30-85
 NUCLEAR Q.A. DEPARTMENT

APPROVED: *E. M. Shuster* 7-31-85
 MANAGER - NUCLEAR Q.A. DEPARTMENT

PORC REVIEW AND RECOMMENDATION FOR APPROVAL MEETING NUMBER: 85-59

APPROVED: *Steven F. Kennicki* 8/5/85
 MANAGER - PERRY PLANT TECHNICAL DEPARTMENT
 J. J. WALDRON
 Alternate
 During Absence

APPROVED: *M. D. Shuster*
 MANAGER - PERRY PLANT OPERATIONS DEPARTMENT

INFORMATION
 ONLY

Shipment of Radioactive Waste for Disposal

PAP-1309

Table of Contents

<u>Section</u>	<u>Title</u>	<u>Page</u>
1.0	<u>PURPOSE</u>	1
2.0	<u>SCOPE</u>	1
3.0	<u>RESPONSIBILITY</u>	1
4.0	<u>REFERENCES</u>	2
5.0	<u>DEFINITIONS</u>	3
6.0	<u>DETAILS</u>	3
6.1	Determination of Radionuclide Content and Quantity	3
6.2	Classifying Radioactive Waste As Low Specific Activity	4
6.3	Instructions for Completing the LSA Worksheet	6
6.4	Waste Classification	8
6.5	Waste Form and Stability	11
6.6	Instructions for Completing the Waste Classification Worksheet	13
6.7	Packaging Radioactive Waste for Shipment	14
6.8	Hazardous Material Shipping Document Requirements	17
6.9	Instructions for Completing Shipment Documents	20
6.10	Selection of Transport Vehicle for Waste Shipments	29
6.11	Preparing a Loading Plan	30
6.12	Loading a Transport Vehicle	32
6.13	Verification of Receipt of Waste Shipments	36
6.14	Records	36
7.0	<u>ATTACHMENTS</u>	39
7.1	Attachment 1 - Table of A_1 and A_2 Values for Radionuclides	41
7.2	Attachment 2 - Form: PNPP No. 6604, LSA Worksheet	51
7.3	Attachment 3 - Table I	53
7.4	Attachment 4 - Table II	54
7.5	Attachment 5 - Form: PNPP No. 6626, Waste Classification Worksheet	55
7.6	Attachment 6 - Barnwell Waste Management Facility Radioactive Shipment Manifest	56

INFORMATION
ONLY

Shipment of Radioactive Waste for Disposal

PAP-1309

Table of Contents (Cont.)

<u>Section</u>	<u>Title</u>	<u>Page</u>
7.0	<u>ATTACHMENTS</u> (Cont.)	
7.7	Attachment 7 - U.S. Ecology Radioactive Shipment Manifest	58
7.8	Attachment 8 - South Carolina Radioactive Waste Shipment Prior Notification and Manifest Form, DHEC 802	60
7.9	Attachment 9 - South Carolina Radioactive Waste Shipment Certification Form, DHEC 803	61
7.10	Attachment 10 - Washington State Low-Level Radioactive Waste Shipment Certification for Commercial Generator/Packages and Brokers and Carriers, RHF-31A	62
7.11	Attachment 11 - Form: PNPP No. 6608, Exclusive Use Shipment Checklist	63
7.12	Attachment 12 - Form: PNPP No. 6610, Vehicle Inspection Form	64
7.13	Attachment 13 - Form: PNPP No. 6675, Isotopic Analysis Results Form	65
7.14	Attachment 14 - Standard Transport Van Dimensions (Inside)	66
7.15	Attachment 15 - Form: PNPP No. 6606, Instructions for Maintaining Exclusive Use Vehicle	67
7.16	Attachment 16 - Response to Transportation Incidents	68

INFORMATION
ONLY

10CFR50.59 Applicability Check

	<u>Yes</u>	<u>No</u>
Is there a change to the plant as described in the FSAR?	—	<u>✓</u>
Is there a change to a procedure/instruction as described in the FSAR?	—	<u>✓</u>
Is there a test or experiment not described in the FSAR?	—	<u>✓</u>
Is there a change to the Technical Specifications?	—	<u>✓</u>
(If yes, perform a 10CFR50.59 Safety Evaluation per PAP-0305)		
Applicability Check Performed by <u>C. J. Renteria</u> Date <u>7-24-85</u>		

SCOPE OF REVISION:

INFORMATION
ONLY

SHIPMENT OF RADIOACTIVE WASTE FOR DISPOSAL

1.0 DESCRIPTION

This procedure provides instructions and requirements for the shipment of Low Specific Activity (LSA) Radioactive Waste by exclusive use motor carrier to a burial facility.

2.0 SCOPE

The packaging and shipment of radioactive material is governed by regulations issued by the Department of Transportation (DOT) and the Nuclear Regulatory Commission (NRC). Additional regulations have been issued by various state and local agencies which must be complied with when shipping radioactive material through areas over which they have jurisdiction.

Adherence to this procedure will ensure that shipments of LSA radioactive waste comply with Federal, State, and burial facility regulations.

3.0 RESPONSIBILITY

3.1 General Supervising Engineer for Radiation Protection is responsible for:

3.1.1 Ensuring shipment activities are in accordance with the plant operating license and applicable government, state, and local agency regulations.

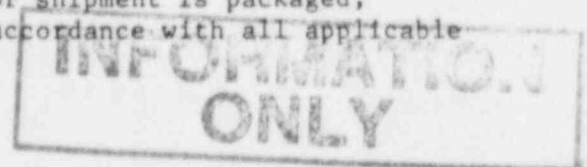
3.1.2 Implementing the Perry Nuclear Power Plant Radioactive Material Shipment Procedures.

3.1.3 Review and signature of shipment paperwork prior to the shipment.

3.2 The Radwaste Supervisor is responsible for ensuring that radwaste material is properly processed for disposal or storage.

3.3 The Radioactive Shipment Coordinator is responsible for:

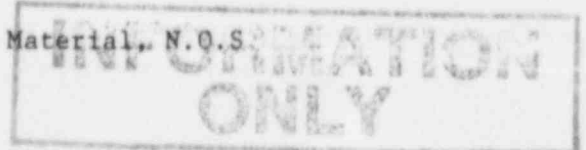
3.3.1 Ensuring radioactive material for shipment is packaged, handled, stored and shipped in accordance with all applicable rules and regulations.



- 3.3.2 Scheduling of transport vehicles and equipment.
- 3.3.3 Obtaining burial site allocations.
- 3.3.4 Ensuring the PNPP Radioactive Material Shipment Procedures are in compliance with the latest federal government, state and local agency regulations.
- 3.4 The Chemistry Unit is responsible for providing the necessary chemical and isotopic analyses on radioactive waste for shipment.
- 3.5 The Health Physics Unit is responsible for all surveys.
- 3.6 The Quality Assurance Department is responsible for providing the necessary quality controls and checks that are required in the PNPP Quality Assurance Plan.
- 3.7 The Operations Department is responsible for the operation of loading equipment.
- 3.8 The Maintenance Section is responsible for construction and installation of any necessary blocking and bracing required in a shipment.

4.0 REFERENCES

- 4.1 Title 10, Code of Federal Regulations, Part 20.
- 4.2 Title 10, Code of Federal Regulations, Part 61.
- 4.3 Title 10, Code of Federal Regulations, Part 71.
- 4.4 Title 49, Code of Federal Regulations, Parts 100-199.
- 4.5 State of South Carolina, Radioactive Materials License 097, issued to Chem-Nuclear Systems, Inc.
- 4.6 State of Washington, Radioactive Materials License WN-1019-2, issued to U.S. Ecology, Inc.
- 4.7 Radwaste Unit Logs and Records, OAP-1703.
- 4.8 Shipment of Limited Quantity Radioactive Material, PAP-1305.
- 4.9 Shipment of Low Specific Activity (LSA), Radioactive Material, PAP-1306.
- 4.10 PAP-1307, Shipment of Radioactive Material, N.O.S.



- 4.11 PAP-1308, Shipment of Radioactive Empty Packages.
- 4.12 PAP-1304, Radioactive Shipment Criteria.
- 4.13 PAP-1310, Packaging Radioactive Material for Shipment.
- 4.14 PAP-1311, Shipment of Highway Route Controlled Quantity Radioactive Material.
- 4.15 PAP-1312, Shipment of Fissile Radioactive Material.
- 4.16 South Carolina Regulation No. 61-83, Transportation of Radioactive Waste Into or Within South Carolina.

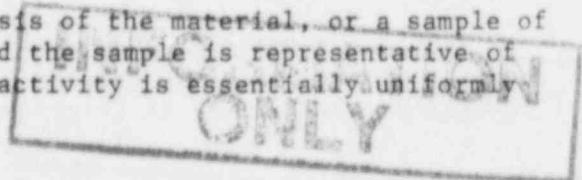
5.0 DEFINITIONS

Definitions are listed in OMIA: PAP-1304, Radioactive Shipment Criteria.

6.0 DETAILS

6.1 Determination of Radionuclide Content and Quantity

- 6.1.1 To determine if the waste may be classified as Low Specific Activity it is necessary to identify and quantify the specific activity of each radionuclide present in the material.
- 6.1.2 Identifying the radionuclide content of the material is done by one of these methods:
 - a. Obtain a smear sample from the material and perform an isotopic analysis of the smear.
 - b. Use the isotopic analysis results of the latest resin samples to determine the radionuclides present in the material. This method can only be used if the material became radioactive due to exposure to plant systems or components.
 - c. Direct isotopic analysis of the material or a representative sample of the material.
- 6.1.3 Determination of specific activity of the material can be performed by one of two methods:
 - a. Direct isotopic analysis of the material, or a sample of the material (provided the sample is representative of the material and the activity is essentially uniformly



distributed throughout the material). The activity of the material is then divided by the weight of the material analyzed to determine specific activity.

- b. Calculation of total activity based on radiation levels of the material. The calculated activity is then divided by the total weight of the material to determine total specific activity.

6.1.4 If calculations of total specific activity based on radiation levels are used, an isotopic analysis must be used to determine the percent abundance of the radionuclides. The total specific activity of the material is then ratioed for each radionuclide based on the percent abundance of the radionuclide.

6.1.5 In order to classify radioactive waste for disposal, in accordance with NRC requirements, it is necessary to identify and quantify certain radionuclides in the material that PNPP is not able to measure with our equipment. The use of scaling factors allows the unmeasurable radionuclides to be ratioed to the radionuclides that are identified in routine analysis. Complete instructions for the sampling and analysis of radioactive waste for 10CFR61 classification are contained in OMIE: RAP-1102, 10CFR61 Compliance Sampling.

6.2 Classifying Radioactive Waste As Low Specific Activity

6.2.1 Determine the A_2 values for each radionuclide in the material. The values are obtained from the Table of A_1 and A_2 Values for Radionuclides, Attachment 1.

6.2.2 Once the A_2 values for the material are known, the activity limits for LSA can be determined as follows:

1. For material in which the radioactivity is essentially uniformly distributed, the average concentration of contents shall not exceed:
 - a. 0.0001 millicurie per gram of radionuclides for which the A_2 quantity is not more than .05 curie (Group I);
 - b. 0.005 millicurie per gram of radionuclides for which the A_2 quantity is more than .05 curie, but not more than 1 curie (Group II); or
 - c. 0.3 millicurie per gram of radionuclides for which the A_2 quantity is more than 1 curie (Group III).
2. For objects of non-radioactive material externally contaminated with radioactive material, the surface contamination shall not exceed:

INFORMATION
ONLY

- a. $2.2 \text{ E7 dpm/100 cm}^2$ of radionuclides for which the A_2 quantity is not more than .05 curie; or
- b. $2.2 \text{ E8 dpm/100 cm}^2$ for all other radionuclides.

6.2.3 The activity present in the material is then compared to the activity limit for the material to determine if it falls within the shipment category.

Example: A 100 lb. drum of radioactive material requires shipment. Based on radioactive levels, it is calculated that curie content is 10 curies. Isotopic analysis shows the only radionuclide present in the material is Co-60. The activity is uniformly distributed throughout the drum.

Determine the specific activity as follows:

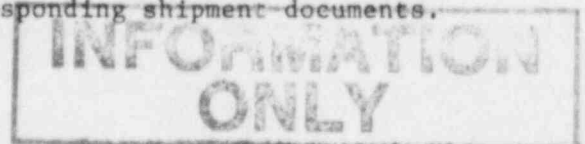
$$\frac{10 \text{ curies}}{100 \text{ lbs.}} \times \frac{1 \text{ lb.}}{454 \text{ grams}} \times \frac{1000 \text{ mCi}}{1 \text{ curie}} = .022 \text{ mCi/gram of Co-60}$$

Attachment 1 shows the A_2 limit for Co-60 is 7 curie, therefore the LSA limit is 0.3 mCi/gram.

Since 0.22 mCi/gram is within the LSA limit of 0.3 mCi/gram, the material qualifies as low Specific Activity.

NOTE: The Table of A_1 and A_2 Values for Radionuclides, Attachment 1, is a modified table from 49CFR173.435. The LSA limit, in mCi/gram, has already been calculated for each radionuclide and is listed in the LSA limit column.

- 6.2.4 If the package contains more than one radionuclide, the unity equation must be used to determine if the material exceeds the LSA quantity limits.
- 6.2.5 When determining the specific activity of solidified waste, the concentration of the radionuclide mixture shall be averaged over the volume of the waste and the solidification agent if the waste form is a homogenous mixture.
- 6.2.6 The concentration of radionuclides in filters encapsulated with a solidification agent shall be averaged over the volume of the filter, not the solidification agent.
- 6.2.7 An LSA worksheet is provided to aid in classifying radioactive waste as Low Specific Activity. All completed worksheets shall be filed with the corresponding shipment documents.



NOTE: The radioactive waste shipping computer program is normally used to perform the required LSA calculations. If the computer program is used, use of the LSA worksheet is not required.

6.3 Instructions for Completing the LSA Worksheet (Attachment 2)

6.3.1 The number preceding each of the following instructions corresponds to the applicable item on the worksheet.

6.3.2 The LSA worksheet consists of two parts:

- a. Part 1 - used to determine the specific activity and LSA group of each radionuclide present in the package.
- b. Part 2 - used to perform the unity equation to determine if the material can be classified as LSA.

6.3.3 Instructions

Part 1

1. Enter the date the worksheet is calculated (Part 1 and 2).
2. Enter a description of the material (Part 1 and 2).
3. Enter the package number (Part 1 and 2).
4. If the contents of the package is part of a process batch, enter the batch number (Part 1 and 2).
5. Enter the gross weight of the package (for filters enter the weight of the filter only).
6. Enter the total activity of the package in millicuries.
7. Enter the sample activity in millicuries. If the activity of the package is calculated based on dose rates of the package, enter "N/A" for the sample activity and sample weight.
8. Enter the sample weight in grams.
9. List each radionuclide present in the material.
10. List the percent abundance of each radionuclide found in the material.
11. List the activity, in millicuries, for each radionuclide. The activity can be calculated by multiplying the percent

ONLY

abundance of the radionuclide (10) by the sample activity (7). If the activity of the package was determined by dose rate calculations, multiply the percent abundance by the total activity (6).

12. List the specific activity for each radionuclide in millicuries per gram. The specific activity is calculated by dividing the radionuclide activity (11) by the sample weight (8). If the activity of the package was determined by dose rate calculations, divide the radionuclide activity (11) by the package weight (5). Convert the package weight (5) to grams by multiplying by 454 grams/ pound.
13. Enter the LSA group for each radionuclide. The LSA group is found by comparing the A_2 quantity of the radionuclide to the following limits:
 - a. Group I = A_2 quantity is not more than .05 curies.
 - b. Group II = A_2 quantity is more than .05 curie but not more than 1.0 curie.
 - c. Group III = A_2 quantity is more than 1.0 curie.

The A_2 quantity for the radionuclide is found in the Table² of A_1/A_2 Values for Radionuclides, Attachment 1.

Part 2

14. List each radionuclide present in the material that falls in LSA Group I.
15. List the specific activity for each of the LSA Group I radionuclides.
16. List each radionuclide present in the material that falls in LSA Group II.
17. List the specific activity for each of the LSA Group II radionuclides.
18. List each radionuclide present in the material that falls in LSA Group III.
19. List the specific activity for each of the LSA Group III radionuclides.
20. Enter the sum of the specific activities for Group I radionuclides.

INFORMATION
ONLY

21. Enter the sum of the specific activities for Group II radionuclides.
22. Enter the sum of the specific activities for Group III radionuclides.
23. Enter the total specific activity calculated for each LSA group.
24. Calculate the unity factor for each LSA group by dividing the total specific activity for each group (23) by the LSA limit.
25. Enter the sum of the unity factors (24). If the total unity factor does not exceed 1.0, then the material may be classified as LSA. If the total unity factor exceeds 1.0, the material must be classified as Radioactive Material n.o.s. in accordance with Reference 4.10.

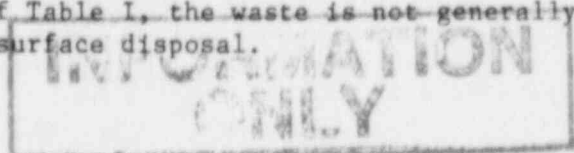
6.3.4 The completed LSA worksheets shall be kept on file with the applicable shipment documents.

6.4 Waste Classification

6.4.1 Determination of the classification of radioactive waste involves two considerations. The first consideration must be given to the concentration of long-lived radionuclides and their shorter-lived precursors. The potential hazard of these radionuclides will persist long after the burial facility has ceased operation. The second consideration must be given to the concentration of shorter-lived radionuclides for which the requirements or institutional controls and disposal methods are effective.

6.4.2 Classification determined by long-lived radionuclides - If radioactive waste contains only radionuclides listed in Table I (Attachment 3), classification shall be determined as follows:

1. If the radionuclide concentration does not exceed the value listed in Column 1 of Table I, the waste is Class A.
2. If the radionuclide concentration exceeds the values listed in Column 1 of Table I, but does not exceed the values listed in Column 2, the waste is Class C.
3. If the radionuclide concentration exceeds the value listed in Column 2 of Table I, the waste is not generally acceptable for near-surface disposal.



4. For wastes containing mixtures of radionuclides listed in Table I, the total concentration shall be determined by the unity equation. When performing the unity equation, ensure the values used in the denominator of the equation are all from the same column.

6.4.3 Classification determined by short-lived radionuclides - If radioactive waste does not contain any of the radionuclides listed in Table I (Attachment 3), classification shall be determined based on the concentrations shown in Table II (Attachment 4), as follows:

1. If the radionuclide concentration does not exceed the value in Column A of Table II, the waste is Class A.
2. If the radionuclide concentration exceeds the value in Column A of Table II, but does not exceed the value in Column B, the waste is Class B.
3. If the radionuclide concentration exceeds the value in Column B of Table II, but does not exceed the value in Column C, the waste is Class C.
4. If the radionuclide concentration exceeds the value in Column C of Table II, the waste is not generally acceptable for near-surface disposal.
5. For wastes containing mixtures of radionuclides listed in Table II, the total concentration shall be determined by the unity equation. When performing the unity equation, ensure the values used in the denominator of the equation are all from the same column.

6.4.4 Classification determined by both long-lived and short-lived radionuclides - If radioactive waste contains a mixture of radionuclides, some of which are listed in Table I, and some of which are listed in Table II, classification shall be determined as follows:

1. If the concentration of a nuclide listed in Table I (Attachment 3) does not exceed the value listed in Column 1, the class shall be determined by the concentration of nuclides listed in Table II (Attachment 4).
2. If the concentration of a nuclide listed in Table I exceeds the values shown in Column 1 but does not exceed the value shown in Column 2, the waste shall be Class C, provided the concentration of nuclides listed in Table II does not exceed the value shown in Column C.

INFORMATION
ONLY

3. The unity equation must be used for mixtures of radionuclides. The appropriate values used in the denominator of the equation must all be taken from the same column of the same table. The sum of the fractions for the column must be less than 1.0, if the waste class is to be determined by that column.

Example: To classify a waste containing .05 uCi/cc of C-14, 0.1 uCi/cc of Tc-99, 0.9 uCi/cc of Cs-137, and 2.3 uCi/cc of Ni-63, the following steps must be taken.

1. Compare the activities of the long-lived nuclides to the values listed in Table I (Attachment 3). C-14 and Tc-99 both fall within the limits listed in Column 1, therefore the unity equation is calculated for Column 1.

$$\frac{0.5 \text{ uCi/cc (C-14)}}{0.8 \text{ uCi/cc (C-14 limit)}} + \frac{0.1 \text{ uCi/cc (Tc-99)}}{0.3 \text{ uCi/cc (Tc-99 limit)}} = .096$$

Since the unity equation is less than 1.0, these nuclides fall within the Class A limits, therefore the waste must be classified by the concentration of nuclides listed in Table II (Attachment 4).

2. Compare the activities of the short-lived nuclides to the values listed in Table II. Cs-137 and Ni-63 both fall within the limits listed in Column A, therefore the unity equation is calculated for Column A.

$$\frac{0.9 \text{ uCi/cc (Cs-137)}}{1 \text{ uCi/cc (Cs-137 limit)}} + \frac{2.3 \text{ uCi/cc (Ni-63)}}{3.5 \text{ uCi/cc (Ni-63 limit)}} = 1.56$$

Since the unity equation is greater than 1.0, these nuclides do not fall within the Class A limits, therefore the nuclide concentrations must be compared to the Column B values.

$$\frac{0.9 \text{ uCi/cc (Cs-137)}}{44 \text{ uCi/cc (Cs-137 limit)}} + \frac{2.3 \text{ uCi/cc (Ni-63)}}{70 \text{ uCi/cc (Ni-63 limit)}} = 0.5$$

Since the unity equation for Column B is less than 1.0 the waste is classified as Class B.

- 6.4.5 If radioactive waste does not contain any nuclides listed in either Table I or Table II, it is Class A.

INFORMATION
ONLY

6.5 Waste Form and Stability

- 6.5.1 In addition to classifying radioactive waste by the concentration of nuclides present in the material, the waste must also meet the form and stability requirements set forth in Reference 4.2.
- 6.5.2 The NRC Technical Position on Waste Form, Rev. 0, May 1983 contains the requirements and tests necessary to comply with the form and stability requirements of Reference 4.2.
- 6.5.3 The following requirements are minimum requirements for all classes of waste:
1. Waste must not be packaged for disposal in cardboard or fiberboard boxes.
 2. Liquid waste must be shipped or packaged in sufficient absorbent material to absorb twice the volume of the liquid.
 3. Solid waste containing liquid shall contain as little free standing and noncorrosive liquid as is reasonably achievable, but in no case shall the liquid exceed 0.5% of the volume.
 4. Waste shall not be readily capable of detonation or of explosive composition or reaction at normal pressures and temperatures, or of explosive reaction with water.
 5. Water must not contain, or be capable of generating quantities of toxic gases, vapors, or fumes harmful to persons transporting, handling, or disposing of the waste.
 6. Waste must not be pyrophoric. Pyrophoric materials contained in waste shall be treated, prepared, and packaged to be nonflammable.
 7. Waste in a gaseous form must be packaged at a pressure that does not exceed 1.5 atmospheres at 20°C. Total activity must not exceed 100 curies per container.
 8. Waste containing hazardous, biological, pathogenic, or infectious material must be treated to reduce to the maximum extent practicable the potential hazard from the non-radiological materials.

INFORMATION
ONLY

6.5.4 In addition to the minimum requirements of paragraph 6.5.3, Class B and C wastes are required to have stability. In order to ensure that Class B and C waste or its container will maintain its stability, the following conditions need to be met:

1. The waste should be a solid form or in a container or structure that provides stability after disposal.
2. The waste should not contain free standing and corrosive liquids. The wastes should contain only trace amounts of drainable liquid, and in no case may the volume of free standing liquid exceed one percent of the waste volume when wastes are disposed of in containers designed to provide stability, or 0.5 percent of the waste volume for solidified waste.
3. The waste or container should be resistant to degradation caused by radiation effects.
4. The waste or container should be resistant to biodegradation.
5. The waste or container should remain stable under the compressive loads inherent in the disposal environment.
6. The waste or container should remain stable if exposed to moisture or water after disposal.
7. The as-generated waste should be compatible with the solidification media or container.

6.5.5 In order to ensure radioactive waste meets the federal requirements for burial, all processed radioactive waste is processed and tested in accordance with the Process Control Program (PCP), OM12E: PCP. The Process Control Program provides the requirements and tests necessary to demonstrate the final waste product meets the form and stability requirements of the applicable waste classification.

6.5.6 An alternative to processing some Class B or C waste streams, particularly ion exchange resins and filter sludges, is the use of a high integrity container (HIC). The high integrity container would be used to provide the long-term stability required to meet the stability requirements in Reference 4.2.

INFORMATION
ONLY

NOTE: The radioactive waste shipping computer program is normally used to perform the required waste classification calculations. If the computer program is used, use of the waste classification worksheet is not required.

6.6 Instructions for Completing the Waste Classification Worksheet
(Attachment 5)

6.6.1 The number preceding each of the following instructions corresponds to the applicable item on the worksheet.

6.6.2 Instructions:

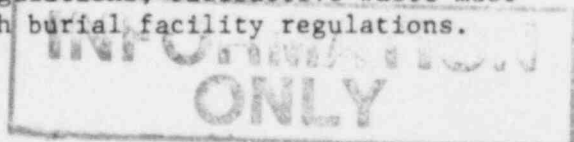
1. Enter the process batch number if applicable.
2. Enter the type of waste (i.e., DAW, resins, etc.).
3. Enter the package numbers for which the worksheet applies.
4. Determine the waste classification based on the long-lived nuclides as follows:
 - a. Enter the activity of each nuclide listed in Table II in the appropriate column. If the activity of any nuclide exceeds the Column 1 limit for that nuclide, enter the activity of each nuclide in Column 2.
 - b. If the nuclide listed in the table is not present in the radioactive waste, enter "NP" in the activity block.
 - c. Calculate the unity factor for each nuclide by dividing the activity of the nuclide by its limit.
 - d. Add the unity factors in the column to obtain the total unity factor.
 - e. If the Column 1 total unity factor is less than one the waste is classified based on the Table II nuclide concentration.
 - f. If the Column 1 total unity factor is one or greater, the unity factors must be calculated using Column 2 limits.
 - g. If the Column 2 total unity factor is less than one, the waste is Class C provided the Table II nuclide concentrations do not exceed the Column C limits.
 - h. If the column 2 total unity factor is one or greater the waste is generally not acceptable for disposal. Enter "N" in the Waste Class block (16).

INFORMATION
ONLY

5. Determine the waste classification based on the short-lived nuclides as follows:
 - a. Enter the activity of each nuclide listed in Table II in the appropriate column. If the waste was classified as Class C in Table I, enter the Table II nuclides in Column C.
 - b. If the nuclide listed in the table is not present in the radioactive waste, enter "NP" in the activity block.
 - c. Calculate the unity factor for each nuclide by dividing the activity of the nuclide by its limit.
 - d. Add the unity factors in the column to obtain the total unity factor.
 - e. If the Column A total unity factor is less than one, the waste is Class A.
 - f. If the Column A total unity factor is one or greater, calculate the unity factors for each nuclide using Column B limits. If the Column B total unity factor is less than one, the waste is Class B.
 - g. If the Column B total unity factor is one or greater, calculate the unity factor for each nuclide using Column C limits. If the Column C total unity factor is less than one, the waste is Class C.
 - h. If the Column C total unity factor is one or greater, the waste is generally not acceptable for disposal, enter "N" in the Waste Class Block (6).
6. Enter the appropriate waste class in the block. Enter "N" if the waste is not acceptable for disposal.
7. Enter the total activity of all nuclides in the waste with half-lives greater than five years.
8. Check the appropriate box based on the following:
 - a. Waste Class B and C must be STABLE.
 - b. Class A wastes shipped to the Barnwell disposal facility must be STABLE if the total activity of all radionuclides with half-lives greater than five years is 1 uCi/cc or greater.
 - c. All other Class A wastes may be UNSTABLE.
9. Date and sign the worksheet.

6.7 Packaging Radioactive Waste for Shipment

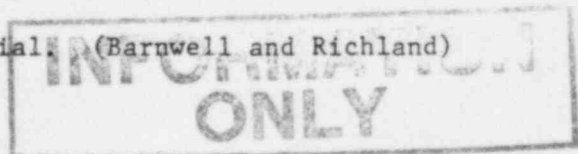
- 6.7.1 In addition to DOT and NRC regulations, radioactive waste must be packaged in accordance with burial facility regulations.



- 6.7.2 Processed radioactive waste and dry active waste (DAW) are packaged in accordance with the applicable Radwaste solidification or compacting instruction. These packages shall then be marked, labeled, and otherwise prepared for shipment in accordance with this procedure.
- 6.7.3 Some requirements for packaging are based on the burial facility to which the waste will be shipped to. If a requirement for packaging the waste is specific to one burial facility, the applicable burial facility is listed in parentheses next to the requirement.
- 6.7.4 Inspect each packaging for the following:
- Holes or openings where radioactive contents may leak.
 - Seals and closure devices are intact and operate properly.
 - Rust or corrosion is removed and the area is repainted as necessary.
 - Large dents or dents which may affect the integrity of the package.
 - Nails or fasteners which protrude into the package interior.

NOTE: The Radioactive Shipment Coordinator shall be informed of any package that does not meet the inspection or test requirements specified in this procedure. The affected package shall not be used for shipment unless it can be satisfactorily repaired and reinspected.

- 6.7.5 LSA radioactive waste that is shipped in an exclusive use vehicle shall be packaged in a strong tight package such that there will be no leakage of the material under normal conditions of transportation.
- 6.7.6 LSA waste shall be packaged so that under conditions normally incident to transportation the radiation level does not exceed 200 mr/hr on the accessible external surface of the package unless the shipment is made in a closed transport vehicle in which case the limit is 1000 mr/hr.
- 6.7.7 LSA waste shall be packaged so that void spaces in the package are reduced to a minimum, but in no case shall the volume of the waste be less than 85% of the package volume. (Barnwell)
- 6.7.8 The following material is prohibited from burial at the indicated disposal facility:
- Any pyrophoric material. (Barnwell and Richland)



- b. Toluene, xylene, dioxane, scintillation liquids, or other organic liquids or solids with similar chemical properties or packaging which have at any time contained any of these liquids. (Barnwell, Richland)
- c. Chelating agents with concentrations greater than 8 percent by weight. (Barnwell)
- d. Waste containing transuranic nuclides with concentrations greater than 10 uCi/gm. (Barnwell, Richland)
- e. Radioactive waste containing toxic and hazardous chemicals whose chemical hazard exceeds the radiological hazard. (Barnwell, Richland)
- f. Waste containing oil or lubricants in concentrations greater than 1% by waste volume. (Barnwell)

6.7.9 For the purposes of this procedure, chelating agents include the following:

- a. Amine polycarboxylic acids (e.g., EDTA, DTPA);
- b. Hydroxy-carboxylic acids; and
- c. Polycarboxylic acids (e.g., citric acid, carbolic acid, and glucinic acid).

6.7.10 Radioactive waste shall not contain any detectable free standing liquid. Free standing liquid is defined as 0.5 percent liquid by volume per package. The Barnwell facility allows up to 1 percent liquid by volume for solidified or dewatered waste that is disposed of in a high integrity container that is approved by the South Carolina Department of Health and Environmental Control (DHEC).

6.7.11 All wooden boxes shall be banded with metal bands. Drums shall have the threads interrupted on the closure bolt so that the nuts do not come loose during transportation.

6.7.12 Each package of LSA waste shall be marked with the following:

- 1. "RADIOACTIVE LSA" - Must be marked on two sides of the package (excluding the top and bottom), except that drums require only one marking on the side of the drum.
- 2. Package identification number.
- 3. The waste class (A, B, or C).

6.7.13 Each package of LSA waste should be marked with the weight of the package.

6.7.14 The waste class shall be marked on each package, in letters greater than one-half inch high, as follows:

**INFORMATION
ONLY**

1. For shipments to Barnwell the waste class shall be marked on the top of the package as follows:
 - a. Class A unstable waste shall be marked "Class A".
 - b. Class A stable waste shall be marked "Class A-S".
 - c. Class B and C waste shall be marked "Class B" or "Class C".
 2. For shipments to Richland, the waste class shall be marked in close proximity (within six inches) to each radioactive marking or label. Waste marked "RADIOACTIVE - LSA" need only have one classification marking. The classification markings shall appear as follows:
 - a. Class A unstable waste shall be marked "Class A Unstable".
 - b. Class A stable waste shall be marked "Class A Stable".
 - c. Class B and C waste shall be marked "Class B" or "Class C".
- 6.7.15 Contamination surveys shall be performed on the package after loading and closing. Contamination levels on the external surface of the package shall not exceed:
- a. 2,200 dpm/100 cm² beta-gamma contamination, and
 - b. 220 dpm/100 cm² alpha contamination.

6.8 Hazardous Material Shipping Document Requirements

- 6.8.1 Shipping documents are a communication device designed to provide pertinent information about hazardous material contained in the shipment. For this reason it is important that the documents are complete, accurate, and legible.
- 6.8.2 Although there is no standard form for hazardous material shipping documents, there are requirements for what information is to be entered on the documents.
- 6.8.3 The shipping description of a hazardous material listed on the shipment document must include:
 - a. The proper shipping name prescribed for the material in Reference 4.4, part 172.101, Hazardous Material Table.
 - b. The hazard class prescribed for the material in the Hazardous Material Table. Except for a proper shipping name that contains words describing more than one hazard class, inclusion of the hazard class is not required when the words of the proper shipping name contain the key word or words of the hazard class of the material, such

INFORMATION
ONLY

- as Radioactive Material, LSA, n.o.s.
- c. The identification number (preceded by "UN" or "NA" as appropriate) prescribed for the material in the Hazardous Material Table.
 - d. Except for empty packagings, the total quantity (by weight, volume, or as otherwise appropriate) of the hazardous material covered by the description.
 - e. The basic description specified in paragraphs a., b., and c. of this section must be shown in sequence.
 - f. The total quantity of the material covered by one description must appear before or after, or both before and after the description of the material.
 - g. Abbreviations may be used to specify the type of packaging and weight or volume. Example: 1 Dr. Radioactive Material, LSA, n.o.s., UN2912, 100 lbs.
 - h. The type of packaging and destination marks may be entered in any appropriate manner before or after the basic description.
 - i. Technical and chemical group names may be entered in parentheses between the proper shipping name and hazard class.
 - j. Each shipping document issued in connection with a shipment made under an exemption must bear the notation "DOT-E" followed by the exemption number assigned and so located that the notation is clearly associated with the description to which the exemption applies.
 - k. The description for a material offered for transportation as "limited quantity" must include the words "Limited Quantity" or "Ltd. Quantity" following the basic description.

6.8.4 The description for a shipment of radioactive waste to a disposal facility must also include:

- a. The name, address, and telephone number of the person generating the waste.
- b. The name, address, and telephone number of the person transporting the waste to the land disposal facility.
- c. The name and activity of each radionuclide in the radioactive material.
- d. A description of the physical and chemical form of the material, if the material is not in special form (generic chemical description is acceptable for chemical form).
- 2. The activity contained in each package of the shipment in terms of curies, millicuries, or microcuries. Abbreviations are authorized. For the shipment of a package containing a highway route controlled quantity of radioactive materials, the words "Highway Route Controlled Quantity" must be entered in association with the basic description.

INFORMATION
ONLY

- f. The total activity of the shipment.
- g. The total volume of waste contained in the shipment.
- h. The total quantity of the radionuclides, H-3, C-14, Tc-99 and I-129 must be shown.
- i. The total amount of source material, in pounds, must be shown.
- j. The total amount of Special Nuclear Material, in grams, must be shown.
- k. The type of solidification agent, if used, must be specified.
- l. Waste containing more than 0.1 percent chelating agents by weight must be identified and the weight percentage of the chelating agent estimated.
- m. Wastes classified as Class A, Class B, or Class C in accordance with Reference 4.2, must be identified.
- n. The category of label applied to each package in the shipment. Example: "RADIOACTIVE WHITE-1".
- o. The transport index assigned to each package in a shipment bearing RADIOACTIVE YELLOW-II or RADIOACTIVE YELLOW-III labels.
- q. For a package approved by the U.S. Department of Energy (DOE) or U.S. Nuclear Regulatory Commission (NRC), a notation of the package identification working as prescribed in the applicable DOE or NRC approval.

6.8.5 Each person who offers a hazardous material for transportation shall certify that the material is offered for transportation in accordance with Reference 4.4 by printing (manually or mechanically) on the shipping document containing the required shipping description the following certification:

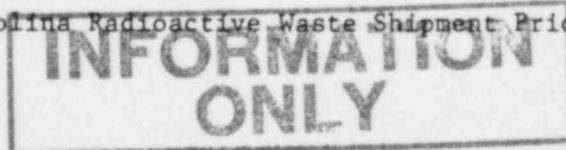
"This is to certify that the above-named materials are properly classified, described, packaged, marked and labeled, and are in proper condition for transportation according to the applicable regulations of the Department of Transportation".

NOTE: In line one of the certification the words "herein-named" may be substituted for the words "above-named".

6.8.6 Shipments of radioactive waste to a disposal facility require the use of the burial facility's Radioactive Shipment Manifest (RSM). Each RSM meets the requirements of Reference 4.1 and 4.4 for radioactive waste shipping documents.

6.8.7 In addition to the radioactive shipment manifest, each shipment of radioactive waste requires the following state forms:

- a. The South Carolina Radioactive Waste Shipment Prior



- b. Notification and Manifest Form, DHEC-802. (Barnwell)
The South Carolina Radioactive Waste Shipment
Certification Form, DHEC-803. (Barnwell)
- c. The Washington State Low-Level Radioactive Waste Shipment
Certification Form, RHF-31A. (Richland)

6.9 Instructions for Completing Shipment Documents

6.9.1 Barnwell Waste Management Facility Radioactive Shipment Manifest (Attachment 6)

The numbers preceding each instruction correspond to the numbered item on the Barnwell RSM. Information must be provided for all numbered items on the RSM form. Use of N/A for "Not Applicable" is authorized.

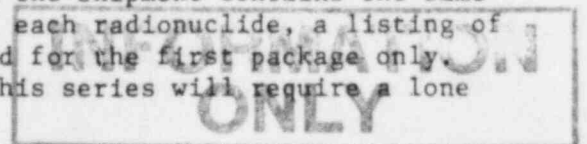
1. Indicate generator name (consignor), address, contact person and phone number of person responsible for making the shipment. Contact person is the Radioactive Shipment Coordinator.
2. The consignee is pre-printed.
3. Each shipment is assigned a volume allocation number by the Barnwell office. Write the number in this space and use this number on all continuation pages used for each shipment. Number all the pages in chronological order.
4. List the carrier, address, telephone number, shipping date, shipment type (van, cask, etc.), shipment surface exposure (highest radiation level on the exterior of the van, cask, etc.), shipment number, liner serial number, driver signature, and date.
5. Indicate the total number of packages and the total weight, in pounds, of each hazard class.
6. Record the cumulative total of all hazard classes in these blocks. Check the appropriate box for the units of activity measurements. If the stated radionuclides listed in the four columns are not present, record in the blocks as "not present" (N.P.). If the radionuclides do exist, but are in quantities less than the lower limit of detection (LLD), the quantities of the nuclides must be recorded as being less than the minimum detectable. The minimum detectable activity must be included in parentheses. Isotopes U-238, Th-232, or any other material which is source material must be recorded in source pounds.

INFORMATION
ONLY

7. List the weight, in grams, of all special nuclear material.
8. Record volume, in cubic feet, of all disposable pallets.
9. Describe briefly what the waste is, if the material is solidified, indicate what solidification media is used. Example: Compacted trash, non-compacted trash, dewatered resin, solidified liquid in cement, solidified resin in cement, filters in cement, compacted lab trash, building rubble, metal components, etc.
10. Record the physical form of the waste material. "Liquid" is not authorized.
11. Record the chemical form of the waste material. If the material contains chelating agents in quantities greater than 0.1%, the names and weight percentage must be listed.
12. Check the appropriate box(es) for each waste class present in the shipment.
13. Indicate if the shipment is transported as exclusive use or not. If "yes" is checked, instructions for maintenance of exclusive use vehicles must be provided by the shipper to the carrier.
14. A company representative of the consignor must sign the DOT certification. All signatures must be legible.
15. A company representative of the generator must sign the S.C. DHEC certification. Title, organization, and phone number must be indicated. The date must be within 48 hours of the shipping date specified in block 4. All signatures must be legible.

Barnwell RSM Continuation Sheet

16. List each package separately. Item number on the disposal package must correspond with the item number listed on the RSM.
17. List the prominent radionuclides in each package. Use of MFP or MCP are not authorized. Use as many lines as necessary to describe the contents of the package. If more than one package in the shipment contains the same activity distribution of each radionuclide, a listing of radionuclides is required for the first package only. Subsequent packages in this series will require a lone



line entry with appropriate information on each. Use of the words, "See attached ...", is not an appropriate entry.

18. Record the percent abundance of each radionuclide or the activity of each radionuclide in uCi, in each package (See Item 17).
19. Record the cumulative total of all isotopes in each package, in uCi.
20. Record the physical form of the waste material. "Liquid" is not authorized.
21. Record the chemical form of the waste material. If the material contains chelating agents in quantities greater than 0.1%, the names and weight percentage must be listed.
22. Describe briefly the waste material is. If the material is solidified, indicate what solidification media is used. Example: Compacted trash, non-compacted trash, dewatered resin, solidified liquid in cement, solidified resin in cement, filters in cement, compacted lab trash or non-compacted lab trash, building rubble, metal components, etc.
23. List the waste classification of the package, either A, B or C.
24. Indicate if the waste is stable (S) or unstable (U).
25. Weight, in grams, of the isotope U-233 or U-235 or any other material which is special nuclear material.
26. Weight, in pounds, of the isotopes U-238, Th-232, or any other material which is source material.
27. Weight, in pounds, of each disposable container including its contents.
28. Record the volume, in cubic feet, of the disposable container. Boxes with attached skids must include the skids in this volume. Drum pallets or spaces inside casks are not classified as container volume. Pallet volumes is chargeable but is not included in volume allocation.
29. List each type of disposable container, such as wood box, steel box, drum, 17H, 17E, STC etc.

INFORMATION
ONLY

30. Record the highest measured radiation level for each disposable container surface. Package surface may be the same as disposable container if a cask is not used. Transport Index (TI) equals mrem/hr at 1 meter from accessible container(s).
31. Record the results of contamination surveys performed on the disposable containers. Do not use "BKG" for background levels unless the background level is indicated in this column.
32. Indicate DOT subtype such as A₁, A₂, LSA, etc.
33. If fissile radioactive material is being shipped, record the fissile class of the material as appropriate.
34. Indicate what kind of DOT labels or markings are used on each container, such as RADIOACTIVE W-1, Y-11, Y-111 or LSA.
35. Record in the indicated blocks, the page totals for the column.

6.9.2 U.S. Ecology Radioactive Shipment Manifest (Attachment 7)

The numbers preceding each instruction correspond to the numbered item on the U.S. Ecology RSM. Information must be provided for all numbered items on the RSM form.

1. Generator Number and Name - In the boxes provided, enter the number assigned to PNPP by U.S. Ecology. Indicate the plant name, address, contact person, and telephone number. The contact person is the Radioactive Shipment Coordinator. The User Permit Number is assigned to PNPP by the State of Washington, and should be consistent with the consigned disposal facility (Item 4). The shipment number should agree with the "Radiation Shipment Record Number" indicated on the Washington State form RHF-31. This number is assigned by the Radioactive Shipment Coordinator.
2. Billing Information - Indicate in this section the exact name, address, and purchase order number which should be used by U.S. Ecology for invoicing. If disposal charges are to be billed to a broker, simply write the word "BROKER" in this section. If U.S. Ecology is the broker, all the information in this section must be completed.
3. Agent/Broker - If an agent or broker is utilized, complete this section listing the Agent or Broker, address,

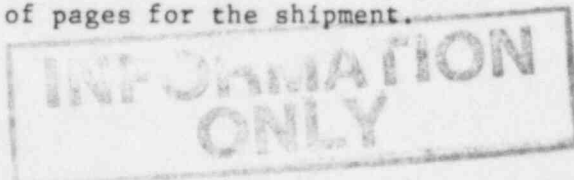
ONLY

contact person, telephone number, and the User Permit Number assigned to the Agent or Broker by the state of Washington. The broker may sign in this area to acknowledge receipt of the waste.

4. Assigned to - Check the box for the Hanford Reservation site.
5. Carrier - Indicate the originating carrier name, address, phone number, and EPA hazardous waste identification number if required. Indicate the shipping date, type of cask used (if any) and the highest cask surface exposure rate.
6. Proper shipping name - Indicate the total number of packages and total weight, in pounds, of all packages in each of the proper shipping name categories. The total weight in this section should equal the total of the weights recorded in column 12 of the continuation sheets.
7. Shipment totals - Indicate the total volume, in cubic feet, and the number of packages for the entire shipment. Pallets and skids are not included in package volumes. Also indicate the total quantity of source material, in kilograms, and special nuclear material, in grams. Ensure the totals, in grams, for U-233, U-235, and Plutonium equals the grand total for special nuclear material. Indicate the quantity of Tritium, C-14, Tc-99, and I-129. The total activity for all isotopes in the shipment is to be indicated in the "ALL ISOTOPES" column. Check the appropriate box for the units of activity used for these isotopes.
8. Signature - The certification must be signed and dated by the person responsible for the packaging and labeling operations and who is authorized to sign on behalf of the company.

Continuation Sheet

- A. Complete the generator number, name, and agent/broker name (if used) in the upper left corner of the continuation sheet.
- B. Transfer the manifest number from page 1 of the manifest to the block in the upper right corner on the continuation sheet. Fill in the page number and total number of pages for the shipment.



C. Item number - Each container must be listed individually, even if each is exactly alike in all respects. The number entered is the identification number stenciled on the container.

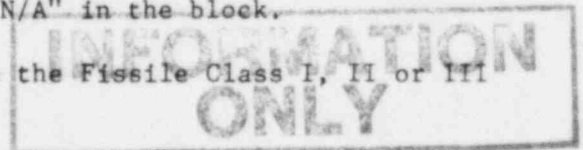
10. Container type - Indicate the type of disposable container used, such as 55-gallon drum, wood box, etc.
11. Container Volume - Indicate the cubic footage of the outside dimensions of each disposable container to the nearest hundredth of a cubic foot. Pallets and skids attached to the container are not to be included in the container volume. Some common containers are:
 - 55 gallon drum - 7.50 cu. ft.
 - 30 gallon drum - 4.01 cu. ft.
 - 5 gallon drum - 0.67 cu. ft.
12. Container weight - List the combined weight of the container plus the contents to the nearest pound.
13. Physical Form - Describe the physical form of the contents in the container. "Solid", "Liquid" or "Gas" are the only acceptable descriptions.
14. Waste description - Using the codes found in NOTE #1 at the bottom of the continuation sheet, indicate the single code which most specifically describes the type of waste in the container. If "OTHER" is used, a written explanation must be attached to the manifest.
15. Solidification or absorbent media - Using the codes found in NOTE #2 at the bottom of the continuation sheet, indicate the single code which identifies the name of the material used to solidify or absorb the waste material. Use of any other material or brand name must be specifically approved by the government authority regulating disposal of the material. Use of "OTHER" in this column requires a written explanation attached to the manifest which will include a copy of the letter of approval from the appropriate government authority.
16. Chemical Form - As accurately as possible, list the most prevalent chemical form, such as cellulose, Na, cement, metallic oxides, toluene, xylene, etc.

Indicate the name and percentage of chelating agents which are present in amounts greater than 0.1% by weight of the waste or greater than 1.0% by package volume. Specify whether the percentage is by weight or volume.

ONLY

If chelating agents are not present or if they represent less than 0.1% by weight, then check the column provided.

17. Radionuclide - List all radionuclides present in the container. Enter each nuclide on a separate line and use as many lines as required for each container. Listing only the most abundant radionuclides or the category "mixed fission products" is not acceptable.
18. Activity - List the activity for each radionuclide. Check the appropriate box at the top of the column to indicate the units used.
19. DOT sub-type - Indicate the Department of Transportation category used to determine the maximum activity allowed in the package. Categories include "A₁", "A₂", "LSA", "HRCQ", "Limited Quantity" (LQ), "Instruments and Articles" (I/A), etc.
20. Special Nuclear Material - List any special nuclear material, in grams.
21. Source Material - Indicate the weight, in kilograms, of source material contained in the shipment.
22. Waste form class - Indicate the waste classification (A, B, or C) of the waste in the container.
23. Stability Class - Indicate the stability of the waste in the container. Use the codes "S" for stable waste and "U" for unstable.
24. Radiation Level - Disposal container surface - Indicate the highest radiation level, in mrem/hr, or contact with the disposable container. Do not enter the values for the exposure levels on the cask (if used).
25. Do not make any marks in this column.
26. Radiation level - Disposal container at 1 meter - List the highest radiation level measured at one meter from the disposable container. Do not enter values for the exposure levels on the cask (if used).
27. Transport Index - Indicate the transport index for the package, if required. If the package does not require a transport index, enter "N/A" in the block.
28. Fissile Class - Indicate the Fissile Class I, II or III as applicable.

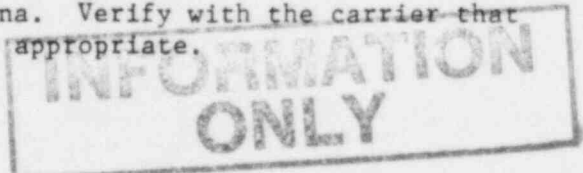


29. DOT label - Indicate the type of label or marking which appears on the package, such as "WHITE-1", "YELLOW-11", or "LSA", etc.
30. Totals - Enter the page totals on each continuation sheet for columns 9, 11, 12 18, 20 and 21.

6.9.3 South Carolina Radioactive Waste Shipment Prior Notification and Manifest Form (Attachment 8)

The numbers preceding each instruction correspond to the numbered item on the Prior Notification Form.

1. Enter the company name and address of PNPP.
2. Enter the name, title, and telephone number of the Radioactive Shipment Coordinator.
3. Enter the South Carolina Waste Transport Permit number assigned to PNPP.
4. Enter the volume allocation number assigned to the shipment.
5. Enter "Perry Nuclear Power Plant
10 Center Road
Perry, OH 44081"
6. Enter "Barnwell Waste Management Facility
P.O. Box 726
Barnwell, S.C. 29812"
7. Enter the date the shipment is expected to leave PNPP.
8. Enter the date the shipment is expected to arrive at Barnwell. This date is normally two days after shipment leaves PNPP.
9. Enter the name of the carrier.
10. Enter the trailer number and owner, if known (exclusive use vehicle only).
11. Enter the type of transport vehicle, such as "van" or "flatbed" (exclusive use vehicle only).
12. List the specific routes the vehicle will take within the State of South Carolina. Verify with the carrier that the routes listed are appropriate.



13-25 Obtain the required information pertaining to the shipment from the manifest and enter it in the appropriate blocks.

The notification statement shall be signed by the General Supervising Engineer, Radiation Protection Section, or designee.

6.9.4 South Carolina Radioactive Waste Shipment Certification Form (Attachment 9)

The South Carolina certification form is a two part form that is to be completed by the shipper and carrier. The information in Part I is to be completed by the Radioactive Shipment Coordinator, or designee. The certification statement shall be signed by the General Supervising Engineer, Radiation Protection Section, or designee. Part II is completed by the carrier upon receipt of the shipment.

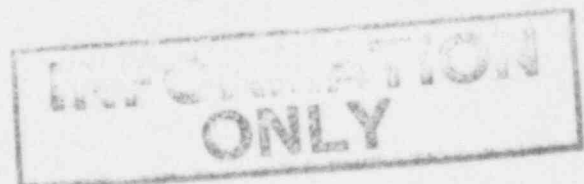
6.9.5 The Washington State Low-Level Radioactive Waste Shipment Certification for Commercial Generator/Packagers, and Brokers and Carriers (Attachment 10)

The Washington State certification form is a three part form that is to be completed by the waste generator, the shipment broker, and the carrier. The information in Section A is to be completed by the Radioactive Shipment Coordinator, or designee. The General Supervising Engineer, Radiation Protection Section, or designee, shall sign the certification in Section A. Section B shall be completed by the broker. If a broker is not used, write "NO BROKER USED" in Section B. The carrier shall complete Section C upon receipt of the shipment.

NOTE: A broker constitutes any person, company, or organization who takes possession of waste from a generator and assumes responsibility for that waste.

6.9.6 Exclusive Use Shipment Checklist (Attachment 11)

The Exclusive Use Shipment Checklist shall be completed by the Radioactive Shipment Coordinator or his designee. A Quality Control Inspector shall witness the steps indicated on the checklist. Initials shall be placed in the appropriate blocks upon completion of the step. The checklist shall be signed by the appropriate personnel upon satisfactory completion.



6.9.7 Vehicle Inspection Form (Attachment 12)

The instructions for completing the Vehicle Inspection Form are contained on the form. The individual performing the inspection shall sign the certification statement after the vehicle has been satisfactorily inspected.

6.9.8 Isotopic Analysis Results Form (Attachment 13)

The Isotopic Analysis Results Form shall be completed for each shipment to the Barnwell disposal facility that contains resins or aqueous filter media (including filters). A computer printout may be used in lieu of Attachment 13, provided the following information is contained on the printout.

- a. Radionuclides present
- b. Percent abundance of each radionuclide
- c. Curie Content
- d. Specific activity of each radionuclide expressed in microcuries per cubic centimeter. Transuranics shall be expressed in nanocuries per gram.

6.10 Selection of Transport Vehicle for Waste Shipments

6.10.1 Whenever possible, a closed transport vehicle should be used for radioactive shipments. A closed transport vehicle provides better protection from the elements, is less conspicuous in public, and in some cases allows for higher radiation levels on the packages.

6.10.2 An open flatbed trailer may be used to ship casks and large boxes of LSA radioactive material providing the following radiation limits are not exceeded:

- a. 200 mr/hr on the accessible external surfaces of the package (PNPP guide value is 180 mr/hr).
- b. 200 mr/hr at any point on the vertical planes projected from the outer edges of the transport vehicle, or the upper surface of the load, and on the lower external surface of the transport vehicle (PNPP guide value is 180 mr/hr).
- c. 10 mr/hr at any point 2 meters (6.6 feet) from the vertical planes projected from the outer edges of the transport vehicle (PNPP guide value is 9 mr/hr).
- d. 2 mr/hr in any normally occupied position in the transport vehicle (this includes sleeper cabs), except that this provision does not apply to private motor carriers when personnel are operating under the radiation

INFORMATION
ONLY

protection program and wear exposure devices (PNPP guide value is 1.8 mr/hr).

NOTE: The General Supervising Engineer, Radiation Protection Section may authorize the PNPP Guide Values to be exceeded, but in no case shall the radiation levels exceed the DOT limits.

- 6.10.3 A van or shielded van may be used to ship packages of LSA radioactive material. The radiation limits for an exclusive use closed transport are as follows:
- a. 1000 mr/hr as the accessible external surfaces of the package (PNPP guide value is 900 mr/hr).
 - b. 200 mr/hr at any point on the outer surfaces of the transport vehicle, including the upper and lower surfaces (PNPP guide value is 180 mr/hr).
 - c. 10 mr/hr at any point 2 meters (6.6 feet) from the vertical planes represented by the outer lateral surfaces of the transport vehicle (PNPP guide value is 9 mr/hr).
 - d. 2 mr/hr in any normally occupied position in the transport vehicle (this includes sleeper cabs), except that this provision does not apply to private motor carriers when personnel are operating under a radiation protection program and wear radiation exposure devices (PNPP guide value is 1.8 mr/hr).
- 6.10.4 Whenever possible, use a canvas or roll top van for drum shipments to the Barnwell disposal facility. The open top van allows the use of a crane with a suction pick-up to off-load the drums. This eliminates the need for palletizing the drums, thereby reducing burial volume.
- 6.10.5 Drums and liners that exceed the radiation limits in paragraph 6.10.2 or 6.10.3, require the use of a shipping cask in order to comply with federal radiation limits for shipments. In this case the cask becomes the package and must be marked and labeled as such. A guide for selection of a proper shipping cask is contained in Reference 4.13.
- 6.11 Preparing a Loading Plan
- 6.11.1 A loading plan is useful for reducing the amount of time it takes to load a shipment, reduces man-rem exposure, and reduces the possibility of having to change the load on a vehicle due to weight distribution or radiation levels.

INFORMATION
ONLY

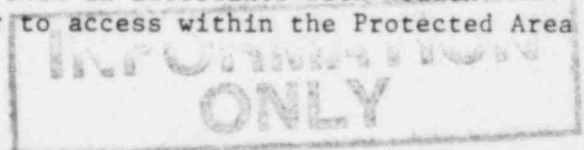
- 6.11.2 For most radioactive shipments the loading plan need only consist of knowing which packages are to be loaded, however, a detailed loading plan is necessary if any or all of the following conditions exist:
- a. Exclusive use shipments that contain packages with radiation levels at or above 200 mr/hr;
 - b. Non-cask shipments to a burial facility;
 - c. Exclusive use shipments that will have packages stacked on one another; or
 - d. Exclusive use shipments that approach the weight or volume limits of the vehicle.
- 6.11.3 A vehicle should be loaded so that the weight is distributed evenly over the trailer. If the weight cannot be distributed evenly, the heaviest portion of the load should be placed over the axle.
- 6.11.4 Heavier packages shall be loaded on the bottom of the shipment. Drums weighing in excess of 300 pounds shall be placed on the bottom of the shipment unless shipped in an open top van.
- 6.11.5 Packages (other than drums) must have a minimum clearance of three inches from the van walls. (Barnwell)
- 6.11.6 Packages must have a top clearance of at least twelve inches in a closed van.
- 6.11.7 Packages weighing more than 8000 pounds shall not be shipped in a closed top van.
- 6.11.8 Attachment 14 shows the inside dimensions for standard trailers used for shipments. Also shown in the table is the number of unpalletized 55 gallon drums per layer the trailer will hold and the number of 6-drum pallets that will fit in the trailer (1 layer).
- 6.11.9 Unstable Class A waste must not be mixed with other waste classes on the same pallet. Unstable Class A waste should be segregated from other wastes as much as possible. Normally unstable Class A wastes are placed in the forward part of the trailer.
- 6.11.10 Shipments should normally be loaded so that the packages with the highest radiation levels are placed in the center of the load. Careful attention should be paid to the radiation levels on the bottom of packages that are loaded on the van floor, and to the radiation levels on the top of packages that are loaded on the top stack of packages.

INFORMATION
ONLY

- 6.11.11 To the extent practicable packages should be arranged with the highest dose rate surfaces facing inboard when loaded in vans, and facing inboard and to the rear when loaded on flatbed trailers.
- 6.11.12 Boxes and unpalletized drums may be stacked but shall be segregated. Boxes should not be stacked on unpalletized drums nor unpalletized drums on boxes.
- 6.11.13 When a loading plan is established, the shipment should be prestaged, if possible, in such a manner so loading equipment can access the packages in the order they are to be loaded. Prestaging the packages also allows for inspection of the shipment.

6.12 Loading a Transport Vehicle

- 6.12.1 Transport vehicles consigned as exclusive use shall be inspected for road-worthiness prior to loading. The Vehicle Inspection Form, Attachment 12, shall be used to perform and record the inspection. The completed form shall be kept on file with the appropriate shipment paperwork.
- 6.12.2 Transport vehicles consigned for shipment to the Richland disposal facility must have a Washington State Patrol or Washington State Utilities and Transportation Commission vehicle inspection certificate, or a visible Washington State 90 day vehicle inspection seal.
- 6.12.3 All shipments of radioactive material consigned as exclusive use shall be inspected by the Radioactive Shipment Coordinator, or his designee, prior to release of the shipment. The Exclusive use Shipment Checklist, Attachment 11, shall be used to record the results of these inspections.
- 6.12.4 Prior to loading a transport vehicle consigned for shipment to the Barnwell disposal facility, verify that a prior notification form (Attachment 8) was completed and mailed to the South Carolina DHEC, and the Barnwell disposal facility in time so they have 72 hours notice before the shipment reaches South Carolina.
- 6.12.5 Transport vehicles that are placarded "RADIOACTIVE" shall have a photograph taken of each of the four sides of the vehicle showing the placarding, and a photograph of the load showing any bracing and shoring.
- 6.12.6 All exclusive use vehicles shall have radiation and contamination surveys performed on them in accordance with Health Physics instructions prior to access within the Protected Area



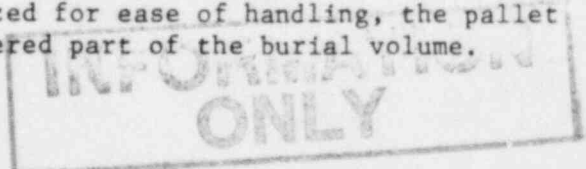
Boundary. Results of these surveys shall be kept on file with the shipment paperwork.

6.12.7 Open flatbed trailers shall be loaded as follows:

1. The loading plan (if required) shall be used during loading operations. Any deviations from the loading plan must be approved by the Radioactive Shipment Coordinator, or designee
2. Packages, other than drums, shall have sufficient bottom clearance to allow for placement of lifting slings or forklift operations.
3. Drums weighing more than 800 pounds must be palletized and banded together on each pallet. (Barnwell)
4. Packages shall be secured to the trailer bed with chains and binders or straps and winches supplied by the carrier.
5. Additional bracing may be provided by installing toeboards. Toeboards will normally be sections of 2 x 4's nailed to the bed of the trailer.
6. A tamper indicating seal shall be installed on the closures of Type A and Type B packages and casks.
7. The four sides of the trailer and the front of the tractor shall be placarded "RADIOACTIVE". Extra placards shall be provided to the driver as replacements in the event a placard is lost during transit.
8. A radiation and contamination survey shall be performed on the loaded trailer and tractor. The radiation levels shall not exceed the limits specified in paragraph 6.10.2 of this procedure. Results of the surveys shall be filed with the shipment paperwork.

6.12.8 Closed transport vehicles without open tops shall be loaded as follows:

1. The loading plan (if required) shall be used during loading operations. Any deviations from the loading plan must be approved of by the Radioactive Shipment Coordinator, or designee.
2. Drums need not be palletized when shipped to Richland. If drums are palletized for ease of handling, the pallet volume is not considered part of the burial volume.



3. Drums weighing less than 600 pounds need not palletized when shipped to Barnwell, but a surcharge will be assessed. Drums weighing 600 pounds or more must be palletized. Pallet volume is charged as burial volume. Drums weighing more than 1250 pounds will not be accepted.
4. Packages, other than drums, must have a minimum clearance of three inches from the van walls. (Barnwell)
5. Packages must have a top clearance of twelve inches from the van roof.
6. Packages, other than drums, shall have sufficient bottom clearance to allow for forklift operations.
7. Blocking and bracing shall be installed to prevent shifting of the load during transportation.
8. Tamper indicating seals shall be installed on the doors of the van in such a way so as to give evidence if the doors are opened.
9. The four sides of the trailer and the front of the tractor shall be placarded "RADIOACTIVE". Extra placards shall be provided to the driver as replacements in the event a placard is lost during transit.
10. A radiation and contamination survey shall be performed on the loaded trailer and the tractor. The radiation levels shall not exceed the limits specified in paragraph 6.10.3 of this procedure. Results of the surveys shall be filed with the shipment paperwork.

6.12.9 Closed transport vehicles with open tops shall be loaded as follows:

1. The loading plan (if required) shall be used during loading operations. Any deviations from the plan must be approved by the Radioactive Shipment Coordinator, or designee.
2. Drums need not be palletized when shipped to Richland. If drums are palletized for ease of handling, the pallet volume is not considered part of the burial volume.
3. Drums weighing less than 800 pounds should not be palletized when shipped to Barnwell, to permit use of a vacuum offloader. Drums weighing 800 pounds or more must be palletized. Pallet volume is charged as burial

INFORMATION
ONLY

volume. Drums weighing more than 1250 pounds will not be accepted.

4. Packages, other than drums, must have a minimum clearance of three inches from the van walls, unless fixed slings are attached. (Barnwell)
5. Packages, other than drums, shall have sufficient bottom clearance to allow for placement of lifting slings or forklift operation.
6. Blocking and bracing should be installed to prevent shifting of the load during transportation.
7. Tamper indicating seals shall be installed on the doors of the van in such a way so as to give evidence if the doors are opened.
8. The four sides of the trailer and the front of the tractor shall be placarded "RADIOACTIVE". Extra placards shall be provided to the driver as replacement in the event a placard is lost during transit.
9. A radiation and contamination survey shall be performed on the loaded trailer and the tractor. The radiation levels shall not exceed the limits specified in paragraph 6.10.3 of this procedure. Results of the surveys shall be filed with the shipment paperwork.

6.12.10 Prior to departure, the driver shall be briefed on the following:

- a. Type of material being transported;
- b. Any special routing instructions (these are to be supplied in writing);
- c. Maintenance of exclusive use vehicle. The Instructions for Maintaining Exclusive Use Vehicle, Attachment 15, shall be signed by the driver and a copy provided to him. The original shall be placed in the shipment file;
- d. Emergency response in the event of an accident. The Response to Transportation Incidents, Attachment 16 shall be supplied to the driver; and
- e. Any other special instructions concerning the shipment.

6.12.11 Prior to the shipment leaving the site, notify the burial facility of the date and time of departure. Notify Barnwell at (803) 758-7806 and Richland at (509) 377-2411.

INFORMATION
ONLY

6.13 Verification of Receipt of Waste Shipments

- 6.13.1 The disposal facility is required to acknowledge receipt of the waste shipment within one week of receipt by returning a signed copy of the manifest or equivalent documentation.
- 6.13.2 If receipt of the shipment has not been acknowledged within 20 days, an investigation shall be conducted as follows:
- a. Contact disposal site and the carrier to determine if the shipment arrived at the disposal site, and if not, the location of the shipment and the reasons for non-delivery.
 - b. Within two weeks of the completion of the investigation, a written report shall be prepared and submitted to the US NRC, Region III, Office of Inspection and Enforcement, 799 Roosevelt Road, Glen Ellyn, Illinois, 60137.
- 6.13.3 Verification of receipt and a copy of any investigation report (if applicable) shall be filed with the shipment paperwork.

6.14 Records

- 6.14.1 The following documents are generated by this procedure:

Quality Assurance Records

Barnwell Waste Management Facility Radioactive Shipment
Manifest
South Carolina Radioactive Waste Shipment Prior Notification
and Manifest Form
South Carolina Radioactive Waste Shipment Certification Form
U.S. Ecology Radioactive Shipment Manifest
Washington State Low-Level Radioactive Waste Shipment
Certification
Carrier's Bill of Lading
High Integrity Container Certification
Instructions for Maintaining Exclusive Use Vehicle, PNPP 6606
Written statement of any unusual conditions or hazards
Exclusive Use Shipment Checklist, PNPP 6608
Vehicle Inspection Form, PNPP 6610
Package Surveys
Vehicle arrival surveys
Vehicle departure surveys
Verification of Receipt from burial facility
Lost shipment investigation report to NRC
Photographs of Transport vehicle showing placarding and load
bracing
Waste Classification Worksheet, PNPP 6626
Isotopic Analysis Results Form, PNPP 6675

INFORMATION
ONLY

Quality Assurance Records (Cont.)

LSA Worksheet, PNPP 6604
Routing Instructions

Non Quality Records

None

Records identification and disposition are accomplished in accordance with the Records Retention/Disposition Schedule (RR/DS) and handled in accordance with PAP-1701, Plant Records Management.

- 6.14.2 The records generated by this procedure are to be filed together in the applicable shipment document package.
- 6.14.3 The following notations are used to indicate the distribution of the records:
- a. (Shipment) - The original document is included in the shipment package that the carrier delivers to the consignee.
 - b. (Carrier) - The document is included in the package the carrier retains for their records.
 - c. (File) - The document is filed with all records generated under the same shipment number in the shipment package.
 - d. (Mailed/DHEC) - The original document is mailed to the South Carolina Department of Health and Environmental Control at least 72 hours prior to shipment.
 - e. (Mailed/CNSI) - The document is mailed to Chem-Nuclear Systems Inc. at the Barnwell Waste Management Facility at least 72 hours prior to shipment.
 - f. (Mailed/U.S. Ecology) - The document is mailed to U.S. Ecology at the Richland disposal facility at the time of shipment.
- 6.14.4 The document package for radioactive waste shipments to the Barnwell disposal facility shall include:
- a. Barnwell Waste Management Facility Radioactive Shipment Manifest, (Attachment 6).
(Shipment) (Carrier) (File)
 - b. South Carolina Prior Notification and Manifest Form (Attachment 8).
(Shipment) (File) (Mailed/DHEC) (Mailed/CNSI)
 - c. South Carolina Radioactive Waste Shipment Certification Form (Attachment 9).
(Shipment) (Carrier) (File)

INFORMATION
ONLY

- d. Isotopic Analysis Results Form, (Attachment 13), if applicable.
(Shipment) (File)
- e. Instructions for Maintaining Exclusive Use Vehicle, (Attachment 15).
(Shipment) (Carrier) (File)
- f. Carrier's Bill of Lading (if required by the carrier).
(Shipment) (Carrier) (File)
- g. Response to Transportation Incidents (Attachment 16).
(Carrier)
- h. High Integrity Container Certification (if applicable).
(Shipment) (File)
- i. Written statement of any unusual conditions or hazards (if applicable).
(Shipment) (Mailed/CNSI) (File)
- j. LSA Worksheet (Attachment 2).
(File)
- k. Waste Classification Worksheet (Attachment 5).
(File)
- l. Exclusive Use Shipment Checklist (Attachment 11).
(File)
- m. Vehicle Inspection Form (Attachment 12).
(File)
- n. Package surveys.
(File)
- o. Vehicle arrival surveys.
(File)
- p. Vehicle departure surveys.
(File) (Shipment)
- q. Routing Instructions (if applicable)
(Carrier) (File)

6.14.5 The document package for radioactive waste shipments to the Richland disposal facility shall include:

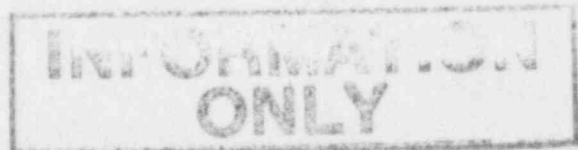
- a. U.S. Ecology Radioactive Shipment Manifest
(Attachment 7).
(Shipment) (Carrier) (File) (Mailed/U.S. Ecology)
- b. Washington State Low-Level Radioactive Waste Shipment Certification (Attachment 10).
(Shipment) (Carrier) (File)
- c. Instructions for Maintaining Exclusive Use Vehicle
(Attachment 15).
(Shipment) (Carrier) (File)
- d. Carrier's Bill of Lading (if required by carrier).
(Shipment) (Carrier) (File)
- e. Response to Transportation Incidents (Attachment 16).
(Carrier)

INFORMATION
ONLY

- f. Written statement of any unusual conditions or hazards (if applicable).
(Shipment)(Mailed/U.S. Ecology)(File)
- g. LSA Worksheet (Attachment 2).
(File)
- h. Waste Classification Worksheet (Attachment 5).
(File)
- i. Exclusive Use Shipment Checklist (Attachment 11).
(File)
- j. Vehicle Inspection Form (Attachment 12).
(File)
- k. Package Surveys
(File)
- l. Vehicle Arrival Surveys
(File)
- m. Vehicle Departure Surveys
(File) (Shipment)
- n. Routing Instructions (if applicable)
(Carrier) (File)

7.0 ATTACHMENTS

- 7.1 Attachment 1 - Table of A_1 and A_2 Values for Radionuclides.
- 7.2 Attachment 2 - Form: PNPP No. 6604, LSA Worksheet.
- 7.3 Attachment 3 - Table I.
- 7.4 Attachment 4 - Table II.
- 7.5 Attachment 5 - Form: PNPP No. 6626, Waste Classification Worksheet.
- 7.6 Attachment 6 - Barnwell Waste Management Facility Radioactive Shipment Manifest.
- 7.7 Attachment 7 - U.S. Ecology Radioactive Shipment Manifest.
- 7.8 Attachment 8 - South Carolina Radioactive Waste Shipment Prior Notification and Manifest Form, DHEC 802.
- 7.9 Attachment 9 - South Carolina Radioactive Waste Shipment Certification Form, DHEC 803.
- 7.10 Attachment 10 - Washington State Low-Level Radioactive Waste Shipment Certification for Commercial Generator/Packages and Brokers and Carriers, RHF-31A.



OMIA: PAP-1309
Page: 40
Rev.: 0

- 7.11 Attachment 11 - Form: PNPP No. 6608, Exclusive Use Shipment Checklist.
- 7.12 Attachment 12 - Form: PNPP No. 6610, Vehicle Inspection Form.
- 7.13 Attachment 13 - Form: PNPP No. 6675, Isotopic Analysis Results Form.
- 7.14 Attachment 14 - Standard Transport Van Dimensions (Inside).
- 7.15 Attachment 15 - Form: PNPP No. 6606, Instructions for Maintaining Exclusive Use Vehicle.
- 7.16 Attachment 16 - Response to Transportation Incidents.

INFORMATION
ONLY

TABLE OF A1 and A2 VALUES
FOR RADIONUCLIDES

Element and Atomic Number	Symbol of Radionuclide	Limited Qty. ¹ Normal Form (Ci)	A1 Special Form (Ci)	A2 Normal Form (Ci)	Highway Rt. ¹ Controlled Qty. Normal Form (Ci)	LSA Limit (mCi/gm)	Advance ⁷ Notification (Ci)
Actinium (89)	227 Ac	3E-6	1,000	0.003	9	0.0001	20
	228 Ac	0.004	10	4	12,000	0.3	20
Americium (95) ²	241 Am	8E-6	8	0.008	24	0.0001	20
	243 Am	8E-6	8	0.008	24	0.0001	20
Antimony (51)	122 Sb	0.03	30	30	30,000	0.3	200
	124 Sb	0.005	5	5	15,000	0.3	200
	125 Sb	0.025	40	25	30,000	0.3	200
Argon (18)	37 Ar (compressed or uncompressed)	1.0	1,000	1,000	30,000	0.3	50,000
	41 Ar (uncompressed)	0.02	20	20	30,000	0.3	5,000
	41 Ar (compressed)	0.001	1	1	3,000	0.005	20
Arsenic (33)	73 As	0.4	1,000	400	30,000	0.3	200
	74 As	0.02	20	20	30,000	0.3	200
	76 As	0.01	10	10	30,000	0.3	200
	77 As	0.02	300	20	30,000	0.3	200
Astatine (85)	211 At	0.007	200	7	21,000	0.3	200
Barium (56)	131 Ba	0.04	40	40	30,000	0.3	200
	133 Ba	0.01	40	10	30,000	0.3	200
	140 Ba	0.02	20	20	30,000	0.3	200
Berkelium (97)	249 Bk	0.001	1,000	1	3,000	0.005	200
Beryllium (4)	7 Be	0.3	300	300	30,000	0.3	200
Bismuth (83)	206 Bi	0.005	5	5	15,000	0.3	200
	207 Bi	0.01	10	10	30,000	0.3	200
	210 Bi (RaE)	0.004	100	4	12,000	0.3	20
	212 Bi	0.006	6	6	18,000	0.3	200
Bromine (35)	77 Br	0.025	70	25	30,000	0.3	200
	82 Br	0.006	6	6	18,000	0.3	200
Carbon (6)	109 Cd	0.07	1,000	70	30,000	0.3	200
	115 m Cd	0.03	30	30	30,000	0.3	200
	115 Cd	0.02	80	20	30,000	0.3	200
	45 Ca	0.025	1,000	25	30,000	0.3	200
	47 Ca	0.02	20	20	30,000	0.3	200

Element and Atomic Number	Symbol of Radionuclide	Limited Qty. Normal Form (Ci)	A1 Special Form (Ci)	A2 Normal Form (Ci)	Highway Rt. Controlled Qty. Normal Form (Ci)	LSA Limit (mCi/gal)	Advanced Notification (Ci)
Californium (98)	249 Cf	2E-6	2	0.0025	27	0.0001	20
	250 Cf	7E-6	7	0.009	27	0.0001	20
	252 Cf	9E-6	2	20	30,000	0.3	200
Carbon (6)	11 C	0.02	20	60	30,000	0.3	200
	14 C	0.06	1,000	100	30,000	0.3	200
Cerium (58)	139 Ce	0.1	300	25	30,000	0.3	200
	141 Ce	0.025	60	20	30,000	0.3	200
	143 Ce	0.02	10	7	21,000	0.3	200
	144 Ce	0.007	40	1,000	30,000	0.3	200
Cesium (55)	129 Cs	0.04	1,000	10	30,000	0.3	200
	131 Cs	1.0	1,000	10	30,000	0.3	200
	134 m Cs	0.01	10	10	30,000	0.3	200
	134 Cs	0.01	1,000	25	21,000	0.3	200
	135 Cs	0.025	7	10	30,000	0.3	200
	136 Cs	0.007	30	10	30,000	0.3	200
	137 Cs	0.01	300	10	30,000	0.3	200
Chlorine (17)	36 Cl	0.01	10	10	30,000	0.3	200
	38 Cl	0.01	600	600	30,000	0.3	200
Chromium (24)	51 Cr	0.6	5	5	15,000	0.3	200
	56 Co	0.005	90	1,000	30,000	0.3	200
Cobalt (27)	57 Co	0.09	20	20	30,000	0.3	200
	58 m Co	1.0	7	7	21,000	0.3	200
Copper (29)	64 Cu	0.025	80	25	30,000	0.3	200
	67 Cu	0.025	200	25	30,000	0.3	200
Curium (96)	242 Cm	2E-4	200	0.2	600	0.005	20
	243 Cm	9E-6	9	0.009	27	0.0001	20
	244 Cm	1E-5	10	0.01	30	0.0001	20
	245 Cm	6E-6	6	0.006	18	0.0001	20
Dysprosium (66)	165 Dy	0.02	100	20	30,000	0.3	200
	166 Dy	0.2	1,000	200	30,000	0.3	200
Erbium (68)	169 Er	0.025	1,000	25	30,000	0.3	200
	171 Er	0.02	50	20	30,000	0.3	200

Element and Atomic Number	Symbol of Radionuclide	Limited Qty. Normal Form (Ci)	A1 Special Form (Ci)	A2 Normal Form (Ci)	Highway Rt. Controlled Qty. Normal Form (Ci)	LSA Limit (mCi/gm)	Advance Notification (Ci)
Europium (63)	152 m Eu	0.03	30	30	30,000	0.3	200
	152 Eu	0.01	20	10	30,000	0.3	200
	154 Eu	0.005	10	5	15,000	0.3	200
	155 Eu	0.06	400	60	30,000	0.3	200
Fluorine (9)	18 F	0.02	20	20	30,000	0.3	200
	153 Gd	0.1	200	100	30,000	0.3	200
	159 Gd	0.02	300	20	30,000	0.3	200
Gadolinium (64)	159 Gd	0.02	300	20	30,000	0.3	200
	67 Ga	0.1	100	100	30,000	0.3	200
	68 Ga	0.02	20	20	30,000	0.3	200
	72 Ga	0.007	7	7	21,000	0.3	200
Germanium (32)	68 Ge	0.01	20	10	30,000	0.3	200
	71 Ge	1.0	1,000	1,000	30,000	0.3	200
	193 Au	0.2	200	200	30,000	0.3	200
	196 Au	0.03	30	30	30,000	0.3	200
Gold (79)	196 Au	0.02	40	20	30,000	0.3	200
	198 Au	0.025	200	25	30,000	0.3	200
	199 Au	0.025	30	25	30,000	0.3	200
	181 Hf	0.03	30	30	30,000	0.3	200
Hafnium (72)	166 Ho	0.03	30	30	30,000	0.3	200
	3 H, see Tritium	---	---	---	---	---	---
	123 I	0.05	50	50	30,000	0.3	200
	125 I	0.07	1,000	70	30,000	0.3	200
Hydrogen (1)	126 I	0.01	40	10	30,000	0.3	200
	129 I	0.002	1,000	2	6,000	0.3	20
	131 I	0.01	40	10	30,000	0.3	200
	132 I	0.007	7	7	21,000	0.3	200
Iodine (53)	133 I	0.01	30	10	30,000	0.3	200
	134 I	0.008	8	8	24,000	0.3	200
	135 I	0.01	10	10	30,000	0.3	200
	111 In	0.025	30	25	30,000	0.3	200
Indium (49)	113 m In	0.06	60	60	30,000	0.3	200
	114 m In	0.02	30	20	30,000	0.3	200
	115 m In	0.02	100	20	30,000	0.3	200
							200

Attachment 1 (Cont.)

Element and Atomic Number	Symbol of Radionuclide	Limited Qty. 1 Normal Form (Ci)	A1 Special Form (Ci)	A2 Normal Form (Ci)	Highway Rt. 1 Controlled Qty. Normal Form (Ci)	LSA Limit (mCi/gm)	Advance 7 Notification (Ci)
Iron (26)	52 Fe	0.005	5	5	15,000	0.3	200
	55 Fe	1.0	1,000	1,000	30,000	0.3	200
	59 Fe	0.01	10	10	30,000	0.3	200
Krypton (36)	85 m Kr (uncompressed)	0.1	100	100	30,000	0.3	5,000
	85 m Kr (compressed)	0.003	3	3	9,000	0.3	20
	85 Kr (uncompressed)	1.0	1,000	1,000	30,000	0.3	50,000
	85 Kr (compressed)	0.005	5	5	15,000	0.3	200
	87 Kr (uncompressed)	0.02	20	20	30,000	0.3	5,000
Lanthanum (57)	87 Kr (compressed)	6E-4	0.6	0.6	1,800	0.005	20
	140 La	0.03	30	30	30,000	0.3	200
	201 Pb	0.02	20	20	30,000	0.3	200
Lead (82)	210 Pb	2E-4	100	0.2	600	0.005	20
	212 Pb	0.005	6	5	15,000	0.3	200
	177 Lu	0.025	300	25	30,000	0.3	200
Lutetium (71)	28 Hg	0.006	6	6	18,000	0.3	200
	52 Mn	0.005	5	5	15,000	0.3	200
	54 Mn	0.02	20	20	30,000	0.3	200
Magnesium (12)	56 Mn	0.005	5	5	15,000	0.3	200
	197 m Hg	0.2	200	200	30,000	0.3	200
	197 Hg	0.2	200	200	30,000	0.3	200
Manganese (25)	203 Hg	0.025	80	25	30,000	0.3	200
Mercury (80)	Mixed Fission Products	4E-4	10	0.4	1,200	0.005	20
	99 Mo	0.02	100	20	30,000	0.3	200
	147 Nd	0.02	100	20	30,000	0.3	200
Molybdenum (42)	149 Nd	0.02	30	20	30,000	0.3	200
	237 Np	5E-6	5	0.005	15	0.0001	20
	239 Np	0.025	200	25	30,000	0.3	200
Neodymium (60)	59 Ni	0.9	1,000	900	30,000	0.3	200
	63 Ni	0.1	1,000	100	30,000	0.3	200
	65 Ni	0.01	10	10	30,000	0.3	200
Neptunium (93)	93 m Nb	0.2	1,000	200	30,000	0.3	200
	95 Nb	0.02	20	20	30,000	0.3	200
	97 Nb	0.02	20	20	30,000	0.3	200
Nickel (28)							
Niobium (41)							

Attachment 1 (Cont.)

Element and Atomic Number	Symbol of Radionuclide	Limited Qty. 1 Normal Form (Ci)	A1 Special Form (Ci)	A2 Normal Form (Ci)	Highway Rt. 1 Controlled Qty. Normal Form (Ci)	LSA Limit (mCi/gm)	Advance 7 Notification (Ci)
Nitrogen (7) Osmium (76)	13 N	0.01	20	10	30,000	0.3	200
	185 Os	0.02	20	20	30,000	0.3	200
	191 Os	0.2	600	200	30,000	0.3	200
	191 m Os	0.2	200	200	30,000	0.3	200
	193 Os	0.02	100	20	30,000	0.3	200
Palladium (46)	103 Pd	0.7	1,000	700	30,000	0.3	200
	109 Pd	0.02	100	20	30,000	0.3	200
Phosphorus (15)	32 P	0.03	30	30	30,000	0.3	200
Platinum (78)	191 Pt	0.1	100	100	30,000	0.3	200
	193 m Pt	0.2	200	200	30,000	0.3	200
	197 m Pt	0.02	300	20	30,000	0.3	200
	197 Pt	0.02	300	20	30,000	0.3	200
	238 Pu	3E-6	3	0.003	9	0.0001	20
Plutonium (94) ²	239 Pu	2E-6	2	0.002	6	0.0001	20
	240 Pu	2E-6	2	0.002	6	0.0001	20
	241 Pu	1E-4	1,000	0.1	300	0.005	20
	242 Pu	3E-6	3	0.003	9	0.0001	20
	244 Pu	2E-4	200	0.2	600	0.005	20
Polonium (84)	210 Po	0.01	10	10	30,000	0.3	200
Potassium (19)	42 K	0.01	20	10	30,000	0.3	200
Praseodymium (59)	142 Pr	0.01	10	10	30,000	0.3	200
	143 Pr	0.02	300	20	30,000	0.3	200
Promethium (61)	147 Pm	0.025	1,000	25	30,000	0.3	200
Protactinium (91)	149 Pm	0.02	100	20	30,000	0.3	200
	230 Pa	8E-4	20	0.8	2,400	0.005	20
	231 Pa	2E-6	2	0.002	6	0.0001	20
Radium (88)	223 Ra	0.1	100	100	30,000	0.3	200
	224 Ra	2E-4	50	0.2	600	0.005	20
	226 Ra	5E-4	6	0.5	1,500	0.005	20
	228 Ra	5E-5	10	0.05	150	0.0001	20
	228 Ra	5E-5	10	0.05	150	0.0001	20
Radon (86)	222 Rn	0.002	10	2	6,000	0.3	20

INFORMATION ONLY

Element and Atomic Number	Symbol of Radioisotope	Limited Qty. 1 Normal Form (Ci)	A1 Special Form (Ci)	A2 Normal Form (Ci)	Highway Rt. 1 Controlled Qty. Normal Form (Ci)	LSA Limit (mCi/gm)	Advance 7 Notification (Ci)
Rhodium (45)	103 m Rh	1.0	1,000	1,000	30,000	0.3	200
	105 Rh	0.025	200	25	30,000	0.3	200
Rubidium (37)	81 Rb	0.025	30	25	30,000	0.3	200
	86 Rb	0.03	30	30	30,000	0.3	200
	87 Rb		unlimited	unlimited	30,000		
	Rb (natural)		unlimited	unlimited	30,000		
Ruthenium (44)	97 Ru	0.08	80	80	30,000	0.3	200
	103 Ru	0.025	30	25	30,000	0.3	200
	105 Ru	0.02	20	20	30,000	0.3	200
	106 Ru	0.007	10	7	21,000	0.3	200
Samarium (62)	147 Sm		unlimited	unlimited	30,000		
	151 Sm	0.09	1,000	90	30,000	0.3	200
	153 Sm	0.02	300	20	30,000	0.3	200
Scandium (21)	46 Sc	0.008	8	8	24,000	0.3	200
	47 Sc	0.02	200	20	30,000	0.3	200
	48 Sc	0.005	5	5	15,000	0.3	200
	75 Se	0.04	40	40	30,000	0.3	200
Selenium (34)	31 Si	0.02	100	20	30,000	0.3	200
Silicon (14)	105 Ag	0.04	40	40	30,000	0.3	200
Silver (47)	110 m Ag	0.007	7	7	21,000	0.3	200
	111 Ag	0.02	100	20	30,000	0.3	200
Sodium (11)	22 Na	0.008	8	8	24,000	0.3	200
	24 Na	0.005	5	5	15,000	0.3	200
Sodium (11)	85 m Sr	0.08	80	80	30,000	0.3	200
Strontium (38)	85 Sr	0.03	30	30	30,000	0.3	200
	87 m Sr	0.05	50	50	30,000	0.3	200
	89 Sr	0.01	100	10	30,000	0.3	200
	90 Sr	4E-4	10	0.4	1,200	0.005	20
	91 Sr	0.01	10	10	30,000	0.3	200
	92 Sr	0.01	10	10	30,000	0.3	200
Sulfur (16)	35 S	0.06	1,000	60	30,000	0.3	200
Tantalum (73)	182 Ta	0.02	20	20	30,000	0.3	200

Element and Atomic Number	Symbol of Radionuclide	Limited Qty. ¹ Normal Form (Ci)	A1 Special Form (Ci)	A2 Normal Form (Ci)	Highway Rt. Controlled Qty. Normal Form (Ci)	LSA Limit (mCi/gm)	Advance ⁷ Notification (Ci)
Technetium (43)	96 m Tc	1.0	1,000	1,000	30,000	0.3	200
	96 Tc	0.006	6	6	18,000	0.3	200
	97 m Tc	0.2	1,000	200	30,000	0.3	200
	97 Tc	0.4	1,000	400	30,000	0.3	200
	99 m Tc	0.1	100	100	30,000	0.3	200
Tellurium (52)	99 Tc	0.025	1,000	25	30,000	0.3	200
	125 m Te	0.1	1,000	100	30,000	0.3	200
	127 m Te	0.02	300	20	30,000	0.3	200
	127 Te	0.02	300	20	30,000	0.3	200
	129 m Te	0.01	30	10	30,000	0.3	200
	129 Te	0.02	100	20	30,000	0.3	200
	131 m Te	0.01	10	10	30,000	0.3	200
	132 Te	0.007	7	7	21,000	0.3	200
	160 Tb	0.01	20	10	30,000	0.3	200
	200 Tl	0.02	20	20	30,000	0.3	200
Terbium (65)	201 Tl	0.2	200	200	30,000	0.3	200
	202 Tl	0.04	40	40	30,000	0.3	200
	204 Tl	0.01	300	10	30,000	0.3	200
	227 Th	2E-4	200	0.2	600	0.005	20
	228 Th	8E-6	6	0.008	8	0.0001	20
	230 Th	3E-6	3	0.003	3	0.0001	20
	231 Th	0.025	1,000	25	30,000	0.3	200
	232 Th	0.01	unlimited	unlimited	30,000	0.3	200
	234 Th	0.01	10	10	30,000	0.3	200
	Th (natural)	Note 3	unlimited	unlimited	30,000	LSA	200
Thallium (81)	Th (irradiated)						
	170 Tm	0.01	300	10	30,000	0.3	200
	171 Tm	0.1	1,000	100	30,000	0.3	200
	113 Sn	0.06	60	60	30,000	0.3	200
Thorium (90)	119 m Sn	0.1	100	100	30,000	0.3	200
	125 Sn	0.01	10	10	30,000	0.3	200
Thulium (69)							
Tin (50)							

INFORMATION ONLY

Attachment 1 (Cont.)

Element and Atomic Number	Symbol of Radionuclide	Limited Qty. Normal Form (C1)	A1 Special Form (C1)	A2 Normal Form (C1)	Highway Rt. Controlled Qty. Normal Form (C1)	LSA Limit (mCi/gm)	Advance 7 Notification (C1)
Tritium (1)	T (uncompressed)	20 Note 4	1,000	1,000	30,000	0.3	50,000
	T (compressed)	20 Note 4	1,000	1,000	30,000	0.3	50,000
	T (activated luminous paint)	20 Note 4	1,000	1,000	30,000	0.3	50,000
	T (adsorbed on solid carrier)	20 Note 4	1,000	1,000	30,000	0.3	50,000
Tungsten (74)	T (tritiated water)	Note 4	20	20	30,000	0.3	200
	T (other forms)	0.02	200	100	30,000	0.3	200
		0.1	1,000	25	30,000	0.3	200
		0.025	1,000	20	30,000	0.3	200
Uranium (92)		0.02	40	0.1	300	0.005	20
		1E-4	100	0.03	90	0.0001	20
		3E-5	30	0.1	300	0.005	20
		1E-4	100	0.1	300	0.005	20
		1E-4	100	0.2	600	0.005	20
		Note 6 15 grams	100	0.2	600	0.005	20
		2E-4	200	unlimited	30,000	LSA	
			unlimited	unlimited	30,000	LSA	
		Note 6	unlimited	unlimited	30,000	LSA	20
		Note 6	unlimited	unlimited	30,000		
		Note 6	unlimited	unlimited	30,000		
		Note 6	unlimited	unlimited	30,000		
		Note 5	6	6	18,000	0.3	200
		0.006	70	70	30,000	0.3	200
		0.07	5	5	15,000	0.3	200
		0.005	100	100	30,000	0.3	5,000
		0.1	10	10	30,000	0.3	200
		0.01	1,000	1,000	30,000	0.3	50,000
		1.0	5	5	15,000	0.3	200
		0.005	70	70	30,000	0.3	5,000
		0.07	2	2	6,000	0.3	20
		0.002	80	80	30,000	0.3	200
		0.08	400	400	30,000	0.3	200
		0.025					
Vanadium (23)							
Yttrium (39)							
Ytterbium (70)							

Attachment 1 (Cont.)

Element and Atomic Number	Symbol of Radionuclide	Limited Qty. 1 Normal Form (Ci)	A1 Special Form (Ci)	A2 Normal Form (Ci)	Highway Rt. 1 Controlled Qty. Normal Form (Ci)	LSA Limit (mCi/gm)	Advance 7 Notification (Ci)
Yttrium (39)	87 Y	0.02	20	20	30,000	0.3	200
	90 Y	0.01	10	10	30,000	0.3	200
	91 m Y	0.03	30	30	30,000	0.3	200
	91 Y	0.03	30	30	30,000	0.3	200
	92 Y	0.01	10	10	30,000	0.3	200
Zinc (30)	93 Y	0.01	10	10	30,000	0.3	200
	65 Zn	0.03	30	30	30,000	0.3	200
	69 m Zn	0.02	40	20	30,000	0.3	200
Zirconium (40)	69 Zn	0.02	300	20	30,000	0.3	200
	93 Zr	0.2	1,000	200	30,000	0.3	200
	95 Zr	0.02	20	20	30,000	0.3	200
	97 Zr	0.02	20	20	30,000	0.3	200

INFORMATION
ONLY

Note 1.

Refer to 49 CFR 173.423, Table 7 and 173.403 (1). Limited Quantity values shown are materials package limits. Refer to 49 CFR 173.421 for other requirements.

Note 2.

For shipments solely within the United States the A_1 value is 20 curies for Americium and Plutonium contained in Am-Be or Pu-Be neutron sources or in nuclear powered pacemakers.

Note 3.

The values for A_1 and A_2 must be calculated in accordance with 49 CFR 173.433 taking into account the activity of the fission products and of the U-233 in addition to that of the thorium.

Refer to 49 CFR 173.423, Table 7.

Note 4.

The values for A_1 and A_2 must be calculated in accordance with 49 CFR 173.433, taking into account the activity of the fission products and plutonium isotopes in addition to that of the uranium.

Note 5.

Refer to 49 CFR 173.421 and 173.424.

Note 6.

Refer to 10 CFR 71.97 for advance notification requirements. Type B packaging must be required and shipment must cross state boundary en route to a disposal site. Values given are for normal form only. Special form value is 5,000 Ci. Greater than Type A LSA shipments are excepted when transported in a Type A container. Advance notification shall be made to the governor of each state or the governor's designee.

Note 7.

Attachment 1 (Cont.)

OMIA: PAP-1309
Page: 5C
Rev.: 0



OMIA: PAP-1309
Page: 51
Rev.: 0

LSA Worksheet

PART 1

Attachment 2
Form: PNPP No. 6604

- 1) Date _____
- 2) Description _____
- 3) Package No. _____
- 4) Batch No. _____
- 5) Package Weight _____ lbs
- 6) Total Activity _____ mCi
- 7) Sample Activity _____ mCi
- 8) Sample Weight _____ gms
- 9) Radionuclide 10) Percent Abundance 11) Activity 12) Specific Activity 13) LSA Group

SAMPLE

LSA Group I = $A_2 \leq .05$ curie

LSA Group II = $A_2 > .05$ but ≤ 1.0 curie

LSA Group III = $A_2 > 1.0$ curie

PART 1 Calculated By

INFORMATION ONLY

OMIA: PAP-1309

Page: 52

Rev.: 0

LSA Worksheet

PART 2

Attachment 2 (Cont.)

Form: PNPP No. 6604

1) Date _____

2) Description _____

3) Package No. _____

4) Batch No. _____

14) Group I <u>Nuclides</u>	15) Specific <u>Activity</u>	16) Group II <u>Nuclides</u>	17) Specific <u>Activity</u>	18) Group III <u>Nuclides</u>	19) Specific <u>Activity</u>
<div style="font-size: 2em; opacity: 0.5;">SAMPLE</div>					
20) Total	_____ mCi/gm Group I	21) Total	_____ mCi/gm Group II	22) Total	_____ mCi/gm Group III

<u>LSA Group</u>	23) <u>Activity</u>	<u>LSA Limit</u>	24) <u>Unity Factor</u>
I	_____	0.0001	_____
II	_____	0.005	_____
III	_____	0.3	_____

25) Total Unity Factor _____

If the total unity factor does not exceed 1.0, the material may be classified as Low Specific Activity.

PART 2 Calculated By _____

INFORMATION
ONLY

TABLE I

Radionuclide	Concentration	
	col. 1 .1 X value of col. 2	col. 2 $\mu\text{Ci/cc}$ or Ci/m^3
C-14	.8	8
C-14 in activated metal	8	80
Ni-59 in activated metal	22	220
Nb-94 in activated metal	0.02	0.2
Tc-99	0.3	3
I-129	0.008	0.08
Alpha-emitting transuranic nuclides with half-life greater than 5 years	¹ 10	¹ 100
Pu-241	¹ 350	¹ 3,500
Cm-242	¹ 2,000	¹ 20,000

¹units are nanocuries/gram

INFORMATION ONLY

TABLE II

Radionuclide	Concentration, $\mu\text{Ci/cc}$		
	A	B	C
Total of all nuclides with less than 5 year half-life	700	(1)	(1)
H-3	40	(1)	(1)
Co-60	700	(1)	(1)
Ni-63	3.5	70	700
Ni-63 in activated metal	35	700	7,000
Sr-90	0.04	150	7,000
Cs-137	1	44	4,600

¹ There are no limits established for these radionuclides in Class B or C wastes. Practical considerations such as the effects of external radiation & internal heat generation on transportation, handling, & disposal will limit the concentrations for these wastes. These wastes shall be Class B unless the concentrations of other nuclides in Table 2 determine the waste to Class C independent of these nuclides

**INFORMATION
ONLY**

PNPP No. 6626

WASTE CLASSIFICATION WORKSHEET	BATCH NO. _____	CONTENTS _____
PACKAGE NOS. _____ _____ _____		

TABLE I RADIONUCLIDES						
NUCLIDE	COLUMN 1			COLUMN 2		
	ACTIVITY μ Ci/cc	LIMIT μ Ci/cc	UNITY FACTOR	ACTIVITY μ Ci/cc	LIMIT μ Ci/cc	UNITY FACTOR
C - 14		0.8			8.0	
C - 14 Act. Mtl.		8			80	
Ni - 59 Act. Mtl.		22			220	
Nb - 94 Act. Mtl.		0.02			0.2	
Tc - 29		0.3			3	
I - 129		0.008			0.08	
	ACTIVITY nCi/GR	LIMIT nCi/GR	UNITY FACTOR	ACTIVITY nCi/GR	LIMIT nCi/GR	UNITY FACTOR
Pu - 241		350			3500	
Cm - 242		2000			20000	
TRANSURANICS WITH T 1/2 > 5 yrs		10			100	
TOTAL UNITY = FACTOR				TOTAL UNITY = FACTOR		

WASTE CLASS ☐ STABLE ☐ UNSTABLE
 TOTAL ACTIVITY OF
 NUCLIDES WITH T1/2 > 5YRS
 _____ μ Ci/cc

TABLE II RADIONUCLIDES									
NUCLIDE	COLUMN A			COLUMN B			COLUMN C		
	ACTIVITY μ Ci/cc	LIMIT μ Ci/cc	UNITY FACTOR	ACTIVITY μ Ci/cc	LIMIT μ Ci/cc	UNITY FACTOR	ACTIVITY μ Ci/cc	LIMIT μ Ci/cc	UNITY FACTOR
H - 3		40			*			*	
Co - 60		700			*			*	
Ni - 63		3.5			70			700	
Ni - 63 Act. Mtl.		35			700			7000	
Sr - 90		0.04			1			1000	
Cs - 137		1			4			4600	
NUCLIDES WITH T1/2 < 5 yrs		700			*			*	
TOTAL UNITY = FACTOR				TOTAL UNITY = FACTOR			TOTAL UNITY = FACTOR		

* - NO LIMIT

SAMPLE

CALCULATED BY _____

 INFORMATION
 ONLY

DATE _____

(1) GENERATOR NAME

ADDRESS

CITY STATE

CONTACT PHONE

(2) consignee to:
CHEM NUCLEAR SYSTEMS, INC
P O BOX 726 OSBORN ROAD
BARNWELL, S.C. 29812

(3) USE THIS NUMBER ON
ALL CONTINUATION PAGES

VOLUME ALLOCATION NO

PAGE
OF

BARNWELL WASTE MANAGEMENT FACILITY

Operated by: CHEM NUCLEAR SYSTEMS, INC
P O Box 726, Barnwell, South Carolina 29812
(803) 259 1781

RADIOACTIVE SHIPMENT MANIFEST FORM

(4)

CARRIER ADDRESS

TELEPHONE SHIPPING DATE

SHIPMENT TYPE SHIPMENT SURFACE EXPOSURE mR/hr

SHIPMENT NO LINER SERIAL NO

DRIVER SIGNATURE DATE

(5) TOTAL FOR EACH CLASS		PROPER SHIPPING NAME & HAZARD CLASS (PER 49 CFR 172.101)	ID NUMBER
NO OF PACKAGES	WEIGHT (Pounds)		
		Radioactive Material, empty packages	UN2908
		Radioactive Material, fissile, n.o.s. - Radioactive Material	UN2918
		Radioactive Material, low specific activity, n.o.s. - Radioactive Material	UN2912
		Radioactive Material, n.o.s. - Radioactive Material	UN2982
		Radioactive Material, limited quantity, n.o.s. - Radioactive Material	UN2910
		Radioactive Material, special form, n.o.s. - Radioactive Material	UN2974
		Radioactive Material, instruments and articles - Radioactive Material	UN2911
		Other (Specify)	

(6) SHIPMENT TOTALS

VOLUME (Cubic Feet)	TOTAL NO OF PACKAGES	ACTIVITY (BECQUEREL 20 111)				SOURCE (Pounds)
		ALL ISOTOPES	TRITIUM	C-14	Y-90	
						1129

(7) TOTAL SNM

ISOTOPE	GRAMS
U 233	
U 235	
TOTAL	

(8) TOTAL PALLET
VOLUME (CU. FT.)

(9) WASTE DESCRIPTION

(10) PHYSICAL FORM/
SOLIDIFICATION AGENT

(11) CHEMICAL FORM AND
NAME AND % OF CHELATING AGENT(S)

(12) WASTE FORM CLASS
☐ A ☐ B ☐ C

(13) () Yes () No THIS VEHICLE IS CONSIGNED EXCLUSIVE USE. LOADING AND UNLOADING MUST BE ACCOMPLISHED BY CONSIGNOR OR CONSIGNEE OR HIS DESIGNATED AGENT

(14) IMPORTANT: This is to certify that the above named materials are properly classified, described, packaged, marked, and labeled, and are in proper condition for transportation according to the applicable regulations of the Department of Transportation

Signature

Company

Date

Date

By

Title and Organization

Telephone No ()

CNSI USE ONLY

- ☐ This material meets all license requirements.
☐ This material was disposed of in accordance with license.
☐ Discrepancy

DISPOSAL SITE COPY

Form No. CNS 201
(9-83)

SEE INSTRUCTIONS ON REVERSE SIDE
FOR FILLING OUT THIS FORM

Arrival Date

Date/Time Buried

Trench No

Waste Class. Code

Arrival Survey No

H. P. Initial

Location Code

Personnel Exposure

Date

Authorized Signature

Title

OMIA: PAP-1309
Page: 56
Rev.: 0
Attachment 6

GENERATOR NAME: _____

PAGE 1 OF 1

[illegible]

PAGE TOTALS

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
---	---	---	---	---	---	---	---	---	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	-----

OMIA: PAP-1309
Page: 57
Rev.: 0
Attachment 6 (Cont.)

US ECOLOGY, INC.

CONTINUATION SHEET

REV. 1/84

PAGE _____ OF _____

18	17b	17c	17d	17e	17f	17g	17h	17i	17j	17k	17l	17m	17n	17o	17p	17q	17r	17s	17t	17u	17v	17w	17x	17y	17z	17aa	17ab	17ac	17ad	17ae	17af	17ag	17ah	17ai	17aj	17ak	17al	17am	17an	17ao	17ap	17aq	17ar	17as	17at	17au	17av	17aw	17ax	17ay	17az	17ba	17bb	17bc	17bd	17be	17bf	17bg	17bh	17bi	17bj	17bk	17bl	17bm	17bn	17bo	17bp	17bq	17br	17bs	17bt	17bu	17bv	17bw	17bx	17by	17bz	17ca	17cb	17cc	17cd	17ce	17cf	17cg	17ch	17ci	17cj	17ck	17cl	17cm	17cn	17co	17cp	17cq	17cr	17cs	17ct	17cu	17cv	17cw	17cx	17cy	17cz	17da	17db	17dc	17dd	17de	17df	17dg	17dh	17di	17dj	17dk	17dl	17dm	17dn	17do	17dp	17dq	17dr	17ds	17dt	17du	17dv	17dw	17dx	17dy	17dz	17ea	17eb	17ec	17ed	17ee	17ef	17eg	17eh	17ei	17ej	17ek	17el	17em	17en	17eo	17ep	17eq	17er	17es	17et	17eu	17ev	17ew	17ex	17ey	17ez	17fa	17fb	17fc	17fd	17fe	17ff	17fg	17fh	17fi	17fj	17fk	17fl	17fm	17fn	17fo	17fp	17fq	17fr	17fs	17ft	17fu	17fv	17fw	17fx	17fy	17fz	17ga	17gb	17gc	17gd	17ge	17gf	17gg	17gh	17gi	17gj	17gk	17gl	17gm	17gn	17go	17gp	17gq	17gr	17gs	17gt	17gu	17gv	17gw	17gx	17gy	17gz	17ha	17hb	17hc	17hd	17he	17hf	17hg	17hh	17hi	17hj	17hk	17hl	17hm	17hn	17ho	17hp	17hq	17hr	17hs	17ht	17hu	17hv	17hw	17hx	17hy	17hz	17ia	17ib	17ic	17id	17ie	17if	17ig	17ih	17ii	17ij	17ik	17il	17im	17in	17io	17ip	17iq	17ir	17is	17it	17iu	17iv	17iw	17ix	17iy	17iz	17ja	17jb	17jc	17jd	17je	17jf	17jg	17jh	17ji	17jj	17jk	17jl	17jm	17jn	17jo	17jp	17jq	17jr	17js	17jt	17ju	17jv	17jw	17jx	17jy	17jz	17ka	17kb	17kc	17kd	17ke	17kf	17kg	17kh	17ki	17kj	17kk	17kl	17km	17kn	17ko	17kp	17kq	17kr	17ks	17kt	17ku	17kv	17kw	17kx	17ky	17kz	17la	17lb	17lc	17ld	17le	17lf	17lg	17lh	17li	17lj	17lk	17ll	17lm	17ln	17lo	17lp	17lq	17lr	17ls	17lt	17lu	17lv	17lw	17lx	17ly	17lz	17ma	17mb	17mc	17md	17me	17mf	17mg	17mh	17mi	17mj	17mk	17ml	17mm	17mn	17mo	17mp	17mq	17mr	17ms	17mt	17mu	17mv	17mw	17mx	17my	17mz	17na	17nb	17nc	17nd	17ne	17nf	17ng	17nh	17ni	17nj	17nk	17nl	17nm	17nn	17no	17np	17nq	17nr	17ns	17nt	17nu	17nv	17nw	17nx	17ny	17nz	17oa	17ob	17oc	17od	17oe	17of	17og	17oh	17oi	17oj	17ok	17ol	17om	17on	17oo	17op	17oq	17or	17os	17ot	17ou	17ov	17ow	17ox	17oy	17oz	17pa	17pb	17pc	17pd	17pe	17pf	17pg	17ph	17pi	17pj	17pk	17pl	17pm	17pn	17po	17pp	17pq	17pr	17ps	17pt	17pu	17pv	17pw	17px	17py	17pz	17qa	17qb	17qc	17qd	17qe	17qf	17qg	17qh	17qi	17qj
----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------

TABLE 24 - Description of Attachment Methods

Sanctuary, Climate
Scribe

11. Dixie Mocha
12. Caramel
13. Apple
14. Decadent Caramel Mocha
15. E-narrations
16. Mocha

[illegible]

SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL
Radioactive Waste Shipment Prior Notification and Manifest Form

[Failure to Complete ALL Entries Will Result in Return of Form and Constitute Noncompliance.]

See Reverse Side for Instructions

1. Name and Address of Shipper/Generator:		2. Person Responsible for Waste Shipment: a) Name: b) Title: c) Telephone: ()	
3. Radioactive Waste Transport Permit No.		4. Shipment Identification No.:	
5. Location from which waste will be shipped:		6. Name and Address of Consignee:	
7. Scheduled Date of Departure of Shipment:		8. Estimated Date of Arrival of Shipment:	
9. Carrier:	10. Trailer No. & Owner: (if avail.)	11. Type Transport Vehicle:	
12. Routes shipment will follow in State of South Carolina (Be Specific):			
13. Type Package or Cask Model No.:	14. Type Container in Cask:	15. Package or Cask Spec.:	
16. Complete Waste Description (Be Specific):			
17. Physical & Chemical Form:		18. Total No. of Packages:	19. Prominent Radionuclides:
20. Total Curies:	21. Waste Class & Stability:	22. Total Cubic Feet:	
23. DOT Sub Type:	24. DOT Class. & Hazard Class UN No.:	25. Hwy. Route Controlled: (Large Quantity) [] Yes [] No	

CERTIFICATION

I hereby certify on behalf of the above-named shipper/generator to the South Carolina Department of Health and Environmental Control that the information provided herein is complete and correct to the best of my knowledge; and that the shipper/generator has complied with all the provisions as required by Act No. 429 of 1980, the South Carolina Radioactive Waste Transportation and Disposal Act, and Department Regulation 61-83.

Date _____

Typed Name

Signature of Consignor's Authorized Representative

CONSIGNEE ACKNOWLEDGEMENT

This acknowledges to the South Carolina Department of Health and Environmental Control that the above-described radioactive waste shipment was received.

Date of Delivery _____

Signature of Consignee's Authorized Representative

Issued w. Printed Name and Title

DHEC 802 (Rev. 10/84)

(Copies of this form may be reproduced locally as needed)



Attachment 9

Form RMA-CT
(5/80)

SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL
Radioactive Waste Shipment Certification Form

General Instructions and Information: This is a two part form to be used by shippers and carriers of radioactive waste. The certifications contained herein satisfy the requirements of Section 13-7-150, of Act No. 499 of 1980, the South Carolina Radioactive Waste Transportation and Disposal Act. This certification along with a copy of the prior notification form shall accompany each shipment of radioactive waste into and within the State of South Carolina. The shipper is to complete his portion of the form and present it to the carrier as part of the shipping documents. Upon receipt, the carrier shall complete his portion of the form. Upon delivery of the shipment to the consignee, a copy of this certification form, and a copy of the Prior Notification and Manifest form with the consignee acknowledgment, shall be returned to the Department.

Part I: Shipper's Certificate of Compliance

1. Name of Shipper and Address: Telephone No. ()	2. Shipment Identification No. 3. Transport Permit No.
--	---

In compliance with Act No. 499 of 1980, the South Carolina Radioactive Waste Transportation and Disposal Act, I hereby certify on behalf of the above-named shipper to the South Carolina Department of Health and Environmental Control that the above-named shipper has complied with all provisions of Act No. 499 of 1980, and all applicable laws and administrative rules and regulations both State and Federal, regarding the packaging, transportation, storage, disposal and delivery of such wastes. I further certify that this shipment of radioactive waste has been inspected within 48 hours of the time of departure and that no items of non-compliance with applicable laws, rules or regulations were found.

Date _____

Typed Name and Title of Agent of Shipper _____

Signature _____

Part II: Carrier's Certification

1. Name of Carrier and Address: Telephone No. ()	2. Shipment Identification No. 3. Transport Trailer No.
4. Scheduled Date of Departure of Shipment:	5. Estimated Date of Arrival of Shipment:

Certification is hereby made to the South Carolina Department of Health and Environmental Control that: (a) the shipper has provided the carrier with a copy of the shipment manifest, the certificate of compliance, and the routing instructions; (b) the shipment of radioactive waste has been properly placarded for transport according to applicable U.S. Department of Transportation Regulations; (c) all shipping papers originated or reproduced by the carrier have been properly executed; (d) the transport vehicle has been inspected according to applicable State and Federal regulations within the prescribed intervals and that all safety and operational components are in good working order and meet the requirements of regulations; (e) all drivers who will operate the vehicle within the State of South Carolina are qualified to transport hazardous materials as specified by applicable U.S. Department of Transportation regulations; (f) the Department shall be immediately notified of any variance, occurring after departure, from the shipper's notification of primary routes in South Carolina and estimated date of arrival; (g) all applicable laws and administrative rules and regulations, both State and Federal, regarding the transportation of radioactive wastes will be complied with.

Date _____

Typed or Printed Name and Title _____

Signature _____

DMEC 803
(5/80)

(Copies of this form may be reproduced locally as needed)

INFORMATION
ONLY



DEPARTMENT OF SOCIAL AND HEALTH SERVICES
OLYMPIA, WASHINGTON

LOW-LEVEL RADIOACTIVE WASTE SHIPMENT CERTIFICATION FOR
COMMERCIAL GENERATOR/PACKAGERS, AND BROKERS AND CARRIERS

The following certification, completed as applicable, is made to the State of Washington:

Certification is hereby made to the State of Washington that Radiation Shipment Record No. _____ of low-level radioactive waste has been inspected in accordance with requirements of the Governor of Washington's Executive Order dated November 19, 1979, prior to its shipment. Further certification is made that the inspection has revealed no items of non-compliance with all applicable laws, rules and regulations.

The undersigned shall indemnify and hold harmless the State of Washington, in an amount not to exceed \$1,000,000.00 per individual who may be injured, provided that indemnification shall not exceed \$5,000,000.00 in total, for each occurrence, from any and all claims, suits, losses, damage, injury and expenses to any person whomsoever or to property arising or growing out of or in any manner connected with the activities performed under this order.

Except for any violation of applicable existing state or federal statute or regulation respecting packaging and shipment, inspection and acceptance of any item, or container or material covered by this certification by the State of Washington or a duly authorized contractor shall release the party who executed this certificate from any and all requirement of indemnification from injury or loss.

SECTION A:
FOR THE GENERATOR/PACKAGER: _____ (Company Name)

PERMIT NUMBER: _____

VOLUME OF WASTE IN THIS SHIPMENT: _____

DATE: _____ BY: _____

TITLE: _____

SECTION B:
FOR THE BROKER: _____ (Company Name)

PERMIT NUMBER: _____

VOLUME OF WASTE IN THIS SHIPMENT: _____

DATE: _____ BY: _____

TITLE: _____

SECTION C:
FOR THE CARRIER: _____ (Company Name)

VOLUME OF WASTE IN THIS SHIPMENT: _____

DATE: _____ BY: _____

TITLE: _____

INFORMATION
ONLY

Exclusive Use Shipment Checklist

Attachment II

Form: PNPP No. 6608

Date _____

Shipment Number _____
Destination _____

The following items are inspected for compliance with DOT, NRC, and burial facility regulations as appropriate. Enter "N/A" in the initial block of items that are not applicable.

Initials

1. Arrival radiation and contamination surveys performed on vehicle. (Attach surveys to checklist)
2. Vehicle inspection performed. (Attach Exclusive use Vehicle Inspection Form to checklist).
3. Driver is issued dosimetry for loading (as appropriate).
4. Packages are marked and labeled as indicated on shipping documents.
5. Packages are loaded in accordance with a loading plan.
6. Blocking and bracing is installed to prevent shifting of load.
7. Radiation surveys performed on vehicle are within the limits of 49CFR173.441 (Attach surveys to checklist).
8. Contamination surveys performed in and around loading area are within site limits. (Attach surveys to checklist).
9. Vehicle is placarded if shipment is LSA EXCLUSIVE USE or if any of the packages bear the RADIOACTIVE YELLOW III label.
10. Tamper proof seals installed on all trailer doors.
11. Photographs taken of all four sides of the vehicle (placarded vehicles only).
12. Driver is provided all necessary shipment documents.
13. Consignee is notified that the shipment is leaving the site and of the expected arrival date.

RSC_____
RSC_____
QC_____
RSC_____
RSC_____
QC_____
RSC_____
RSC_____
QC_____
RSC_____
QC_____
RSC_____
RSC_____
QC_____
RSC_____
RSC_____
RSC_____
RSC_____
Radioactive Shipment Coordinator (RSC)
or Designee._____
Quality Control Inspector (QC)**INFORMATION
ONLY**



DEPARTMENT OF SOCIAL AND HEALTH SERVICES
OLYMPIA, WASHINGTON

LOW-LEVEL RADIOACTIVE WASTE SHIPMENT CERTIFICATION FOR
COMMERCIAL GENERATOR/PACKAGERS, AND BROKERS AND CARRIERS

The following certification, completed as applicable, is made to the State of Washington:

Certification is hereby made to the State of Washington that Radiation Shipment Record No. _____ of low-level radioactive waste has been inspected in accordance with requirements of the Governor of Washington's Executive Order dated November 19, 1979, prior to its shipment. Further certification is made that the inspection has revealed no items of non-compliance with all applicable laws, rules and regulations.

The undersigned shall indemnify and hold harmless the State of Washington, in an amount not to exceed \$1,000,000.00 per individual who may be injured, provided that indemnification shall not exceed \$5,000,000.00 in total, for each occurrence, from any and all claims, suits, losses, damage, injury and expenses to any person whomsoever or to property arising or growing out of or in any manner connected with the activities performed under this order.

Except for any violation of applicable existing state or federal statute or regulation respecting packaging and shipment, inspection and acceptance of any item, or container or material covered by this certification by the State of Washington or a duly authorized contractor shall release the party who executed this certificate from any and all requirement of indemnification from injury or loss.

SECTION A:
FOR THE GENERATOR/PACKAGER: _____ (Company Name)

PERMIT NUMBER: _____

VOLUME OF WASTE IN THIS SHIPMENT: _____

DATE: _____ BY: _____

TITLE: _____

SECTION B:
FOR THE BROKER: _____ (Company Name)

PERMIT NUMBER: _____

VOLUME OF WASTE IN THIS SHIPMENT: _____

DATE: _____ BY: _____

TITLE: _____

SECTION C:
FOR THE CARRIER: _____ (Company Name)

VOLUME OF WASTE IN THIS SHIPMENT: _____

DATE: _____ BY: _____

TITLE: _____

INFORMATION
ONLY

VEHICLE INSPECTION FORM

Attachment, 12

Form: PNPP No. 6610

Prior to loading a vehicle for shipment, an inspection will be conducted to insure the vehicle is in satisfactory condition for transporting radioactive material.

NOTE

Initials of the inspector will be placed in the appropriate block indicating completion of each inspection point.

Unsatisfactory items will be explained in the remarks.

SAT	UNSAT	SAT	UNSAT
____/____	General Condition (1)	____/____	Lights (4)
____/____	Body Condition (2)	____/____	Tires (5)
____/____	Leaks (3)	____/____	Loose Material in Trailer (6)

- (1) Approaching vehicle, note general overall condition (e.g., holes, excessive rust, bent frame, etc.).
- (2) Check for holes, proper flooring in trailer, loose body parts that could affect safety, etc.
- (3) Look under vehicle for leaks of oil, grease, fuel and water (check around wheels for grease).
- (4) Check that headlights, clearance lights and hazard lights operate.
- (5) Check for soft or flat tires, excessive tread wear, and tread stripping off tires.
- (6) No loose material in trailer, such as wood, metal scraps, boxes, tires, etc.

Tractor No. _____ Trailer No. _____

TRANSPORT VEHICLES CONSIGNED FOR SHIPMENT TO WASHINGTON STATE MUST HAVE A WASHINGTON STATE PATROL OR WASHINGTON STATE UTILITIES AND TRANSPORTATION COMMISSION VEHICLE INSPECTION CERTIFICATE, OR A VISIBLE WASHINGTON STATE 90 DAY VEHICLE INSPECTION SEAL,

CERTIFICATE/SEAL NUMBER

REMARKS: _____

CEI Inspector _____

Signature

SAMPLE

I certify, to the best of my knowledge,
that all mechanical and safety related
items are in good working condition.

Driver _____

Signature

FOR OFFICIAL USE ONLY

ISOTOPIC ANALYSIS RESULTS

(FOR PACKAGES CONTAINING RESIN OR FILTER MEDIA)

APPLICABLE PACKAGES

SHIPMENT NO. _____

DATE _____

WASTE VOLUME

PER PACKAGE _____

RADIOISOTOPE	PERCENT ABUNDANCE	ACTIVITY	SPECIFIC ACTIVITY $\mu\text{Ci} / \text{cc}$
SAMPLE			
TRANSURANICS	PERCENT ABUNDANCE	ACTIVITY	SPECIFIC ACTIVITY nCi / gm

COMPLETED BY _____

INFORMATION
ONLY

Table of Standard Transport Van Dimensions (inside)

TYPE OF TRAILER	40 ft.	45 ft.	48 ft.
LENGTH -----	477 in.	540 in.	576 in.
WIDTH -----	96 in.	96 in.	96 in.
HEIGHT -----	99 in.	103 in.	107 in.
No. of ¹ ----- DRUMS	76 (4 x 19)	88 (4 x 22)	96 (4 x 24)
No. of ² ----- PALLETS	1 (1 x 6)	14 (2 x 7)	16 (2 x 8)

NOTE¹ - Number of 55 gallon unpalletized drums per layer.

NOTE² - Number of 6-drum pallets (72 in. x 48 in.) per layer.

ONLY

Instructions for Maintaining Exclusive Use Vehicle

For "Exclusive Use" shipments of Radioactive Materials

Instructions to Carrier:

1. Shipment is to be delivered to Consignee without reloading.
2. Exclusive Use means this vehicle is to transport only those materials loaded by the Perry Nuclear Power Plant.
3. Material is to be shipped directly to and be unloaded by consignee.
4. Trailer must be cleared by consignee to ensure radiation and contamination levels are within specification prior to releasing the trailer for other use.
5. In the event of accidents, leaks or unusual delays, make required report to Department of Transportation and notify the Perry Nuclear Power Plant as soon as possible. Make notification to the Perry Plant by calling (216) 259-3737 day or night and request the individual answering the phone to call this information to the Shift Supervisor.
6. Missing placards shall be replaced immediately. Extra placards will be provided by Perry Nuclear Power Plant.
7. Notify the Perry Nuclear Power Plant in the event a different tractor is attached to the trailer. This is necessary to determine if the different configuration will affect radiation levels in the cab.
8. Keep these instructions with the radioactive material shipping papers.

- ☐ EXTRA PLACARDS PROVIDED
- ☐ PLACARDS NOT REQUIRED

SAMPLE

Driver's Signature

**INFORMATION
ONLY**

RESPONSE TO TRANSPORTATION INCIDENTS
(MAJOR HIGHWAY ACCIDENTS, VEHICLE OR DEPOT FIRE, OR
MAJOR DAMAGE OR LEAKAGE OF PACKAGING)
INVOLVING RADIOACTIVE MATERIALS

INSTRUCTIONS TO CARRIER

1. Radioactive Potential Health Hazards: The degree of hazard to persons exposed to radioactive material will vary depending upon the type, quantity, and form of the material. The hazard may be from internal radiation caused by breathing gases, vapors, or dust from airborne materials, or from contamination of skin, open cuts and sores; or from external radiation (as from gamma rays) due to contamination on the skin or from exposure or unshielded radioactive material. Excessive exposure may be a hazard to health or life in extreme instances.
2. Immediate Action if an Incident Occurs
 - a. Request radiological monitoring assistance from the nearest regional office of E.R.D.A. Interagency Radiological Assistance Plan (see attached sheet).
 - b. As soon as possible, obtain a copy of the shipping papers, load manifest, bill of lading, etc. Information contained on these forms will be especially valuable to persons and organizations rendering emergency assistance.
 - c. Identify and isolate the incident area.
 - d. Do not move any package unless necessary for personnel rescue.
 - e. Keep unnecessary personnel away.
 - f. Avoid areas downwind from the incident area.
 - g. Delay cleanup until arrival of personnel qualified in radiation monitoring and decontamination.
 - h. Advise appropriate individuals and agencies of the incident (state and local police, fire department, ambulance and paramedic squads, truck dispatcher and shipper, as appropriate).
3. Spill or Leak: If a package appears to be damaged in a manner that will allow leakage or spillage of its contents, take the following steps, as appropriate:

INFORMATION
ONLY

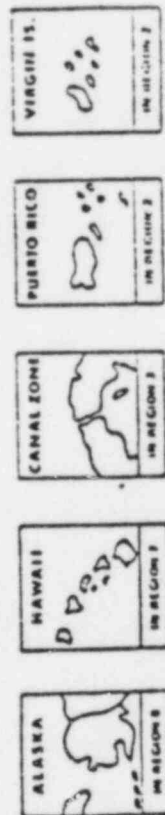
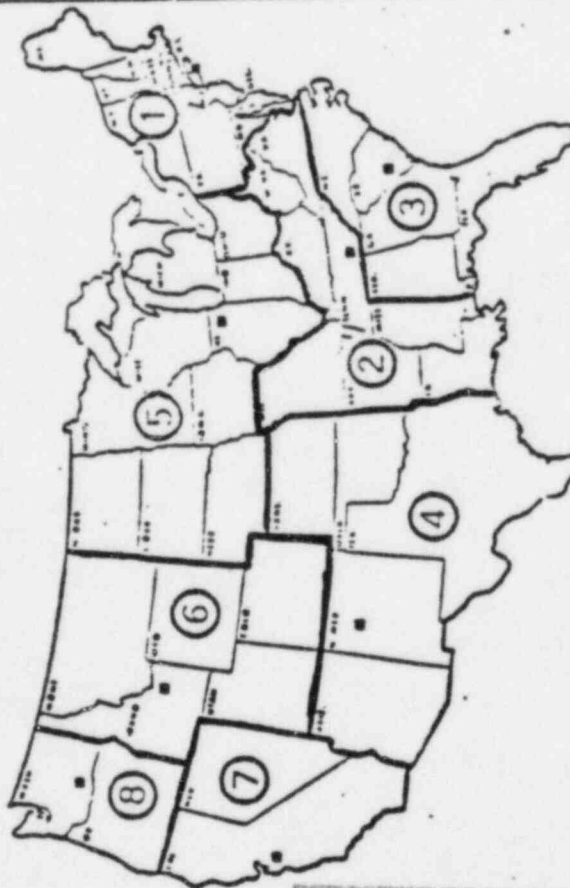
Attachment 16 (Cont.)

- a. Notify emergency assistance personnel (ambulance and fire crews, police, etc.) of the presence of possible radioactive contamination and avoid entry into the hazard area if at all practical until the arrival of persons qualified in radiation monitoring.
- b. Notify the shipper (Cleveland Electric Illuminating Company - (216) 259-3737). Request the person answering to relay this information immediately to the Shift Supervisor.
- c. Avoid contact with all packages, particularly those that may be leaking or damaged.
- d. Prevent the spread of loose material by diking, absorbent materials, covering, or other suitable means.
- e. Limit necessary entries into the hazard areas to the shortest possible duration.
- f. Do not enter the hazard area unless it is necessary to rescue persons or to retard the flow of material from massive spills or leaks.
- g. Delay cleanup until the arrival of personnel qualified in radiation monitoring and decontamination.

RESTRICTED
ONLY

**U. S. ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION
REGIONAL COORDINATING OFFICES**

**FOR
RADIOLOGICAL ASSISTANCE
AND
GEOGRAPHICAL AREAS
OF RESPONSIBILITY**



REGIONAL COORDINATING OFFICE	POST OFFICE ADDRESS	TELEPHONE FOR ASSISTANCE	DDD AREA CODE
(1) Brookhaven Area Office	Upton, L.I., New York, 11973	345-2200	516
(2) Oak Ridge Operations Office	P. O. Box E Oak Ridge, TN 37830	483-8611 Ext. 3-4510	615
(3) Savannah River Operations Office	P. O. Box A Aiken, S.C. 29301	N. Augusta, S.C. 824-6331 Ext. 3333	803
(4) Albuquerque Operations Office	P. O. Box 5500, Albuquerque, N.M., 87115	264-4667	505
(5) Chicago Operations Office	9203 S. Cottage Ave., Chicago, Ill., 60639	739-7711 Ext. 2111 Ext. 4451	312
(6) Idaho Operations Office	P. O. Box 2100, Idaho Falls, Idaho 83401	526-0111 Ext. 1515	208
(7) San Francisco Operations Office	1333 Broadway, Oakland, CA, 94612	273-4237	415
(8) Richland Operations Office	P.O. Box 550 Richland, Washington 99352	942-7381	509

OMIA: PAP-1309
Page: 70 - LAST
Rev.: 0

Attachment 16 (Cont.)

**Fig. A5
U.S. Energy Research and Development Administration (ERDA)
Regional Coordinating Offices for Radiological Assistance
and Geographical Areas of Responsibility**

**INFORMATION
ONLY**

TABLE 11.2-10 (Continued)

Stream Number	Stream Description	Normal Batches/Day	Maximum Batches/Day	Gallons/ Batch	Solids/ Batch (Pounds)	Normal Gal/Yr (Both Units)	Isotopic Activity ⁽¹⁾
24	Radioactive Chemical Waste Effluent Design Discharge	-	1/36.5	15,360	N/A	154,000 (max)	See Table 11.2-14
25	Hot Shower and Detergent Drains	3.0	3.0	500	-	547,000	Negligible
27	Detergent Waste Effluent	1.48	2.65	1,600	-	864,000	Negligible
29	Radioactive Evap. Bottoms to SRW	1/51	1/14	5,000	-	36,000	See Table 11.4-3
30	Floor Drains Demin. Spent Resins Transfer	1/30.5	1/22.35	1,455	1,970	17,000	Buildup on F.D. Demin.
31	Waste Demineralizer Spent Resins Transfer	1/35	1/15.35	1,455	1,970	15,000	Buildup on Waste Demineralizer
34-a	Cond. Demin. Spent Resins to SRW Disposal (both units)	6/3.6 yrs	6/3.6 yrs	9,970	12,090	17,000	See Table 11.4-4
34-b	W.D., F.D. and S.P.D. Spent Resins to SRW Disposal	1/83.5	1/31.6	9,980	11,700	44,000	See Table 11.4-4
35	Condensate Filter Backwash (each unit)	1/3.0	8.0	5,200	360	1,265,000	See Note 5
40	Cond. Filter Sludge to SRW Disposal	2/36.0	1/2	7,000	4,350	142,000	See Table 11.4-2 ⁽⁶⁾
43	Avg. CBST Decantate	1/1.5	8.0	4,610	N/A	1,122,000	S/6

TABLE 11.2-10 (Continued)

Stream Number	Stream Description	Normal Batches/Day	Maximum Batches/Day	Gallons/ Batch	Solids/ Batch (Pounds)	Normal Gal/Yr (Both Units)	Isotopic Activity ⁽¹⁾
45	RWCU F/D Backwash (each unit)	1/6.5	1.0	2,400	70	270,000	See Note 7
48	RWCU F/D Sludge to SRW Disposal	2/97.5	5/30	2,150	1,040	16,000	See Table 11.4-4 ⁽⁸⁾
51	Avg. RBST Decantate	1/3.25	1.0	2,300	N/A	258,000	M/4
53	Fuel Pool F/D Backwash	1/5.2	1/5.2	2,160	65	152,000	See Note 2
62	Fuel Pool F/D Sludge to SRW Disposal	1/348	1/30	7,000	4,350	7,000	See Table 11.4-2 ⁽⁹⁾
65	Decantate from Fuel Pool Filter Backwash	1/5.2	1/5.2	2,055	N/A	144,000	Negligible
81	Cask Pit Draw-Down	1/20.3	-	47,000	N/A	845,000	Negligible
84	Suppression Pool Maintenance Drain (each unit)	-	1/10 yrs	1,000,000	N/A	-	Negligible
86	Cond. Mixed Bed Demin. Spent Resins Transfer (each unit)	6/3.6 yrs	6/3.6 yrs	4,950	5,750	16,000	See Note 4
87	Suppression Pool Cleanup Demin. Spent Resins Transfer	1/30	1/15	1,750	2,365	21,000	Buildup on Suppression Pool Cleanup Demin.

TABLE 11.4-2

SOLID RADWASTE SYSTEM INFLUENT NUCLIDE ACTIVITIES

<u>Isotope</u>	<u>Condensate F/D Sludge⁽¹⁾ μCi/cc</u>	<u>Radwaste Filter Sludge⁽²⁾ μCi/cc</u>
Na-24	2.9-3	Negligible
P-32	4.6-3	9.7-6
Cr-51	1.4-1	4.6-3
Mn-54	1.2-2	8.8-3
Co-58	1.4+0	3.7-1
Co-60	1.6-1	1.3-1
Fe-59	2.2-2	2.7-3
Zn-65	6.2-4	4.0-4
Zn-69m	3.1-5	Negligible
Ag-110m	1.8-2	1.2-2
Ag-110	1.8-2	1.2-2
W-187	2.0-2	Negligible
TOTAL	1.8+0	5.5-1

NOTES:

1. Activity based on 4 days accumulation of 8 batches followed by a 2 day decay period.
2. Activity based on 100 days accumulation of 149 batches of filter sludge from the waste collector and floor drain systems followed by a 100 day decay period.

TABLE 11.4-3

SOLID RADWASTE SYSTEM CHEMICAL WASTE CONCENTRATE

<u>Isotope</u>	<u>Chemical Waste Concentrate ($\mu\text{Ci/cc}$)</u>	<u>Isotope</u>	<u>Chemical Waste Concentrate ($\mu\text{Ci/cc}$)</u>
P-32	4.0 - 6	Te-132	7.5 - 5
Cr-51	3.1 - 4	I-132	7.7 - 5
Mn-54	7.7 - 5	Cs-137	7.3 - 2
Co-58	6.7 - 3	Ba-137m	7.3 - 2
Co-60	1.1 - 3	Ba-140	4.2 - 2
Fe-59	8.0 - 5	La-140	4.8 - 2
Zn-65	3.8 - 6	Pr-143	2.1 - 4
I-131	1.6 - 1	Ce-144	8.4 - 3
Sr-89	2.8 - 1	Pr-144	8.4 - 3
Cs-134	4.5 - 2	Nd-147	3.5 - 5
Cs-136	5.8 - 4	Pm-147	8.2 - 6
Sr-90	7.0 - 2	Np-239	1.2 - 5
Y-90	7.0 - 2	Pu-239	1.1 - 6
Mo-99	7.6 - 6	Y-91	2.6 - 3
Tc-99m	8.4 - 6	Zr-95	4.6 - 3
Ru-103	1.3 - 3	Nb-95m	9.8 - 5
Rh-103m	1.2 - 3	Nb-95	5.9 - 3
Ru-106	6.6 - 4	Te-129m	2.0 - 3
Rh-106	6.6 - 4	Ce-141	5.0 - 3
Ag-110m	1.2 - 4		
Ag-110	1.2 - 4	Total	9.1 - 1

TABLE 11.4-4

SOLID RADWASTE SYSTEM DEMINERALIZER ACTIVITIES

<u>Isotope</u>	<u>RWCU Filter/ Demineralizer Sludge ($\mu\text{Ci/cc}$)</u>	<u>Condensate Demineralizer ($\mu\text{Ci/cc}$)</u>	<u>Radwaste Demineralizer ($\mu\text{Ci/cc}$)</u>
P-32	2.1-2	--	--
Cr-51	3.5+0	--	--
Mn-54	2.1+0	--	--
Co-58	1.4+2	--	--
Co-60	3.1+1	--	--
Fe-59	1.3+0	--	--
Zn-65	1.0-1	--	--
Br-83	--	--	6.5-4
Br-84	--	--	1.2-4
I-131	8.7-1	6.6-7	2.9-1
I-134	--	--	1.8-3
Sr-89	7.0+1	2.2-2	4.1-1
Tc-101	--	--	2.2-4
Cs-134	1.1+1	1.8-2	5.3-2
Cs-136	1.0-1	3.2-7	4.1-3
Cs-138	--	--	7.0-4
Ba-139	--	--	2.5-3
Sr-90	1.7+1	3.2-2	8.1-2
Y-90	1.7+1	3.2-2	6.5-2
Sr-92	--	--	6.0-3
Y-92	--	--	9.2-3
Mo-99	2.3-5	--	1.6-1
Tc-99m	2.5-5	--	8.1-2

TABLE 11.4-4 (Continued)

<u>Isotope</u>	<u>RWCU Filter/ Demineralizer Sludge ($\mu\text{Ci/cc}$)</u>	<u>Condensate Demineralizer ($\mu\text{Ci/cc}$)</u>	<u>Radwaste Demineralizer ($\mu\text{Ci/cc}$)</u>
Ru-103	3.0-1	5.5-5	2.1-3
Rh-103m	2.9-1	5.3-5	1.1-3
Ru-106	1.6-1	2.3-4	7.6-4
Rh-106	1.6-1	2.3-4	6.0-4
Ag-110m	2.9+0	--	--
Ag-110	2.9+0	--	--
Te-132	5.2-4	--	3.9-1
I-132	5.2-4	--	2.3-2
I-135	--	--	3.8-2
Cs-137	1.8+1	3.4-2	8.1-2
Ba-137m	1.8+1	3.4-2	6.5-2
Ba-140	6.6+0	1.2-5	3.2-1
La-140	7.7+0	1.4-5	6.5-2
Ba-142	--	--	2.1-4
La-142	--	--	7.6-4
Ce-143	--	--	1.1-4
Pr-143	3.8-2	--	1.5-3
Ce-144	2.1+0	2.9-3	9.7-3
Pr-144	2.1+0	2.9-3	7.6-3
Nd-147	5.6-3	--	4.2-4
Pm-147	9.4-3	3.4-6	2.5-5
Np-239	1.3-5	--	1.4+0

TABLE 11.4-4 (Continued)

<u>Isotope</u>	<u>RWCU Filter/ Demineralizer Sludge ($\mu\text{Ci/cc}$)</u>	<u>Condensate Demineralizer ($\mu\text{Ci/cc}$)</u>	<u>Radwaste Demineralizer ($\mu\text{Ci/cc}$)</u>
Pu-239	2.2-3	4.5-7	6.5-1
Br-85	--	--	9.2-6
Sr-91	--	--	3.8-2
Y-91m	--	--	3.6-3
Y-91	1.3+0	1.9-4	2.7-1
Zr-95	1.1+0	5.3-4	6.5-3
Nb-95m	2.4-2	1.1-5	8.7-5
Nb-95	1.9+0	9.8-4	8.1-3
Zr-97	--	--	4.2-5
Nb-97m	--	--	3.0-6
Nb-97	--	--	4.9-6
Te-129m	4.9-1	6.1-5	3.8-3
Te-129	--	--	8.7-6
I-129	--	--	4.8-6
I-133	--	--	1.4-1
Ba-141	--	--	3.5-4
La-141	--	--	2.8-3
Ce-141	1.2+0	1.4-4	2.4+0
Totals	3.6+2	1.8-1	7.1+0