

SAMPLING AND ANALYSES PLAN USDOE ROCKY FLATS PLANT

SOLAR POND 207A



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SUBMITTED TO

Rockwell International
North American Space Operations
Rocky Flats Plant
Golden, Colorado



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USDOE ROCKY FLATS PLANT
Solar Pond 207A

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Rockwell International
North American Space Operations
Rocky Flats Plant
Golden, Colorado

Prepared by
Roy F. Weston, Inc.
938 Quail Street
Denver, Colorado

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1.0 INTRODUCTION

This sampling plan has been designed to provide a waste characterization of the contents of Solar Pond 207A. The plan is the first step in the development of a comprehensive waste analysis plan for the Rocky Flats facility. Water and sediment samples will be collected and analyzed for a comprehensive suite of parameters that will provide the basis for assessing future waste management practices for the pond. Solar Pond 207A has been the repository for process waste streams and a full characterization of selected samples will identify the contaminants of concern. The approach described herein is consistent with a CERCLA remedial investigation of an abandoned and uncharacterized hazardous waste site because the characteristics of the wastes disposed in the pond are not clearly defined. The collected data will also be used to determine whether the pond contents are characteristic of radioactive mixed wastes.

2.0 BACKGROUND

Solar evaporation Pond 207A (see Figure 1) was constructed primarily to store and treat (by evaporation) process wastes containing high nitrates, low level radioactivity and treated acid wastes containing aluminum hydroxide (the pond pH generally ranges from 9 to 10). Over time, the pond is known to have received additional wastes such as sanitary sewage sludge, lithium metal, sodium nitrate, ferric chloride, lithium chloride, sulfuric acid, ammonium persulfate, hydrochloric acid, nitric acid, hexavalent chrome, and solutions containing cyanide in concentrations of less than 20 parts per million. Solvents have not been routinely discharged to the ponds; however, low concentrations of solvents may have been present as a minor constituent in other aqueous wastes received by the pond.

207 SOLAR PONDS

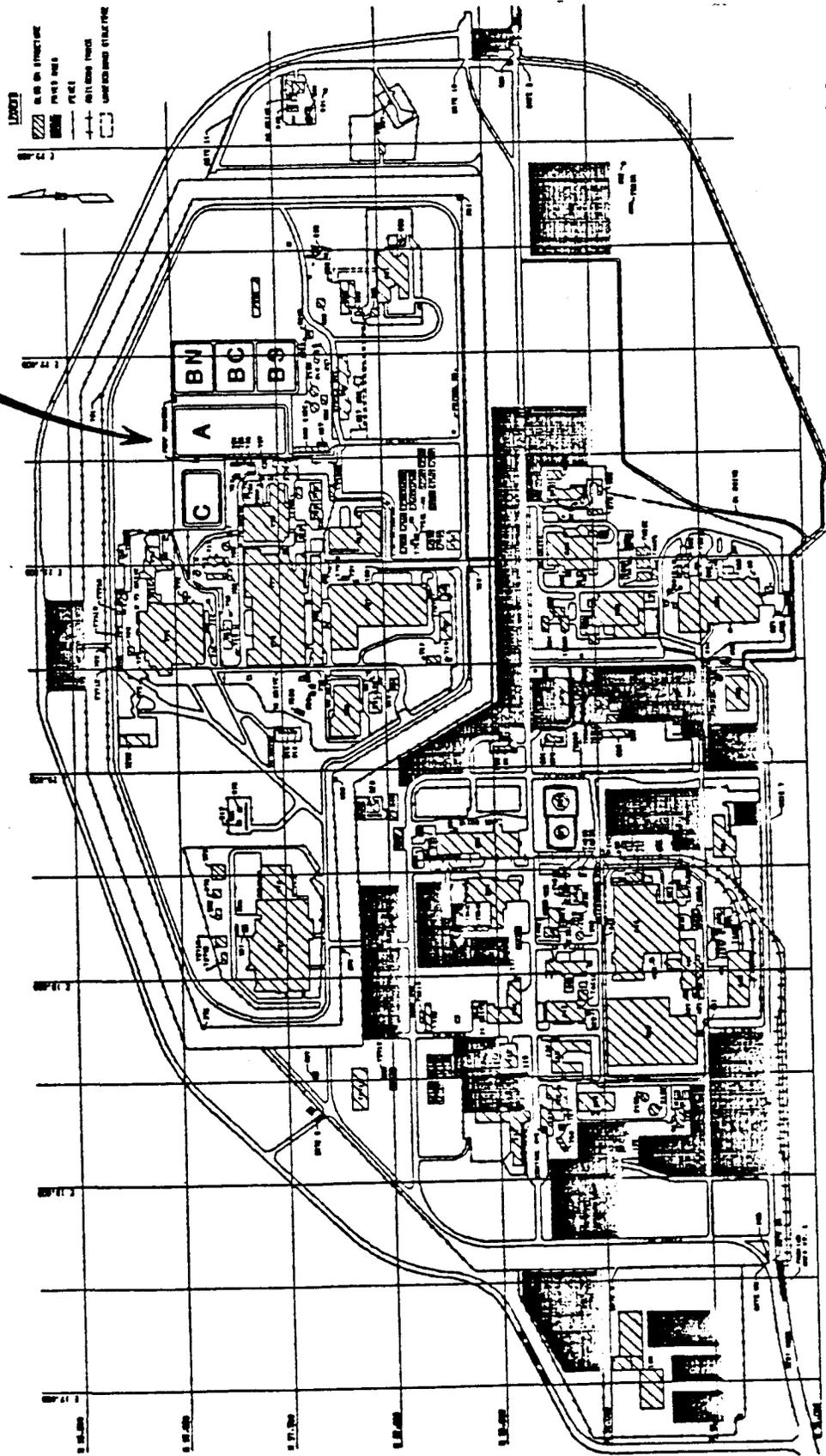


FIGURE 1 SOLAR PONDS

Existing analytical data for Pond 207A does not include RCRA hazardous waste constituents. The water has been analyzed for pH, nitrates, total dissolved solids, cyanide, beryllium, and radioactivity, the latter including gross alpha, gross beta, Pu-239, Am-241, U-233,234,238 and tritium.

3.0 SAMPLING PLAN

3.1 Chemical Analysis Rationale

Because the wastes contained in the pond have not been thoroughly characterized to date, it is proposed that the contents of the pond be analyzed for the Hazardous Substance List (HSL) defined in CERCLA, Sections 101 (14) and 104 (a) (2) and presented in Appendix A of this sampling plan. EPA approved analytical methods exist for their measurement in soils and water. Because the solar pond waste is also radioactive, all samples will be analyzed for tritium, plutonium 239, americium 241, and uranium 233, 234 and 238, gross alpha and gross beta using the EML HASL 300 methodologies which are acceptable to EPA. Estimated detection limits for radiological analyses are also presented in Appendix A.

Another purpose for sampling is to establish whether the solar pond contents are characteristic of a radioactive mixed waste. To achieve this the pond waste characteristics will be compared to the hazardous and radioactive waste characteristics criteria listed below:

1. Exhibits characteristics of a hazardous waste identified in Subpart C (40 CFR 261.3 (a) (2) (i)).
2. It is a mixture of a solid waste and a hazardous waste listed in Subpart D (40 CFR 261.3 (a) (2) (iii) & (iv)).

3. It poses a potential hazard to human health or the environment (40 CFR 261.1 (b)).
4. It contains radioactive constituents including tritium, americium, plutonium, and uranium.

In order to provide sufficient analytical information to preliminarily determine if the pond contents (water and sediment) are radioactive mixed wastes, by criteria 1, it will be necessary to perform the Subpart C characteristic testing (ignitability, corrosivity, reactivity, and EP toxicity). Classification of a waste as hazardous by criteria 2 is generally made through prior knowledge of co-disposal with a Subpart D listed waste. Records of waste disposed at the solar pond are incomplete regarding RCRA hazardous waste components. Therefore, a RCRA classification of the solar pond contents cannot be made based on criteria 2. The simple presence of 40 CFR 261 Appendix VII constituents (constituents present in the Subpart D listed wastes) in the solar ponds is also inadequate information to determine if the solar pond contents are hazardous by criteria 2.

As for criteria 3, the presence of 40 CFR 261 Appendix VIII constituents in a waste is a factor the EPA would consider in a formal listing of a particular waste stream as a RCRA hazardous waste (Appendix VII is a subset of Appendix VIII). The EPA has not developed approved analytical methodologies for many of the Appendix VIII constituents. Furthermore, in a RCRA waste characterization program it is only necessary to analyze a waste stream for Appendix VIII constituents that are likely to be present. Therefore, measurement of the hazardous substances will be used to address criteria 3. The HSL contains many of the Appendix VIII constituents and all of the priority pollutants, and there are EPA approved methodologies for their analysis.

In summary, all the samples collected will be analyzed for the hazardous substances and be tested for Subpart C characteristics. Radiological characteristics will be addressed by analysis for Am-241, Pu-239, U-233, U-234, U-238, tritium, gross alpha and gross beta.

3.2 Location of Sampling Points

3.2.1 Water - Pond 207A

Water samples will be collected at the surface of Pond 207A in three discreet locations along an imaginary line bisecting the pond longitudinally. The three locations will be equally spaced along the imaginary line with one sample being collected from the center of the pond and the other two samples collected from a point equidistant between the center of the pond and the edge of the pond. Grab samples will be collected to preclude the loss of trace volatile organic compounds that might occur during composite sampling.

3.2.2 Sediments - Pond 207A

Wastes from building 444 have been placed in the pond at the southwest corner. Building 774 wastes enter the pond in the center of the west side, and sewage sludge discharges into the pond at the northwest corner. Therefore, sediment core samples will be collected at the southwest, west center and northwest locations of the pond.

3.3 Sampling Methodology

This section presents a discussion of the sampling procedures. Information is included on analytical requirements, container type, preservation, field measurements, and holding time for the analyses requested.

3.3.1 Sampling Procedure - Pond 207A Water

Surface Water - Grab samples will be collected from a floating platform. Samples will be collected by immersing the sample container under the surface of the water until it is filled to the proper level as described below:

Volatile Organic Analysis - Vials should be filled completely so that a meniscus is visible on the top of the vial. The Teflon cap is slowly placed on the meniscus taking care not to force air into the sample. Screw the cap on the vial tightly and invert the vial. Tap lightly on the vial and observe whether there are air bubbles trapped inside the vial. If there are air bubbles observed, remove the cap and resample until no bubbles are visible inside the vial when it is inverted.

Remaining Analyses - Sample containers need not be completely filled for these analyses. Fill bottles up to shoulder level to allow sufficient ullage for transportation.

Field measurement of pH, conductivity and temperature will be performed on samples of the water from each location in Pond 207A. A beaker or sample jar will be immersed and a sample withdrawn for the measurement of these parameters. pH and

conductivity will be measured by conventional pH and conductivity meters calibrated prior to sampling. pH buffer solutions will be available at the sampling site to double check calibration before analysis. Temperature will be measured using a partial immersion thermometer calibrated in 0.1°C or 0.2°F with a range of 0 - 50°C. The thermometer should be accurate to ±0.1°C as checked against a Bureau of Standards calibrated thermometer. pH, conductivity, and temperature readings will be recorded after equilibrium in measurements is achieved.

Table 3.1 summarizes the analyses to be performed, numbers and types of containers, preservation and holding times, and analytical methodology for water samples collected at the pond.

3.3.2 Sampling Procedure - Pond 207A Sediments

Sediment core samples will be collected by inserting a hollow Teflon or glass coring rod into the sediments and withdrawing a sediment core. A five-inch tube will be pushed into the sediment until approximately 1 inch (2.5 centimeters) or less of the tube is above the sediment-water interface. If the sediment is hard or coarse the tube will be gently rotated to facilitate greater penetration and cut down on core compaction. The tube will then be capped with a Teflon plug or a sheet of Teflon held in place by a rubber stopper or cork. After capping, the tube will be slowly extracted, the negative pressure and adherence of the sediment keeping the sample in the tube. Before the bottom part of the core is pulled above the water surface, it too will be capped.

Table 3.2 summarizes analyses to be performed, numbers and types of sample containers, preservation, holding times, and analytical methodology for sediment samples collected from Pond 207A.

TABLE 3.1 CONTAINERS AND PRESERVATION FOR POND 207A WATER SAMPLES

Analyses	Number of Samples	Recommended Container Type and Volume per Sample	Preservation	Holding Time	Method
Hazardous Substance List Volatiles (HSL)	3	(2) 40ml ^a glass vials w/teflon septum	Cool to 4°C	Analyze within 7 days	EPA 624
HSL Extractable analysis, acid, base-neutral pesticides, PCB	3	(2) 2 liter amber glass jars w/Teflon cap	Cool to 4°C	10 days	EPA 625
HSL Metals	3	(1) liter ^a plastic	Filter, Acidify pH < 2 HNO ₃	6 months	*
Phenol	3	(1) liter plastic ^a	CuSO ₄ , Cool to 4°C	28 days	*
Cyanide	3	(1) liter plastic ^a	Cool to 4°C pH > 12 NaOH	14 days	*
RCRA characterization ignitability, corrosivity, reactivity	3	(2) 250 ml glass w/Teflon lid	Cool to 4°C	none specified	**
Radiological					
Americium 241			Filter, acidify		EML HASL
Plutonium 239			pH < 2 HNO ₃		300
Uranium 233, 234, 238	3	(1) 4 liter ^a cubitainer	(optional for medium level contamination)	6 months	
Tritium					
gross beta					
gross alpha					

^a may require additional sample for lower detection limits

* "Methods for Chemical Analysis of Water and Waste" (EPA-600/4-79-020)

** "Test Methods for Evaluating Solid Waste - Physical/Chemical Methods" July 82, SW-846

TABLE 3.2 CONTAINERS AND PRESERVATION FOR POND 207A SEDIMENTS

Analyses	Number of Samples and Type	Recommended Container Type and Volume per Sample	Preservation	Holding Time	Method
Hazardous Substance List Volatiles (HSL)	3 -Composite	(2) 4 oz glass ^a w/ Teflon lid	Cool to 4°C	Analyze within 7 days	EPA 800 series
HSL Semi-volatiles, pesticides, PCB	3 -Composite	(2) 8 oz glass ^a w/Teflon lid	Cool to 4°C	10 days	EPA 800 series (sonification for pre-extraction)
HSL Metals/CN ⁻	3 -Composite	(1) 8 oz glass ^a w/Teflon lid		6 months	SW-846 or EPA 600
RCRA characterization Ignitability Corrosivity Reactivity EP Toxicity (Less pesticides)	3 -Composite	(2) 8 oz glass ^a w/Teflon lid	None	none specified	
Radiological Americium ²⁴¹ Plutonium ²³⁹ Uranium ^{233, 234, 238} Tritium gross beta gross alpha	3 -Composite	(2) 16 oz glass ^a w/Teflon lid	None	6 months	EML HASL 300

^amay require additional sample for lower detection limits

3.4 Sampling Equipment - Water and Sediment

Instrumentation

pH meter/buffer solutions
conductivity meter
thermometer
beaker for field measurements
plastic squeeze bottles for decontamination
of instrument probes

Sampling Equipment

logbook/ink pens
watch
sample containers/labels
field filtration apparatus
sediment core sampler (Teflon or glass)
preservatives, copper sulfate, nitric acid,
and sodium hydroxide
stainless steel bucket for compositing
paper towels
plastic or metal scoops
HPLC/distilled water
coolers with ice

Sample/Equipment Decontamination

wash bucket
rinse bucket
alkaline detergent
brushes
paper towels/plastic trash bags
methanol
tap water
distilled water

4.0 SAMPLE HANDLING

This section describes procedures for special sample handling, decontamination, and sample identification. Procedures for marking, labelling, packaging, and shipping of environmental and hazardous substance samples not classified as DOT Radioactive Materials are included in Appendix B. Specific shipping requirements for DOT Radioactive Materials are presented in Appendix C.

4.1 Decontamination

To minimize cross contamination between samples and to protect sampling and laboratory personnel from potential exposure to possible hazardous or radioactive contaminants all samples will be decontaminated prior to packaging. At each sample location sample containers and equipment will be washed on the exterior with a detergent, rinsed with tap water, and dried with paper towels. Decontamination solutions and rinse waters will be containerized and stored. After the sample analysis data are received and evaluated, appropriate disposal of these liquids will be determined.

4.2 Sample Identification

Individual sample containers will be numbered sequentially using a white or colored grease pen to identify the sample number before sampling. Grease pens will be used to prevent loss of sample numbers during sampling. Often times, identifying marks on pre-labelled containers are lost during sample immersion in aqueous wastes or during decontamination. After samples have been decontaminated and dried, permanent gum labels or sample tags will be affixed to the sample containers. Permanent labels or tags will include the following information at a minimum:

- Exact location of the sample
- Time and date of sample collection
- Name of sampler and witnesses
- Sample sequential identification number
(corresponding to that listed on the chain of custody record)
- Type of sample (grab or composite)
- Analyses requested
- Preservation methods (nitric acid, NaOH, CuSO₄, etc.)
- Destination (Lab name)
- Other pertinent information

4.3 Packaging, Marking, Labelling, and Shipping

Because samples will contain radionuclides, all samples will be transported in compliance with U.S. Department of Transportation requirements for packaging, marking, and labelling of radioactive materials. Regulations pertaining to the transportation of radioactive materials are detailed in 49 CFR Sections 100 - 177, and are summarized in Appendix C of this sampling plan.

To ensure compliance with DOT shipping requirements, the following procedures must be initiated prior to offering a package for shipment:

1. A representative number of containers will be smear sampled using 47 mm filter paper and then counted for alpha activity. If counts exceed Rocky Flats Plant guidelines, containers will be decontaminated, smeared, and recounted until alpha activity meets these guidelines (see Appendix C).
2. An exterior gamma survey will be performed on individual sample containers. Results of this survey will dictate the appropriate internal and external packaging requirement per DOT specifications (see Appendix C).

3. An exterior gamma survey will be conducted on each package to determine external packaging requirements per DOT specifications (see Appendix C).
4. Hazardous Material Bill of Lading including shipper's certification, chain of custody forms, and instructions for the laboratory will accompany each package offered for shipment.

Personnel responsible for shipping samples will review DOT regulations concerning the shipment of Radioactive Material (49 CFR 172.203) and prepare each shipment accordingly. To assist in this preparation, the Hazardous Materials Form (shown on page 14) will be completed and enclosed with the Dangerous Goods Bill of Lading, Chain of Custody Forms, and other information enclosed with the sample shipment.

4.4 Documentation/Chain of Custody

All aspects of the sampling effort will be documented in various forms by sampling personnel. Documentation is required to assist laboratory personnel in identifying samples, aid in data collection and reporting, and to provide evidence on the validity of information gathered. One member of the sampling team will be assigned as the document coordinator and will be responsible for recording all information during sampling.

4.4.1 Logbook

All information pertinent to field activities will be recorded in bound, sequentially page numbered logbooks. The following information will be recorded prior to sampling and at each sampling location:

HAZARDOUS MATERIALS FORM

Pkg. Certified by: _____ Date: _____ Destination: _____

Mode of transport: _____ Carrier: _____

SHIPPING PAPER ENTRIES (49 CFR 172 B & C)

Material (proper shipping name): _____

Hazard Classes: _____

Identification Number: _____

Quantity (weight or volume): _____

RADIOACTIVE MATERIALS (RAM) (49 CFR 172.203)

Radionuclides: _____

Form (physical or chemical): _____

Activity (Ci, mCi, or uCi): _____

Label Category: _____

Transport Index: _____

Specific Activity: _____ pCi/g Pkg. Contam. _____

MARKING REQUIREMENTS (49 CFR 172.D)

- _____ Proper shipping name
- _____ Identification No.
- _____ Gross weight (RAM, exceeds 110 lbs)
- _____ Type A (RAM only)
- _____ This End Up (liquid only)

LABELING REQUIREMENTS (49 CFR 172 E)

- _____ Hazard class labels
- _____ Two opposite pkg. sides
- _____ Cargo Aircraft Only

PACKAGING REQUIREMENTS
(Give appropriate Section of 40 CFR):

PLACARD REQUIREMENTS

- _____ Placards required;
offered to carrier

REVIEWED BY:

Signature _____ Date _____

- Date and time of entry
- Brief objective of sampling
- Calibration information of field instrumentation
- Names of sampling personnel
- Sample location and proposed sampling methodology
- Results of field measurement (pH, temperature, conductivity, etc.)
- Number and types of samples collected, as well as container types and preservation methods
- Date and time of sample collection
- Sequential sample ID number
- Field observations (weather, etc.)
- Description of sample handling after collection (labelling, packaging, destination of sample)

4.4.2 Photographs

Photographs will be taken to document sampling activities. Information on photographs will be recorded in the site logbook and should include at a minimum:

- Date and time of photograph
- Name of photographer
- General direction faced and description of subject photographed
- Sequential number of photograph and the roll number

4.4.3 Chain of Custody

(adapted from EPA Office of Emergency Preparedness Remedial Response, Hazardous Response Support Division, Personnel and Safety Training Manual)

Chain of Custody will be maintained from sample collection through laboratory receipt of samples. Samples will be transferred from samplers to document coordinator who will be responsible for documentation, sample identification, packaging and shipping of samples. A Standard EPA Chain of Custody Record (presented on page 17) will be used to record sample transfers. Samples will remain in the custody of the document coordinator until they are shipped to the laboratory.

A sample is in someone's "custody" if:

- It is in actual physical possession; or
- It is in view, after being in physical possession; or
- It is in physical possession and then locked up so that no one can tamper with it; or
- It is kept in a secured area, restricted to authorized personnel only.

4.4.3.1 Transfer of Custody and Shipment

When transferring custody of the samples, the original custodian and document coordinator will sign and date the Chain of Custody Record until time of shipment. At the time of shipment the document coordinator and the courier will sign and date the Chain of Custody Record.



Chain of Custody Record

Sample Number	Task Number
Inspection Number	
Sample Name	
Date Sample	Time
Duplicate Requested () Yes () No	

Inspector Name and Address

Inspector Signature

Location of Sampling

Analysis/Testing Required

Laboratory			
Date Received			
Received By			
Sent Via			
Sample Condition			
Condition of Seals			
Units Received			
Storage Location			
Assigned By			
Assigned To			
Delivered By			
Date Delivered			
Number of Units Received			
Units Analyzed			
Date Seal Broken			
Date Resealed			
Resealed By			
Storage Location			
Date Results of Analysis Issued to EPA		Date Results of Analysis Issued to Facility	

Remarks

A photocopy of the signed Custody Record will be retained by the coordinator. The original Chain of Custody Record will accompany the shipment to the laboratory.

4.4.3.2 Laboratory Custody Procedures

Upon arrival of the samples at the laboratory, laboratory personnel will sign and date receipt of the samples on the Chain of Custody Record. Laboratory personnel will then be responsible for maintaining custody until time of analyses. The laboratory must be able to provide a locked and secured area.

5.0 QUALITY ASSURANCE/QUALITY CONTROL

Samplers will implement the following quality assurance procedures to ensure the production of high quality data.

5.1 Sample Blanks

Trip Blanks - A full set of sample glassware and plastic containers will be filled with laboratory grade water and analyzed for all parameters under observation for the purpose of detecting contaminant contributions from the glassware.

Field Blanks - Aqueous field blanks will be prepared on-site by filling each sample container with laboratory grade water to simulate collection of an aqueous environmental sample. Field blanks will be collected, filtered, containerized, preserved, decontaminated, and shipped as if they were environmental samples. Samples will be analyzed to screen for cross contamination during sample handling.

5.2 Laboratory Quality Control

An EPA contract laboratory capable of providing analyses of Hazardous Substance List compounds, RCRA characterization and radiological constituents will be selected for all analyses. The laboratory will incorporate in-house quality control procedures and use EPA approved analytical methodologies. Data reporting under the EPA contract laboratory program is standardized, and provides detection limits required by the respective EPA methodology.

To assure quality data the laboratory must be able to provide the following quality control:

I. Requirement for Organics

The laboratory shall use its analytical experience and equipment to perform qualitative and quantitative analyses of the organic Hazardous Substance List pollutants. The Hazardous Substance List Compounds and their respective detection limits are presented in Appendix A. The laboratory shall follow the protocols established by the U.S. EPA for sample preparation, analysis, storage, and preservation before and after the analysis. Method 600 series for organics in water and Method 800 series for organics in solids shall be followed.

During preparation, the laboratory shall fortify all samples, blanks, matrix spikes with surrogate spiking and compound as given in EPA reference methods. Additionally, all sample semi-volatile extracts and aliquots for volatile organics analysis shall be spiked with internal standard compounds before injection or purging.

All sediment samples for full organic (except volatile) analysis shall be prepared by sonification prior to solvent extraction. Volatile Organic Analysis shall be performed within 7 days for water samples and within 10 days for sediment samples. Volatile Organic Analysis samples should not be stored with pure solvent such as methylene chloride. A matrix spike for Volatile Organic Analysis should be prepared at the beginning of the analysis and should be analyzed at the end of analysis. Sample extraction shall be completed within 5 days for water samples and within 10 days for sediment samples.

The laboratory shall perform one spiked sample analysis and one duplicate spiked sample analysis on each group of samples of a similar matrix and concentration level for each batch of samples received or for each 20 samples, whichever is more frequent. The laboratory shall prepare and analyze one laboratory reagent blank for each group of samples of a similar matrix for each batch or for each 20 samples, whichever is more frequent.

The laboratory shall perform instrument calibration and performance audits for each 12-hour period. Initial multi-level calibration for each HSL compound and continuing calibration for each HSL compound shall be performed. The Gas Chromatograph/Mass Spectrometer instrument should be tuned for both volatile and semi-volatile compound analysis. Gas Chromatograph/Mass Spectrometer performance audit shall include decafluorotriphenylphosphine (DFTPP) and/or bromofluorobenzene (BFB) tuning.

Blank run high value samples shall be performed to rule out any residual amount in the Gas Chromatograph column. EPA or NBS check standards can be used as a performance audit.

Calculations and identification shall be checked by a second person and signed. For calculations, use of a permanent computer program is advisable.

II. Inorganic Requirement

The laboratory shall use its analytical experience and equipment to perform qualitative and quantitative analyses of the inorganic Hazardous Substance List pollutants. The laboratory shall follow the protocols established by the U.S. EPA for sample preparation, analysis, storage, and preservation before and after the analysis. For water, methods given in "Method for Chemical Analysis of Water and Waste" (EPA-600/4-79-020) should be used. Sediment samples should be digested with appropriate acid mix or sonified to extract inorganics.

The laboratory shall perform one spiked sample analysis and one duplicate spiked sample analysis on each group of samples of a similar matrix and concentration level for each batch of samples received or for each 10 samples, whichever is more frequent. The laboratory shall prepare and analyze one laboratory reagent blank for each group of samples of a similar matrix for each batch or for each 10 samples, whichever is more frequent. Duplicate sample analysis (preferably sample with some values) shall be done on each group of samples of a similar matrix for each batch of samples or for each 10 samples, whichever is more frequent.

Initial multi-level calibrations and calibration verification shall be performed in a 12-hour period. ICP or Atomic Adsorption interference check shall be performed. The laboratory control sample (or EPA or NBS) shall be carried through sample preparation and analysis procedures to document the performance of the entire sample process.

Calculations should be checked by a second person. Calibration down slope and intercept should preferably be calculated by using regression. A program for each calculation is advisable.

APPENDIX A

Estimated Detection Limits for
Hazardous Substance List Compounds and
Radiological Analyses

Hazardous Substance List (HSL) and
Required Detection Limits **

Volatiles	CAS Number	Detection Limits*	
		Low Water ^a ug/L	Low Soil/Sediment ^b ug/Kg
1. Chloromethane	74-87-3	10	10
2. Bromomethane	74-83-9	10	10
3. Vinyl Chloride	75-01-4	10	10
4. Chloroethane	75-00-3	10	10
5. Methylene Chloride	75-09-2	5	5
6. Acetone	67-64-1	10	10
7. Carbon Disulfide	75-15-0	5	5
8. 1,1-Dichloroethene	75-35-4	5	5
9. 1,1-Dichloroethane	75-35-3	5	5
10. trans-1,2-Dichloroethene	156-60-5	5	5
11. Chloroform	67-66-3	5	5
12. 1,2-Dichloroethane	107-06-2	5	5
13. 2-Butanone	78-93-3	10	10
14. 1,1,1-Trichloroethane	71-55-6	5	5
15. Carbon Tetrachloride	56-23-5	5	5
16. Vinyl Acetate	108-05-4	10	10
17. Bromodichloromethane	75-27-4	5	5
18. 1,1,2,2-Tetrachloroethane	79-34-5	5	5
19. 1,2-Dichloropropane	78-87-5	5	5
20. trans-1,3-Dichloropropene	10061-02-6	5	5
21. Trichloroethene	79-01-6	5	5
22. Dibromochloromethane	124-48-1	5	5
23. 1,1,2-Trichloroethane	79-00-5	5	5
24. Benzene	71-43-2	5	5
25. cis-1,3-Dichloropropene	10061-01-5	5	5

Volatiles	CAS Number	Detection Limits*	
		Low Water ^a ug/L	Low Soil/Sediment ^b ug/Kg
26. 2-Chloroethyl Vinyl Ether	110-75-8	10	10
27. Bromoform	75-25-2	5	5
28. 2-Hexanone	591-78-6	10	10
29. 4-Methyl-2-pentanone	108-10-1	10	10
30. Tetrachloroethene	127-18-4	5	5
31. Toluene	108-88-3	5	5
32. Chlorobenzene	108-90-7	5	5
33. Ethyl Benzene	100-41-4	5	5
34. Styrene	100-42-5	5	5
35. Total Xylenes		5	5

^aMedium Water Contract Required Detection Limits (CRDL) for Volatile HSL Compounds are 100 times the individual Low Water CRDL.

^bMedium Soil/Sediment Contract Required Detection Limits (CRDL) for Volatile HSL Compounds are 100 times the individual Low Soil/Sediment CRDL.

Semi-Volatiles	CAS Number	Detection Limits*	
		Low Water ^c ug/L	Low Soil/Sediment ^d ug/Kg
36. N-Nitrosodimethylamine	62-75-9	10	330
37. Phenol	108-95-2	10	330
38. Aniline	62-53-3	10	330
39. bis(2-Chloroethyl) ether	111-44-4	10	330
40. 2-Chlorophenol	95-57-8	10	330
41. 1,3-Dichlorobenzene	541-73-1	10	330
42. 1,4-Dichlorobenzene	106-46-7	10	330
43. Benzyl Alcohol	100-51-6	10	330
44. 1,2-Dichlorobenzene	95-50-1	10	330
45. 2-Methylphenol	95-48-7	10	330
46. bis(2-Chloroisopropyl) ether	39638-32-9	10	330
47. 4-Methylphenol	106-44-5	10	330
48. N-Nitroso-Dipropylamine	621-64-7	10	330
49. Hexachloroethane	67-72-1	10	330
50. Nitrobenzene	98-95-3	10	330
51. Isophorone	78-59-1	10	330
52. 2-Nitrophenol	88-75-5	10	330
53. 2,4-Dimethylphenol	105-67-9	10	330
54. Benzoic Acid	65-85-0	50	1600
55. bis(2-Chloroethoxy) methane	111-91-1	10	330
56. 2,4-Dichlorophenol	120-83-2	10	330
57. 1,2,4-Trichlorobenzene	120-82-1	10	330
58. Naphthalene	91-20-3	10	330
59. 4-Chloroaniline	106-47-8	10	330
60. Hexachlorobutadiene	87-68-3	10	330
61. 4-Chloro-3-methylphenol (para-chloro-meta-cresol)	59-50-7	10	330
62. 2-Methylnaphthalene	91-57-6	10	330
63. Hexachlorocyclopentadiene	77-47-4	10	330
64. 2,4,6-Trichlorophenol	88-06-2	10	330
65. 2,4,5-Trichlorophenol	95-95-4	50	1600

Semi-Volatiles	CAS Number	Detection Limits*	
		Low Water ^c ug/L	Low Soil/Sediment ^d ug/Kg
66. 2-Chloronaphthalene	91-58-7	10	330
67. 2-Nitroaniline	88-74-4	50	1600
68. Dimethyl Phthalate	131-11-3	10	330
69. Acenaphthylene	208-96-8	10	330
70. 3-Nitroaniline	99-09-2	50	1600
71. Acenaphthene	83-32-9	10	330
72. 2,4-Dinitrophenol	51-28-5	50	1600
73. 4-Nitrophenol	100-02-7	50	1600
74. Dibenzofuran	132-64-9	10	330
75. 2,4-Dinitrotoluene	121-14-2	10	330
76. 2,6-Dinitrotoluene	606-20-2	10	330
77. Diethylphthalate	84-66-2	10	330
78. 4-Chlorophenyl Phenyl ether	7005-72-3	10	330
79. Fluorene	86-73-7	10	330
80. 4-Nitroaniline	100-01-6	50	1600
81. 4,6-Dinitro-2-methylphenol	534-52-1	50	1600
82. N-nitrosodiphenylamine	86-30-6	10	330
83. 4-Bromophenyl Phenyl ether	101-55-3	10	330
84. Hexachlorobenzene	118-74-1	10	330
85. Pentachlorophenol	87-86-5	50	1600
86. Phenanthrene	85-01-8	10	330
87. Anthracene	120-12-7	10	330
88. Di-n-butylphthalate	84-74-2	10	330
89. Fluoranthene	206-44-0	10	330
90. Benzidine	92-87-5	50	1600
91. Pyrene	129-00-0	10	330
92. Butyl Benzyl Phthalate	85-68-7	10	330
93. 3,3'-Dichlorobenzidine	91-94-1	20	660
94. Benzo(a)anthracene	56-55-3	10	330
95. bis(2-ethylhexyl)phthalate	117-81-7	10	330
96. Chrysene	218-01-9	10	330
97. Di-n-octyl Phthalate	117-84-0	10	330
98. Benzo(b)fluoranthene	205-99-2	10	330
99. Benzo(k)fluoranthene	207-08-9	10	330
100. Benzo(a)pyrene	50-32-8	10	330

Semi-Volatiles	CAS Number	Detection Limits*	
		Low Water ^c ug/L	Low Soil/Sediment ^d ug/Kg
101. Indeno(1,2,3-cd)pyrene	193-39-5	10	330
102. Dibenz(a,h)anthracene	53-70-3	10	330
103. Benzo(g,h,i)perylene	191-24-2	10	330

^cMedium Water Contract Required Detection Limits (CRDL) for Semi-Volatile HSL Compounds are 100 times the individual Low Water CRDL.

^dMedium Soil/Sediment Contract Required Detection Limits (CRDL) for Semi-Volatile HSL Compounds are 60 times the individual Low Soil/Sediment CRDL.

Pesticides	CAS Number	Detection Limits*	
		Low Water ^e ug/L	Low Soil/Sediment ^f ug/Kg
104. alpha-BHC	319-84-6	0.05	2.0
105. beta-BHC	319-85-7	0.05	2.0
106. delta-BHC	319-86-8	0.05	2.0
107. gamma-BHC (Lindane)	58-89-9	0.05	2.0
108. Heptachlor	76-44-8	0.05	2.0
109. Aldrin	309-00-2	0.05	2.0
110. Heptachlor Epoxide	1024-57-3	0.05	2.0
111. Endosulfan I	959-98-8	0.05	2.0
112. Dieldrin	60-57-1	0.10	4.0
113. 4,4'-DDE	72-55-9	0.10	4.0
114. Endrin	72-20-8	0.10	4.0
115. Endosulfan II	33213-65-9	0.10	4.0
116. 4,4'-DDD	72-54-8	0.10	4.0
117. Endrin Aldehyde	7421-93-4	0.10	4.0
118. Endosulfan Sulfate	1031-07-8	0.10	4.0
119. 4,4'-DDT	50-29-3	0.10	4.0
120. Endrin Ketone	53494-70-5	0.10	4.0
121. Methoxychlor	72-43-5	0.5	20.0
122. Chlordane	57-74-9	0.5	20.0
123. Toxaphene	8001-35-2	1.0	40.0
124. AROCLOR-1016	12674-11-2	0.5	20.0
125. AROCLOR-1221	11104-28-2	0.5	20.0
126. AROCLOR-1232	11141-16-5	0.5	20.0
127. AROCLOR-1242	53469-21-9	0.5	20.0
128. AROCLOR-1248	12672-29-6	0.5	20.0
129. AROCLOR-1254	11097-69-1	1.0	40.0
130. AROCLOR-1260	11096-82-5	1.0	40.0

^eMedium Water Contract Required Detection Limits (CRDL) for Pesticide HSL Compounds are 100 times the individual Low Water CRDL.

^fMedium Soil/Sediment Contract Required Detection Limits (CRDL) for Pesticide HSL compounds are 60 times the individual Low Soil/Sediment CRDL.

*Detection limits listed for soil/sediment are based on wet weight. The detection limits calculated by the laboratory for soil/sediment, calculated on dry weight basis, as required by the contract, will be higher.

** Specific detection limits are highly matrix dependent. The detection limits listed herein are provided for guidance and may not always be achievable.

RECOMMENDED WAVELENGTHS⁽²⁾ AND ESTIMATED
INSTRUMENTAL DETECTION LIMITS

Element	Wavelength, nm ⁽¹⁾	Estimated Detection Limit, ug/L ⁽²⁾
Aluminum	308.215	45
Antimony	206.833	32
Arsenic	193.696	53
Barium	455.403	2
Beryllium	313.042	0.3
Boron	249.773	5
Cadmium	226.502	4
Calcium	317.933	10
Chromium	267.716	7
Cobalt	228.616	7
Copper	324.754	6
Iron	259.940	7
Lead	220.353	42
Magnesium	279.079	30
Manganese	257.610	2
Molybdenum	202.030	8
Nickel	231.604	15
Potassium	766.491	see ⁽³⁾
Selenium	196.026	75
Silica (SiO ₂)	288.158	58
Silver	328.068	7
Sodium	588.995	29
Thallium	190.864	40
Vanadium	292.402	8
Zinc	213.856	2

(1) The wavelengths listed are recommended because of their sensitivity and overall acceptance. Other wavelength may be substituted if they can provide the needed sensitivity and are treated with the same corrective techniques for spectral interference. (See 5.1.1). The use of alternate wavelengths must be reported (in nm) with the sample data.

(2) The estimated instrumental detection limits as shown are taken from "Inductively Coupled Plasma-Atomic Emission Spectroscopy-Prominent Lines," EPA-600/4-79-017. They are given as a guide for an instrumental limit. The actual method detection limits are sample dependent and may vary as the sample matrix varies.

(3) Highly dependent on operating conditions and plasma position.

ESTIMATED DETECTION LIMITS FOR RADIOLOGICAL ANALYSES

Analyses	Estimated Detection Limit
Aqueous Matrix	
Tritium	200 pCi/l
Plutonium 239	0.05 pCi/l
Americium 241	0.05 pCi/l
Uranium 233 234	0.05 pCi/l
Uranium 238	0.05 pCi/l
gross alpha	3.0 pCi/l
gross beta	3.0 pCi/l
* * * * *	
Soil Matrix	
Tritium	200 pCi/l
Plutonium 239	0.05 pCi/l
Americium 241	0.05 pCi/l
Uranium 233 234	0.05 pCi/l
Uranium 238	0.05 pCi/l
gross alpha	3.0 pCi/l
gross beta	3.0 pCi/l

APPENDIX B

HAZARDOUS SUBSTANCE SAMPLES

Packing, Marking, Labelling & Shipping

APPENDIX B

HAZARDOUS SUBSTANCE SAMPLES

Packaging, Marking, Labeling & Shipping

I. INTRODUCTION

Samples collected during incident response operations may have to be transported elsewhere for analysis. The transportation of samples must be accomplished not only in a manner designed to protect the integrity of the sample, but also to prevent any detrimental effects from the potentially hazardous nature of the samples. Regulations for packaging, marking, labeling and shipping of hazardous materials, hazardous substances and hazardous wastes are promulgated by the U.S. Department of Transportation (DOT) and described in the Code of Federal Regulations (49 CFR 171 through 177, in particular, 172.402h, packages containing samples). In general, these regulations were not intended to cover the shipment of samples collected at controlled or uncontrolled hazardous waste sites or samples collected at emergency responses. However, the U.S. Environmental Protection Agency has deemed it prudent to package, mark, label and ship samples observing DOT procedures. The information contained in this training outline is for general guidance and, although factual, should not be misconstrued as identical to DOT regulations for transportation of hazardous materials.

.I. ENVIRONMENTAL SAMPLES VERSUS HAZARDOUS SUBSTANCE SAMPLES

Samples collected at an incident should be classified as either environmental or hazardous substances (or wastes) samples. In general, environmental samples are collected off-site, such as water samples from streams, ponds or wells, and are not expected to be grossly contaminated with high levels of toxic substances. On-site samples of soil or water, samples from drums or bulk storage tanks, obviously contaminated ponds, lagoons, pools, leachates from hazardous waste sites, etc., are considered to be hazardous substances. A distinction between the two types of samples, environmental and hazardous, must be made for two major reasons. One, to determine the appropriate procedures for the transportation of the samples. Secondly, to protect the health and safety of the laboratory personnel receiving the samples. Special precautions, procedures and secondary containment areas within laboratories are used when samples other than environmental samples are received. If there is any doubt as to the classification of a sample, it should be considered a hazardous sample and shipped accordingly.

III. ENVIRONMENTAL SAMPLES

Samples judged to be environmental are not considered hazardous materials; however, environmental samples will be packaged and shipped according to the following procedures.

FROM: EPA OFFICE OF EMERGENCY AND REMEDIAL RESPONSE

HAZARDOUS RESPONSE SUPPORT DIVISION

PERSONNEL PROTECTION AND SAFETY TRAINING MANUAL

A. Packing

1. Environmental samples can be packaged following the procedures for samples classified as "flammable liquids" or "flammable solids." See section V.A. 1-5. Marking, labeling, and shipping papers do not apply.
2. Environmental samples can also be packaged without being placed inside metal cans as required for "flammable liquids".
 - a. Sample containers properly identified and with a sealed lid, in sealed polyethylene bags, can be packed in fiberboard containers or metal picnic cooler-type containers. Sufficient incombustible, absorbent cushioning material must be used to minimize the possibility of sample container breakage.
 - b. To further reduce the possibility of leakage, if a sample container and the sample bottles and absorbent material placed in the larger bag which is also sealed.

B. Marking & Labeling

1. Sample containers must have a completed sample identification tag.
2. Outside container should be marked "Environmental Sample".
3. No DOT marking and labeling is required.

C. Shipping Papers

1. No DOT shipping papers are required.

D. Transportation

1. No DOT restrictions on mode of transportation.

IV. HAZARDOUS SUBSTANCE SAMPLES - RATIONALE

Samples not determined to be environmental samples or samples known or expected to contain hazardous materials must be considered hazardous substance samples and transported according to the following requirements. If the material in the sample is known or can be identified, then it should be packaged, marked, labeled and shipped according to the specific instructions for that material (if listed) found in the DOT Hazardous Materials Table, 49 CFR 172.101. For those samples of hazardous substances where the contents are unknown, the selection of the appropriate transportation category is based upon the DOT Hazardous Materials Classification, a prioritized system of transportation categories.

A. DOT Hazardous Material Classification (173.2)

1. Radioactive Material
2. Poison 'A'
3. Flammable Gas
4. Non-Flammable Gas
5. Flammable Liquid
6. Oxidizer
7. Flammable Solid
8. Corrosive Material (liquid)
9. Poison 'B'
10. Corrosive Material (solid)
11. Irritating Material
12. Combustible Liquid (in containers having capacities exceeding 110 gal)
13. ORM-B
14. ORM-A
15. Combustible Liquid (in containers having capacities of 110 gal or less)
16. ORM-E

B. The selection of the correct category for an unknown sample is through a process of elimination, utilizing the DOT classification system.

1. Unless known or demonstrated otherwise (through the use of radiation survey instruments), the sample is considered radioactive and appropriate shipping regulations for radioactive material followed.
2. If radioactive material is eliminated, the sample is considered to contain Poison 'A' materials, the next material on the list. Poison 'A' is defined by DOT as extremely dangerous poisonous gases or liquids of such a nature that a very small amount of gas, or vapor of the liquid, mixed with air is dangerous to life.
3. The class 'A' poisons listed in 49 CFR 172.101 and their physical state at normal temperatures are:

arsine	gas
bromoacetone	liquid
chloropicrin & methyl chloride mixture	gas
chloropicrin & non-flammable, non-liquified	gas
compressed gas mixture	gas
cyanogen chloride	gas at temperature greater than 13.1 degrees Centigrade
cyanogen gas	gas
gas identification set	
gelatin dynamite (H.E. Germaine)	-
grenade (with poison 'A' gas charge)	-
hexaethyl tetraphosphate and compressed	
gas mixture	gas
hydrocyanic acid (prussic) solution	liquid
hydrocyanic acid, liquified	gas
insecticide liquified gas, containing	
poison 'A' or poison 'B' material	gas
methylchloroarsine	liquid
nitric oxide	gas
nitrogen peroxide	gas
nitrogen tetroxide	gas
nitrogen dioxide, liquid	gas
parathion & compressed gas mixture	gas
phosgene (diphosgene)	liquid

Many of the poison 'A' materials are gases or compressed gases and would not be found in drum type containers. The liquid poison 'A's would probably be found in closed containers only. All samples taken from closed drums do not have to be shipped as poison 'A's, which provides a "worst case" situation. Based upon the information available, a judgement must be made as to the hazard class of the sample.

4. If poison 'A' is eliminated as a shipment category, the next two classifications are "flammable" or "non-flammable" gases. Since few gas samples are collected, flammable liquids would be the next applicable category. The elimination of the classification of radioactive, poison 'A', flammable gas, and non-flammable gas which require more stringent shipping procedures, then permits the sample to be classified as flammable liquid (or solid) and shipped accordingly. The shipping requirements for flammable liquids would also suffice for shipping any other samples classified below flammable liquids on the DOT classification schedule.
5. For samples containing unknown material, other categories listed below flammable liquids/solids on the table, are generally not considered because:
 - a. Eliminating other substances as flammable liquids requires flashpoint testing which is impractical and possibly dangerous at a site.
 - b. Unless it is demonstrated that the sample consists of material listed below flammable liquid on the table, it is to be considered a flammable liquid (or solid) and shipped as such.

V. SAMPLES CLASSIFIED AS FLAMMABLE LIQUIDS OR FLAMMABLE SOLIDS -
PROCEDURES

A. Packaging

1. Collect sample in a glass container with non-metallic, teflon-lined screw cap. Allow sufficient ullage (approximately 10% by volume) so that the container is not liquid-full at 130 degrees Fahrenheit. If an air space in the inner most container cannot be tolerated in order to maintain sample integrity, place it within a second container to provide the required ullage.
2. Attach properly completed sample identification tag to sample container.
3. Seal sample container closure and place in 2-mil thick (or thicker) polyethylene bag, one sample per bag. The sample identification tag should be positioned to enable it to be read through the bag.
4. Place sealed bag inside an appropriate sized metal can with enough incombustible, absorbent, cushioning material (e.g. vermiculite or diatomaceous earth) to prevent breakage and absorb liquid; one bag per can. Pressure close the can and use clips, tape or other positive means to hold the lid securely, tightly, and effectively.
5. Place one or more metal cans (or single 1-gallon bottle) surrounded with incombustible, absorbing packaging material for stability during transport into a strong outside container, such as a metal picnic cooler or inside an approved fiber-board box.

B. Marking and Labeling

1. Use abbreviations only where specified. Place the following information on the metal can (or 1 gallon bottle), either hand printed or in label form.

Laboratory Name and Address

"Flammable Liquid, n.o.s. UN1993" or "Flammable Solid, n.o.s. UN1325". Not otherwise specified (n.o.s.) is not used if the flammable liquid (or solid) is identified. In that cases, the name of the specific material is used and listed before the category (i.e. "Flammable Liquid", etc.).

2. Place the following DOT labels on the outside of the can (or bottle).

"Flammable Liquid" or "Flammable Solid". The "Dangerous When Wet" label must be used with the "Flammable Solid" label if the material meets the definition of a water reactive material. The "Cargo Aircraft Only" label must be used if the net quantity of the sample in each package is greater than one quart (for "Flammable Liquid", n.o.s.) or 25 lbs. (for "Flammable Solid", n.o.s.). (172.402, 172.101)

3. If the cans are placed in an exterior container, both that container and inside can (or bottle) must have the same markings and labels as above.

The words: "This End Up" or "This Side Up" must be clearly printed on the top of the outer package. Upward pointing arrows should be placed on the sides of package. The words: "Laboratory Samples" should also be printed on the top of the package.

C. Shipping Papers

1. Use abbreviations only where specified below. Complete the carrier-provided bill of lading and sign the certification statement (if the carrier does not provide, use standard industry form) with the following information in the order listed. One form may be used for more than one exterior container.

"Flammable Liquid, n.o.s. UN1993" or "Flammable Solid, n.o.s. UN1325"; "Limited Quantity" (or "Ltd. Qty."); net weight or net volume (abbreviations of weight or volume are acceptable). Further descriptions such as "Laboratory Samples" or "Cargo Aircraft Only" (if applicable) are allowed if they do not contradict the required information.

The net weight or net volume must be placed just before or just after the "Flammable Liquid, n.o.s." or "Flammable Solid, n.o.s." description.

2. A chain-of-custody record, properly executed, must be included in the exterior container if samples are collected for legal evidence or if there is an expectation that at some future date they may be needed as evidence.

D. Transportation

1. Unknown hazardous substance samples classified as flammable liquids may be transported by rented or common carrier truck, but, railroad, or by Federal Express Corporation, but they should not be transported by any other common carrier air transport, even "cargo only" aircraft. (DOT regulations permit "cargo only" aircraft such as TWA, United, etc.; however, difficulties with regular airlines transportation suggests avoiding these types of transportation.)

These EPA procedures are designed to enable air cargo shipment by entities like Federal Express; however, they should not be construed as an endorsement by EPA of a particular commercial carrier.

2. If samples are transported by any type of government-owned vehicle, including aircraft, DOT regulations are not applicable. However, EPA personnel will use the packaging procedures described, except the bill of lading with a certification, does not have to be executed.

E. Other Considerations

1. The size of the sample to be collected should be ascertained by the analytical laboratory.
2. Use of sample preservatives or packaging in ice should be determined by the analytical laboratory.
3. Using "flammable" does not convey the certain knowledge that a sample is in fact flammable, or how flammable, but is intended to prescribe the class of packaging in order to follow DOT regulations.
4. EPA employees will accompany shipping containers to the transport carrier and if required, open outside container(s) for inspection.
5. For overnight shipments, weight restrictions should be determined. Federal Express, for instance is 70 pounds or less.

VI. SAMPLES CLASSIFIED AS POISON 'A' - PROCEDURES

A. Packaging

1. Collect samples in a polyethylene or glass container which is of an outer diameter narrower than the valve hole on a DOT Spec. #3A1800 or #3AA1800 metal cylinder. Fill sample container allowing sufficient ullage (approximately 10% by volume) so it will not be liquid-full at 130 degrees Fahrenheit. Seal sample container.
2. Attach a properly collected sample identification tag to sample container.
3. With a string or flexible wire attached to the neck of the sample container, lower it into a metal cylinder which has been partially filled with incombustible, absorbent loose packaging material (vermiculite or earth). Allow sufficient absorbing material between the bottom and sides of the container and the metal cylinder to prevent breakage and absorb leakage. After the cylinder is filled with cushioning material, drop the ends of the string or wire into the cylinder valve hole. Only one sample may be placed in a metal cylinder.
4. Replace valve, torque to 250 feet/pound (for 1 inch opening) and replace valve protector on metal cylinder, using teflon tape.
5. One or more cylinders may be placed in a DOT approved outside container.

B. Marking & Labeling

1. Use abbreviations only where specified. Place the following information on the side of the cylinder, or on a tag wired to the cylinder valve protector, either handprinted or in label form.

"Poisonous Liquid, n.o.s." or "Poisonous Gas, n.o.s. NA9035", laboratory name and address, and place the following DOT label on the cylinder - "Poisonous Gas" (even if the sample is liquid).

2. If the metal cylinders are placed in an outside container, both the container and cylinders inside must have the same markings and labels as above. In addition, "Laboratory Sample" and "Inside Packages Comply With Prescribed Specifications" should be marked on the top and/or front side of the outside container. "THIS SIDE UP" marking must be placed on the topside of the container, and upward pointing arrows on all 4 sides.

C. Shipping Papers

1. Complete the shipper-provided bill of lading and sign the certification statement (if the carrier does not provide, use standard industry form) with the following information in the order listed. One form may be used for more than one exterior container. Use abbreviations only as specified.

"Poisonous Liquid, n.o.s. NA9035", "Limited Quality" or "Ltd. Qty.", net weight or net volume. The net weight or net volume must be placed just before or just after the "Poisonous Liquid, n.o.s." marking.

2. A chain-of-custody record form should also be properly executed and included in the container or with the cylinder, if legal use of samples is required or anticipated.
3. Unless samples are driven to the laboratory, an EPA employee will accompany shipping container to the transport carrier and if required, open outside container for freight inspection.
4. Using the word "poisonous" does not convey the certain knowledge that a sample is in fact poisonous, or how poisonous, but is intended to describe the class of packaging in order to comply with DOT regulations.

D. Transportation

1. Poison 'A' categorized packages may not be transported by Federal Express Corporation (air cargo) or other common carrier aircraft, or by rental, non-government aircraft. Samples may be shipped by ground transport or government-owned aircraft.

VII. SAMPLE IDENTIFICATION

The sample tag is the means by which the sample is identified and the pertinent, necessary information recorded about the sample. The sample card should be legibly written and completed in full with an indelible pencil or pen. Information about the sample should also be recorded in a log book. The tag should be firmly affixed to the sample container. The minimum information on the identification card should include:

1. Exact location of the sample.
2. Time and date that sample was collected.
3. Name of sampler and witnesses, if necessary.
4. Project codes, sample station number, and identifying code, if applicable.
5. Type of sample, if known.
6. Hazardous substances or environmental sample.
7. Tag number (if sequential tag system is used).
8. Laboratory number (if applicable).
9. Any other pertinent information about sample.



GUIDE FOR HAZARDOUS MATERIALS SHIPPING PAPERS

The following information has been abstracted from the Code of Federal Regulations, Title 49, Parts 100-177

1. DEFINITIONS

- A. SHIPPING PAPER (Sec. 171.8) A shipping paper may be a shipping order, bill of lading, manifest, or other shipping document serving a similar purpose containing the information required by Sec. 172.202, 172.203 and 172.204.
- B. HAZARDOUS WASTE MANIFEST (CFR, Title 40, Sec. 262.20) A hazardous waste manifest is a document (shipping paper) on which all hazardous waste is identified. A copy of the manifest must accompany each shipment of waste from the point of pick-up to the destination. (CFR, Title 49, Sec. 172.205)

2. SHIPPERS RESPONSIBILITY [Sec. 172.200(a)] The shipper has the responsibility to properly prepare the shipping paper when offering a hazardous material for transport.

NOTE: For shipments of hazardous waste, the hazardous waste manifest is the only authorized documentation. (CFR, Title 40, Sec. 262.23)

3. HAZARDOUS MATERIALS DESCRIPTION (Sec. 172.202) The shipping description of a hazardous material on a shipping paper must include the following information:

- A. Proper shipping name- Sec. 172.101 or Sec. 172.102 (when authorized);
- B. The hazard class prescribed for the material in the same section; [See exceptions Sec. 172.202(a)(2)]
- C. The identification number for the material (preceded by "UN" or "NA" as appropriate); and
- D. Except for empty packagings, the total quantity (by weight, volume, or as otherwise appropriate) of the hazardous materials covered by the description.
- E. Except as otherwise provided in the regulations, the basic description in 3A, B and C above must be shown in sequence. For example "Acetone, Flammable Liquid, UN1090."
- F. The total quantity of the material covered by one description must appear before or after (or both before and after) the basic description as indicated in 3A, B and C above.
- (1) Abbreviations may be used to specify the type of packaging, weight or volume.
Example: "40 Cyl. Nitrogen Nonflammable gas UN 1066, 800 pounds"; "1 box Cement liquid, n.o.s., Flammable liquid, NA1133, 25 lbs."
- (2) Type of packaging and destination marks may be entered in any appropriate manner before or after the basic description.
- G. Technical and chemical group names may be entered in parentheses between the proper shipping name and hazard class. Example: Corrosive liquid, n.o.s. (capryl chloride), corrosive material.

4. GENERAL ENTRIES ON SHIPPING PAPERS (Sec. 172.201)

- A. CONTENTS When describing a hazardous material on the shipping paper(s), that description must conform to the following requirements:

- (1) When a hazardous material, including materials not subject to the regulations, is described on the same shipping paper, the hazardous material description entries required by Sec. 172.202 and those additional entries that may be required by Sec. 172.203.
- a. Must be entered first (See Figure 1), or
- b. Must be entered in a contrasting color, except that a description on a reproduction of a shipping paper may be highlighted, rather than printed, in a contrasting color (these requirements apply only to the basic description required by Sec. 172.202(a)(1), (2) and (3), (See Figure 1); or
- c. Must be identified by the entry "X" placed before the proper shipping name in a column captioned "HM" [the "X" may be replaced by "RQ" (Reportable Quantity), if appropriate] See Figure 1.
- (2) The required shipping description on a shipping paper and all copies that are used for transportation purposes must be legible and printed (manually or mechanically) in English.
- (3) Unless it is specifically authorized or required, the required shipping description may not contain any code or abbreviation.

BASIC DESCRIPTION

Type of Packagings May Be Abbreviated If Used.

Proper Shipping Name

Hazard Class

Total Quantity

No. of Packages	Description and Classification	Total Quantity	Weight or Measure	HAZ	Quantity of Packages
10	Drum, Gasoline, Flammable Liquid, UR1203	4500 lbs.			
40	Cyl. Nitrogen, Non-flammable Gas, UR1066	800 lbs.			
1	Drum, Flammable Solid, n.s.s., UR1325	452 lbs.			
4	Boxes, Advertising Material, Paper, NOI	60 lbs.			
1	Roll, Paper Printing, Newspaper	690 lbs.			
12	Sets, Carbon Paper	22 lbs.			

CERTIFICATION

HAZARDOUS MATERIALS ENTRIES LISTED FIRST

BASIC DESCRIPTION

Type of Packagings May Be Abbreviated If Used.

Proper Shipping Name

Hazard Class

Total Quantity

No. of Packages	Description and Classification	Total Quantity	Weight or Measure	HAZ	Quantity of Packages
10	Drums, Gasoline, Flammable Liquid, UR1203	4500 lbs.			
4	Boxes, Advertising Material, Paper, NOI	60 lbs.			
1	Drum, Flammable Solid, n.s.s., UR1325	452 lbs.			
12	Sets, Carbon Paper	22 lbs.			
40	Cyl. Nitrogen, Non-Flammable Gas, UR1066	800 lbs.			

CERTIFICATION

NM Entries-Contrasting Colors

Note: Reproduction of a shipping paper may be highlighted by a highlighting pen rather than printed in a contrasting color.

HAZARDOUS MATERIALS ENTRIES-CONTRASTING COLOR

BASIC DESCRIPTION

Type of Packagings May Be Abbreviated If Used.

Proper Shipping Name

Hazard Class

Total Quantity

No. of Packages	HM	Description and Classification	Total Quantity	Weight or Measure	HAZ	Quantity of Packages
4		Boxes, Advertising Materials, Paper, N.O.I.	60 lbs.			
10	X	Drums; Gasoline, Flammable Liquid, UR1203	4500 lbs.			
1	X	Drum, Flammable Solid, n.s.s., UR1325	452 lbs.			
12		Sets, Carbon paper	22 lbs.			
40	X	Cyl. Nitrogen, Nonflammable Gas, UR1066	800 lbs.			
1		Roll, Paper, Printing, Newspaper	690 lbs.			

CERTIFICATION

HAZARDOUS MATERIALS PREFIXED BY "X" IN HM COLUMN

FIGURE 1. HAZARDOUS MATERIALS LISTED ON SHIPPING PAPERS

(4) A shipping paper may contain additional information concerning the material provided the information is not inconsistent with the required description. Unless otherwise permitted or required, additional information must be placed after the basic description required by Sec. 172.202(a).

- a. When appropriate, the entries "IMCO" or "IMCO Class" may be entered immediately before or immediately following the class entry in the basic description.
- b. If a material meets the definition of more than one hazard class, the additional hazard class or classes may be entered after the hazard class in the basic description.

B. NAME OF SHIPPER A shipping paper for a shipment by water must contain the name of the shipper.

5. ADDITIONAL DESCRIPTION REQUIREMENTS (Sec. 172.203) (ALL MODES)

A. Exemptions - Each shipping paper issued in connection with a shipment made under an exemption must bear the notation "DOT-E" followed by the exemption number assigned (Example: DOT-E 4648) and so located that the exemption number is clearly associated with the description to which the exemption applies.

B. Limited Quantities - Descriptions for materials defined as "Limited Quantities"...must include the words "Limited Quantities" or "Ltd. Qty." following the basic description.

C. Hazardous Substances

(1) If the proper shipping name for a mixture or solution that is a hazardous substance does not identify the constituents making it a hazardous substance, the name or names of such constituents shall be entered in association with the basic description.

(2) The letters "RQ" (Reportable Quantity) shall be entered on the shipping paper either before or after the basic description required by Sec. 172.202 for each hazardous substance. (See definition Sec. 171.8) Example: RQ, Cresol, Corrosive Material, NA2076; or Adipic Acid, ORM-E, NA9077, RQ.

D. Radioactive Materials - For additional description for radioactive materials, refer to Sec. 172.203(d).

E. Empty Packaging

(1) Except for a tank car, or any packaging that still contains a hazardous substance, the description on the shipping paper for an empty packaging containing the residue of a hazardous material may include the word(s) "EMPTY" or "EMPTY: Last Contained (Name of Substance)" as appropriate in association with the basic description of the hazardous material last contained in the packaging.

(2) For empty tank cars, see Sec. 174.25(c).

(3) If a packaging, including a tank car, contains a residue that is a hazardous substance the description on the shipping paper shall be prefaced with the phrase "EMPTY: Last Contained (Name of Substance)" and shall have "RQ" entered before or after the basic description.

F. Dangerous When Wet - The words "Dangerous When Wet" shall be entered on the shipping paper in association with the basic description when a package covered by the basic description is required to be labeled with a "DANGEROUS WHEN WET" label.

G. Poisonous Materials - Notwithstanding the class to which a material is assigned:

(1) If the name of the compound or principal constituent that causes the material to meet the definition of a poison is not included in the proper shipping name for the material, the name of that compound or constituent shall be entered on the shipping paper in association with the shipping description for the material.

(2) The name of the compound or principal constituent may be either a technical name or any name for the material that is listed in the NIOSH Registry. (Registry of Toxic Effects of Chemical Substances, 1978 Edition) [Sec. 172.203(k)]

NOTE: For additional details, see Sec. 172.203(k)

H. Exceptions: OTHER REGULATED MATERIAL (ORM - A, B, C, AND D)

(1) Shipping paper requirements do not apply to any material other than a hazardous waste or a hazardous substance that is:

- a. An ORM-A, B or C unless it is offered or intended for transportation by air or water when it is subject to the regulations pertaining to transportation by air or water as specified in Sec. 172.101 (Hazardous Materials Table); or
- b. An ORM-D unless it is offered or intended for transportation by air.

MODAL REQUIREMENTS
(ADDITIONAL INFORMATION)

NOTE: In addition to the basic requirements for shipping papers, additional information is listed for each mode.

TRANSPORTATION BY RAIL

A. SHIPPING PAPERS (Sec. 174.24)

(1) Except as provided in paragraph (b) of this section, no person may accept for transportation by rail any hazardous material which is subject to this subchapter unless he has received a shipping paper prepared in a manner specified in Sec. 172.200. In addition, the shipping paper must include a certificate, if required by Sec. 172.204. However, no member of the train crew of a train transporting the hazardous material is required to have a shippers certificate on the shipping paper in his possession if the original shipping paper containing the certificate is in the originating carriers possession.

(2) This subpart does not apply to materials classed as ORM-A, B, C or D.

B. ADDITIONAL DESCRIPTION FOR SHIPPING PAPERS [Sec. 172.203(g)]

(1) The shipping paper for a rail car containing a hazardous material must contain the notation "Placarded" followed by the name of the placard required for the rail car.

(2) The shipping paper for each specification DOT 112A or 114A tank car (without head shields) containing a flammable compressed gas must contain the notation "DOT 112A" or "DOT 114A", as appropriate, and either "Must be handled in accordance with FRA E.O. No. 5" or "Shove to rest per E.O. No. 5."

NOTE: For additional details, refer to Part 174.

TRANSPORTATION BY AIR

A. SHIPPING PAPERS ABOARD AIRCRAFT (Sec. 175.35) A copy of the shipping papers required by Sec. 175.30(a)(2) must accompany the shipment it covers during transportation aboard an aircraft.

NOTE: The documents required (shipping papers and notification of pilot-in-command) may be combined into one document if it is given to the pilot-in-command before departure of the aircraft. [Sec. 175.35(b)].

B. NOTIFICATION OF PILOT-IN-COMMAND (Sec. 175.33) The operator of the aircraft shall give the pilot-in-command the following information in writing before takeoff (Sec. 175.35):

(1) Description of hazardous material on shipping papers (Sec. 172.202 and 172.203);

(2) Location of the hazardous material in the aircraft; and

(3) The results of the inspection requirements by Sec. 175.30(b).

NOTE: For additional details, refer to Part 175.

3. TRANSPORTATION BY WATER

A. SHIPPING PAPERS (Sec. 176.24) A carrier may not transport a hazardous material by vessel unless the material is properly described on the shipping paper in the manner prescribed in Part 172.

B. CERTIFICATE (Sec. 176.27)

(1) A carrier may not transport a hazardous material by vessel unless he has received a certificate prepared in accordance with Sec. 172.204.

(2) In the case of an import or export shipment of hazardous materials which will not be transported by rail, highway, or air, the shipper may certify on the bill of lading or other shipping paper that the hazardous material is properly classed, described, marked, packaged and labeled according to Part 172 or in accordance with the requirements of the IMCO Code. (See Sec. 171.12)

C. DANGEROUS CARGO MANIFEST (Sec. 176.30) The master of a vessel transporting hazardous materials or his authorized representative shall prepare a dangerous cargo manifest, list, or storage plan. This document may not include a material which is not subject to the requirements of CFR, Title 49, or the IMCO Code. This document must be kept in a designated holder on or near the vessel's bridge. (See Sec. 176.30 for details)

D. EXEMPTIONS (Sec. 176.31) If a hazardous material is being transported by vessel under the authority of an exemption and a copy of the exemption is required to be on board the vessel, it must be kept with the dangerous cargo manifest.

NOTE: For additional details, refer to Part 176.

E. ADDITIONAL DESCRIPTION FOR SHIPPING PAPERS [Sec. 172.203(1)]

- (1) Each shipment by water must have the following additional shipping paper entries:
 - a. Identification of the type of packages such as barrels, drums, cylinders, and boxes,
 - b. The number of each type of packages including those in freight container or on a pallet, and
 - c. The gross weight of each type of package or the individual gross weight of each package.
- (2) The shipping papers for a hazardous material offered for transportation by water to any country outside the United States must have in parenthesis the technical name of the material following the proper shipping name when the material is described by a "n.o.s." entry in Sec. 172.101 (Hazardous Materials Table). For example: Corrosive liquid, n.o.s. (caprylyl chloride), Corrosive material. However, for a mixture, only the technical name of any hazardous material giving the mixture its hazardous properties must be identified.

9. TRANSPORTATION BY HIGHWAY

A. SHIPPING PAPERS (Sec. 177.817)

- (1) General - A carrier may not transport a hazardous material unless it is accompanied by a shipping paper that is prepared in accordance with Sec. 172.201, 172.202 and 172.203.
- (2) Shipper's certification - An initial carrier may not accept hazardous materials offered for transportation unless the shipping paper describing the material includes a shipper's certification which meets the requirements in Sec. 172.204 of this subchapter. The certification is not required for shipments to be transported entirely by private carriage and for bulk shipments to be transported in a cargo tank supplied by the carrier. [Sec. 177.817(c)]
- (3) Interlining with carriers by rail - A motor carrier shall mark on the shipping paper required by this section, if it offers or delivers a freight container or transport vehicle to a rail carrier for further transportation: [Sec. 177.817(c)]
 - a. A description of the freight container or transport vehicle; and
 - b. The kind of placard affixed to the freight container or transport vehicle.
- (4) This subpart does not apply to materials classed as an ORM-A, B, C or D.
- (5) Accessibility of shipping papers: The driver and each carrier using the vehicle shall ensure that the shipping paper is readily available and recognizable by authorities in the case of an accident or inspection. [See Sec. 177.817(e) for details]

B. ADDITIONAL DESCRIPTION FOR SHIPPING PAPERS [Sec. 172.203(h)] For additional descriptions for Anhydrous ammonia see Sec. 172.203(h)(1); Liquefied petroleum gas see Sec. 172.203(h)(2) and Exemptions see Sec. 172.203(a).

10. SHIPPER'S CERTIFICATION (Sec. 172.204)

A. GENERAL (Except B and D below)

- (1) Except as provided in paragraphs (b) and (c) of Sec. 172.204, each person who offers a hazardous material for transportation shall certify that the material offered for transportation is in accordance with the regulations by printing (manually or mechanically) the following statement on the shipping paper containing the required description:

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: The words "herein-named" may be substituted for the words "above named".

*NOTE: For hazardous waste shipments, the words "and the EPA" must be added to the end of the certification. [See CFR, Title 40, Sec. 262.21(b)]

(1) General - Certification containing the following language may be used in place of the certification required by paragraph A(1) above:

I hereby certify that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked and labeled, and in proper condition for carriage by air according to applicable national governmental regulations.

(2) Duplicate Certificate - Each person who offers a hazardous material to an aircraft operator for transportation by air shall provide two (2) copies of the certificate. (Sec. 175.30)

(3) Passenger and Cargo Aircraft - If hazardous materials are offered for transportation by air, add to the certificate the following statement:

This shipment is within the limitations prescribed for passenger/cargo-only aircraft. (delete non-applicable)

(4) Radioactive Material - Each person who offers any radioactive material for transportation aboard a passenger-carrying aircraft shall sign (mechanically or manually) a printed certificate stating that the shipment contains radioactive material intended for use in, or incident to, research, medical diagnosis or treatment.

NOTE: See Sec. 175.10 for exceptions.

C. SIGNATURE - The certifications required above must be legibly signed (mechanically or manually) by a principal, officer, partner or employee of the shipper or his agent. [Sec. 172.204(d)]

D. EXCEPTIONS - Except for a hazardous waste, no certification is required for hazardous material offered for transportation by motor vehicle and transported:

(1) In a cargo tank supplied by the carrier, or

(2) By the shipper as a private carrier except for a hazardous material that is to be reshipped or transferred from one carrier to another.

(3) No certification is required for the return of an empty tank car which previously contained a hazardous material and which has not been cleaned or purged.

HAZARDOUS WASTE MANIFEST INFORMATION

The following information has been abstracted from the Code of Federal Regulations (CFR), e 49, Parts 100-177 and CFR, Title 40, Part 262.

1. DEFINITIONS

A. HAZARDOUS WASTE MANIFEST (CFR Title 40, §262.20)

A hazardous waste manifest is a shipping document on which all hazardous wastes are identified.

B. SHIPPING PAPER - A shipping order, bill of lading, manifest, or other shipping document serving a similar purpose and containing the information required by §172.202, §172.203 and §172.204.

2. DOT HAZARDOUS MATERIALS MANIFEST REQUIREMENTS (§172.205)

A. No person may offer, transport, transfer or deliver a hazardous waste unless a hazardous waste manifest is prepared, signed, carried and given as required of that person by §172.205.

B. The shipper (generator) must prepare the manifest in accordance with the EPA Regulations, CFR Title 40, Part 262.

C. The original copy of the manifest must be dated by, and bear the handwritten signature of the person representing the:

(1) Shipper (generator) of waste at the time it is offered for transportation, and

(2) Initial carrier accepting the waste for transportation.

D. A copy of the manifest must be dated by, and bear the handwritten signature of the person representing:

(1) Each subsequent carrier accepting the waste for transportation, at the time of acceptance, and

(2) The designated facility receiving the waste, upon receipt.

- (1) Given to a person representing each carrier accepting the waste for transportation,
- (2) Carried during transportation in the same manner as required for shipping papers,
- (3) Given to a person representing the designated facility receiving the waste,
- (4) Returned to the shipper (generator) by the carrier that transported the waste from the United States to a foreign destination with a notation of the date of departure from the United States, and
- (5) Retained by the shipper (generator) and by the initial and each subsequent carrier for three (3) years from the date the waste was accepted by the initial carrier. Each retained copy must bear all required signatures and dates up to and including those entered by the next person who received the waste.
- F. The requirements of §172.205(d) and (3) do not apply to a rail carrier when waste is delivered to a designated facility by railroad if:
- (1) All of the information required to be entered on the manifest (except generator and carrier identification numbers and the generator's certification) is entered on the shipping paper carried in accordance with §174.26(c);
- (2) The delivering rail carrier obtains and retains a receipt for the waste that is dated by and bears the handwritten signature of the person representing the designated facility; and
- (3) A copy of the shipping paper is retained for three (3) years by each railroad transporting the waste.
- G. The person delivering a hazardous waste to an initial rail carrier shall send a copy of the manifest, dated and signed by a representative of the rail carrier, to the person representing the designated facility.
- H. A hazardous waste manifest required by CFR, Title 40, Part 262 containing all the information required by CFR, Title 49, Subpart C, may be used as the shipping paper.
3. THE MANIFEST—GENERAL REQUIREMENTS (§262.20)
- A. A generator (shipper) who transports, or offers for transportation, hazardous waste for off-site treatment, storage, or disposal must prepare a manifest before transporting the waste off-site.
- B. A generator (shipper) must designate on the manifest one facility which is permitted to handle the waste described on the manifest.
- C. A generator (shipper) may also designate on the manifest one alternate facility which is permitted to handle his waste in the event an emergency prevents delivery of the waste to the primary designated facility.
- D. If the transporter (carrier) is unable to deliver the waste to the designated facility, the generator must either designate another facility or instruct the transporter to return the waste.
4. MANIFEST INFORMATION (§262.21)
- A. The manifest must contain:
- (1) Manifest document number;
- (2) Generator's (Shipper's) name, mailing address, telephone number, and the EPA identification number;
- (3) Name and EPA identification number of each transporter (carrier);
- (4) Name, address and EPA identification number of the designated facility and an alternate facility, if any;
- (5) Description of the waste(s) (e.g. proper shipping name required by the Department of Transportation Hazardous Materials Regulations CFR, Title 49, §172.101, §172.202 and §172.203); and
- (6) Total quantity of each hazardous waste by units of weight or volume, and the type and number of containers loaded into or onto the transport vehicle.
- B. Certification [§262.21(b)] The following certification must appear on the manifest:
"This is to certify that the above named materials are properly classified, described, packaged, marked, labeled and are in proper condition for transportation according to the applicable regulations of the Department of Transportation and the EPA"

5. COPIES OF MANIFEST REQUIRED (§262.22)

The manifest must consist of at least the number of copies to provide the generator, each transporter and the owner or operator of the designated facility with one copy each for their records and another copy to be returned to the generator.

6. USE OF THE MANIFEST (§262.23)

A. The generator must:

- (1) Sign the manifest certification by hand;
- (2) Obtain the handwritten signature of the initial transporter and date of acceptance of manifest; and
- (3) Retain one copy in accordance with §262.40(a).

B. The generator must give the transporter the remaining copies of the manifest.

C. Shipment of hazardous waste within the United States solely by railroad or water (bulk shipments only); the generator must send three (3) copies of the manifest dated and signed in accordance with §262.20 to the owner or operator of the designated facility.

NOTE: Copies of the manifest are not required for each transporter. For special provisions for rail or water (bulk shipment) transporters see §263.20(e).

7. PREPARATION OF HAZARDOUS WASTE FOR SHIPMENT (§262.30)

A. Packaging Hazardous Waste - The generator (shipper) has the responsibility for the classification and packaging of hazardous waste prior to offering for transportation. The requirements for packaging will be found in the Department of Transportation Regulations CFR, Title 49, Parts 172, 173, 178 and 179.

B. Labeling Requirements (§262.31) - Prior to offering a hazardous waste for transportation off-site, the generator (shipper) must label each package in accordance with CFR Title 49, Part 172, Subpart E.

C. Marking Requirements (§262.32) - Prior to offering hazardous waste for transportation off-site, the generator must:

- (1) Mark each package of the hazardous waste; and
- (2) Mark each container 110 gallons or less offered for transportation with the following words and information displayed in accordance with the requirements of CFR, Title 49, Sec. 172.304.

"HAZARDOUS WASTE-Federal Law Prohibits Improper Disposal. If found, contact the nearest police or public safety authority or the United States Environmental Protection Agency"

Generator's Name and Address _____

Manifest Document Number _____

D. Placarding Requirements (§262.33) - Prior to offering a hazardous waste for transportation off-site, the generator must:

- (1) Placard the shipment; or
- (2) Offer the initial transporter (carrier) the appropriate placards. (CFR Title 49, Part 172, Subpart F)

NOTE: This handout is designed as a training aid only. It does not relieve persons from complying with the Department of Transportation's Hazardous Materials Regulations. Final authority for use of shipping papers is found in the Code of Federal Regulations, Title 49, Part 100-177.

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DEPARTMENT OF TRANSPORTATION
RESEARCH AND SPECIAL PROGRAMS ADMINISTRATION
MATERIALS TRANSPORTATION BUREAU
OFFICE OF OPERATIONS AND ENFORCEMENT
INFORMATION SERVICES DIVISION, DMT-11
WASHINGTON, D.C. 20590

REVISED MAY 1981



HAZARDOUS MATERIALS TRANSPORTATION GUIDE FOR MARKINGS

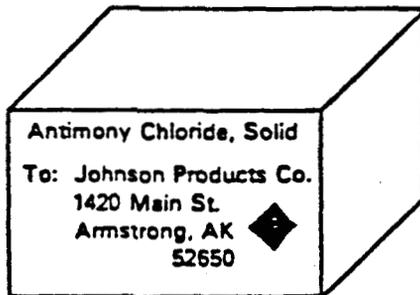
Marking, as addressed in the Hazardous Materials Regulations, refers to application of descriptive information, instructions, cautions, weight, retest dates, or combination thereof on outside packages as required by Title 49, Code of Federal Regulations (49 CFR), Parts 100-199. Marking also means applying the specification marks for both inside and outside containers as required. This definition does not include the requirements for labeling and placarding, as set forth in 49 CFR, Parts 100-199.

DESCRIPTIVE INFORMATION

● GENERAL (§ 172.300 - § 172.304)

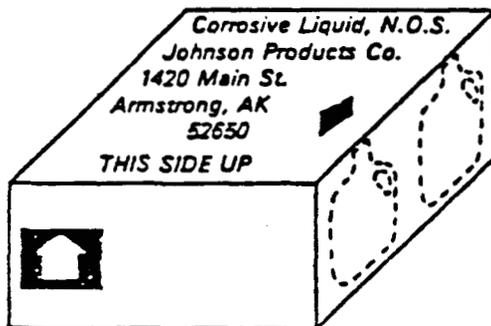
All containers of hazardous materials must, unless specifically excepted, be marked with the proper shipping name of the contents and the name and address of either the consignee or consignor. This marking must be:

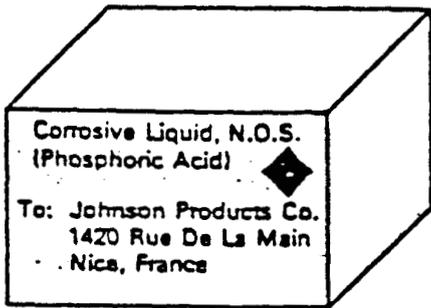
1. Durable, in English, and printed on or affixed to the surface of a package or on a label, tag, or sign.
2. In a sharply contrasting color to its background.
3. Unobscured.
4. Away from other markings which will reduce its effectiveness.



● PACKAGES CONTAINING INSIDE CONTAINERS WHICH HOLD LIQUID HAZARDOUS MATERIALS (§ 172.312)

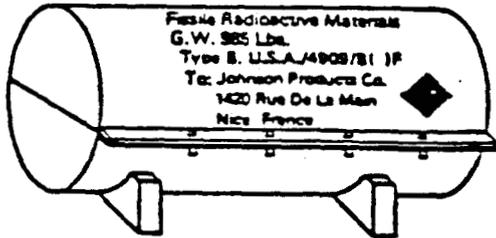
1. Inside containers must be oriented with closures up.
2. Must be marked on outside "This End Up" or "This Side Up".
3. Arrows other than those which show package orientation must not be used. The use of ANSI standard MH6.11968 "This Way Up" arrows is recommended.





● EXPORT BY WATER (§ 172.302)

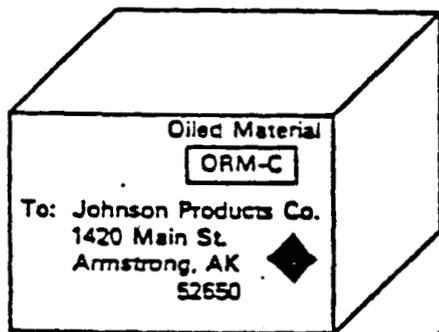
All n.o.s. entries must have the technical name of the commodity immediately following the (proper shipping name) for export by water. (For mixtures, only the hazardous materials which give the mixture its hazard need be identified.)



● RADIOACTIVE MATERIALS (§ 172.310)

1. If over 110 lbs. the gross weight must be marked on the container.
2. Must be marked "TYPE A" or "TYPE B" as required in letters at least 1/2" high.
3. For export, the letters USA must follow the specification marking or package certification.

ORM MATERIALS (§ 172.316)



- ORM materials must be designated immediately following or below the proper shipping name marking within a rectangular border approximately 1/4" larger than the designation. This designation must be one of the following:

- | | |
|-------------------|--------------|
| 1. ORM-A | 4. ORM-C |
| 2. ORM-B-Keep Dry | 5. ORM-D |
| 3. ORM-B | 6. ORM-D-Air |



ORM-B KEEP DRY
Example

(This marking is the certification, for surface transportation, by the shipper that the materials is properly described, classed, packaged, and labeled and in proper condition for transportation, etc.)

● AUTHORIZED CONTAINERS IN OUTSIDE PACKAGES

When a DOT specification container is required for a commodity and that container is further overpacked in another container meeting the requirements of §§ 173.21 and 173.24, the outside container must be marked in compliance with § 173.25.

● CYLINDERS

All cylinders must be marked in compliance with § 173.34 and § 173.301. Those cylinders having been periodically tested and qualifying for reuse must be marked according to the requirements of § 173.34(e)(6).

● PORTABLE TANKS (§ 172.326)

For portable tanks, the proper shipping name, in letters at least 2" in height, must be displayed on two opposing sides. The name of the owner or lessee must be displayed. The contents of the tank may not be changed and offered for transportation without changing the proper shipping name on the tank. Portable tanks carrying compressed gases (DOT 51) must have all inlets and outlets, except safety relief devices marked to indicate whether they communicate with liquid or vapor (§ 178.245-6(b)).

● CARGO TANKS CONTAINING GASES (§ 172.328(c)(d))

Cargo tanks must be marked, in letters of at least 2" in height, with either the proper shipping name or an appropriate common name, such as "Refrigerant Gas". Each cargo tank made to Specification MC 330 and MC 331 must be marked near the Spec. plate, in letters of at least 2" in height, NQT or QT, as appropriate, to designate whether made with quenched and tempered steel or not. Cargo tanks must only be marked for the material contained therein. DOT MC 331 tanks must have inlets and outlets, except safety relief devices, marked to designate whether they communicate with vapor or liquid when the tank is filled to its maximum allowable filling density (§ 178.337-9(c)).

● TANK CARS (§ 172.330)

Tank cars, when required to be marked with the proper shipping name by Part 173 and 179, must be marked in letters at least 4" in height with at least a 5/8" stroke, with the proper shipping name or appropriate common name such as "Refrigerant Gas". These markings must be on both sides of the tank car and clearly visible from either side. Tank cars must only be marked for the material contained therein. See the referenced section for special application for 106 and 110 tank car tanks.

OTHER MARKING REQUIREMENTS

● REQUALIFIED CONTAINERS

Reusable cylinders, portable tanks, cargo tanks, and tank cars are required to be either visually inspected or retested at periodic intervals. When so inspected or tested, the date of requalification must be shown on the container as stated in §§ 173.24, 173.31, 173.32, 173.33, and 173.34.

● REUSE OF CONTAINERS

Some single trip containers in the DOT 17 Series may be qualified for reuse by a reconditioner registered with the Department of Transportation. These drums must have their old labels, exemption numbers (if any) and descriptive markings removed and must be marked as reconditioned. Specific rules for this removal of markings and re-marking are contained in § 173.28.

● CARGO HEATERS

Cargo heaters authorized for use with flammable liquids must be marked in accordance with § 177.834(1)(2)(i).

● MARKING OF MOTOR VEHICLES

The requirements for marking of motor vehicles is addressed in § 177.823, as well as specific relief in emergency situations from these requirements.

SPECIFICATIONS ON CONTAINERS

The marking of specification containers must generally identify: (1) the specification to which a container is made; and (2) the manufacturer's name and address or symbol (registered with the Bureau of Explosives). All containers made to a specification must comply with the marking provisions of § 173.24. Certain exceptions for Canadian and other import/export situations may be found in §§ 171.12 and 173.8. In some cases, specific detailed information, such as original test date information and type of material, may be required by the applicable section of Parts 178 and 179.

Additional marking requirements may be found in Parts 173 and 179, either in general terms or specifically by commodity.

- This publication is intended to be used solely as a guide. It does not include all the required markings required in 49 CFR, Parts 100-199. To assure total compliance, use of the current regulations is required.

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APPENDIX C

Shipping of Radioactive Materials .

From: THE HEALTH PHYSICS AND RADIOLOGICAL HANDBOOK
Bernard Schleien and Michael S. Terpilak
Nucleon Lectern Associates, Inc., 1984

Shipping of Radioactive Materials

This chapter is intended to be a comprehensive guide to the more prominent and basic regulatory requirements for the safe transportation of radioactive materials. Information is included on the shippers' requirements for limitation of activity content of packages, packaging, labeling, shipping documentation and control of radiation and contamination.

Basic guidance also is included on the handling of transport incidents and emergencies during the transport of radioactive materials.

The tables and illustrations in this chapter are directed toward the practical. The references listed in the bibliography are extensive, and should be consulted for a more detailed discussion of the information in this chapter. A great deal of the basic information contained herein is based on a Federal USDOT training publication which reviews the transport regulations for radioactive material. (Pamphlet "A Review of the DOT Regulations for Transportation of Radioactive Material," Revised Fall 1983)

Table 12.1 Regulatory Organizations And Sources

Statutory authority to regulate safety in the transport of radioactive materials is vested principally in two Federal Agencies -- the U.S. Department of Transportation (DOT) and the U.S. Nuclear Regulatory Commission (NRC). The U.S. Postal Service also has established rules for certain very small mailable quantities of radioactive material. Pursuant to the Transportation Safety Act of 1974 ("Transportation Safety Act of 1974", as amended, Public Law 93-633, 88 Stat. 2156, 49 USC 1808, Jan. 3, 1975) and earlier legislation, (The Department of Transportation Act of October 15, 1967, Public Law 89.670 Stat. 937, 49 USC 1657) the DOT is the Federal agency charged with the overall responsibility to regulate shippers and carriers of all types of hazardous materials in interstate and foreign commerce. Under its authority of the Atomic Energy Act of 1954 ("The Atomic Energy Act of 1954," as amended, Public Law 83-703, 68 Stat. 919, 42-USC Chapter 23) and the Energy Reorganization Act of 1974 ("Energy Reorganization Act of 1974," as amended, 42 USC 5841), the NRC regulates the use, possession and transfer (including transportation) of licensed byproduct, source and special nuclear material.

In certain Agreement States*, the state regulates the use, possession and intra-state transportation of byproduct and source materials licensed by the state. Common and contract carriers however are exempted from licensing to the extent that they possess, transport or store licensed material delivered by a licensee for transport. Because of the overlapping and duplicative authority to regulate transport of radioactive materials, the NRC and DOT have accomplished a written Memorandum of Understanding, ("Transportation of Radioactive Materials; Memorandum of Understanding", Federal Register, (44 FR 38690), July 2, 1979), intended to avoid duplicative effort and conflicts.

Table 12.1. Sources of Federal Regulations
Transportation of Radioactive Materials

Title 49 Department of Transportation's Hazardous Materials Regulations, (49 CFR Part 100-77 "Hazardous Regulations" of the US Department of Transportation, Revised as of Oct. 1)
Parts 100-177 and 178-179.

Main Headings

- 49 CFR 106 - Rulemaking Procedures
- 49 CFR 107 - Hazardous Materials Program Procedures
- 49 CFR 171 - General Information, Regulations and Definitions

*States which have entered into an agreement with the NRC pursuant to Section 274 of the Atomic Energy Act of 1954, as amended, under which the NRC has relinquished to such States the majority of its regulatory authority over source, byproduct, and special nuclear materials in quantities not sufficient to form a critical mass.

Table 12.1. Sources of Federal Regulations
Transportation of Radioactive Materials
(continued)

-
- 49 CFR 172 - Hazardous Materials Table and Hazardous Materials Communications Regulations
 - 49 CFR 173 - Shippers-General Requirements for Shipments and Packagings
 - 49 CFR 174 - Carriage by Rail
 - 49 CFR 175 - Carriage by Aircraft
 - 49 CFR 176 - Carriage by Vessel
 - 49 CFR 177 - Carriage by Public Highway
 - 49 CFR 178 - Shipping Container Specifications
-

Title 10 U.S. Nuclear Regulatory Commission (10 CFR Part 71, "Packaging and Transportation of Radioactive Material." Revised annually as of January 1)

- 10 CFR 71 - Packaging and Transportation of Radioactive Material
-

Title 39 Postal Service (US Postal Service Publication No. 6, Dec. 1975 "Radioactive Material, as amended by US Postal Bulletin, June 30, 1983, pages 2-5.)

Domestic Mail Manual, U.S. Postal Service Regulations, Part 124. (Postal Regulations for Transport of Radioactive Matter are published in U.S. Postal Service Publication #6, December 1975 and in the U.S. Postal Manual and in the U.S. Postal Manual.)

Table 12.2 Definition of Radioactive Material

For purposes of transportation, radioactive materials having a specific activity not exceeding two nanocuries per gram (0.002 $\mu\text{Ci/gm}$) are not subject to regulation in transportation. This is, however, a "de minimus" level which applies only to transportation. For purposes of licensing during use and possession, such materials may still be subject to regulation by NRC or an Agreement State.

Safety during the transport of radioactive material is achieved principally by the use of proper packaging, considering the type, quantity and form of the material, and by limitation of the level of radiation from the material. Much less reliance is placed on operational or carriers controls. In establishing the proper type of packaging and activity content limitation within the package, the following factors must therefore be considered:

- a. the type of material, e.g., the radionuclide;
- b. the quantity of radioactivity; and
- c. the form of the material, e.g., whether in:
 1. Special form; or
 2. Normal (non-special) form.

Special Form and Normal Forms of radioactive material are illustrated in Figure 12.1.

Table 12.3 Quantity Limits and Packaging

After considering the type, quantity, and form of the radioactive material, the appropriate packaging and limitation of the activity content of such packaging can then be established. Packaging types generally fall within one of the following broad types:

Type A (Figure 12.2)
Type B (Figure 12.2)
Excepted or exempt
Strong Tight

Table 12.4 A_1/A_2 System for Limiting Package Activity Content

Prior to July 1983, the regulations utilized a "transport group" system to establish activity content limits of packages. Under the old system, each radionuclide was assigned to one of seven transport groups. The activity limit of that material in normal form was the limit for the group, which was based on the most radioactive member of the group. For special form materials, the Type A limit was the same for all nuclides -- 20 curies. After the A_1/A_2 system each radionuclide is assigned an A_1 and A_2 value. The A_1 limit, based on external radiation considerations is the type A limit for that nuclide in special form. The A_2 limit, based on radiotoxicity, is its limit in Type A packaging, when in normal form. The A_1/A_2 values are used to derive limits for excepted (limited) quantities, radioactive articles (devices), and low specific activity (LSA) materials. Quantities exceeding A_1 or A_2 are Type B. The table below lists typical A_1/A_2 limits for several common nuclides.

Table 12.4 Examples of A_1/A_2 Limits

Symbol of Radionuclide	Element and Element Number	A_1 (Ci) (Special Form)	A_2 (Ci) (Normal Form)
^{14}C	Carbon (6)	1000	60
^{137}Cs	Cesium (55)	30	10
^{99}Mo	Molybdenum (42)	100	20
^{235}U	Uranium (92)	100	0.2
^{226}Ra	Radium (88)	10	0.05
^{201}Pb	Lead (82)	20	20
^{239}Pu	Plutonium (94)	2	0.002
^{35}S	Sulfur (16)	1000	60
^{60}Co	Cobalt (27)	7	7
^{90}Sr	Strontium (38)	10	0.4
^{241}Am	Americium (95)	8	0.008
^{192}Ir	Iridium (77)	20	10

Table 12.5 Types of Packaging

Figure 12.2 is an illustration of "Typical Type A Packaging Schemes." Type A packaging is that which must be designed in accordance with the applicable general packaging requirements as prescribed in the regulations (Sections 173.24, 173.411, 173.412), and which must be adequate to prevent the loss or dispersal of its radioactive contents and to maintain its radiation shielding properties if the package is subjected to normal conditions of transport. The regulations prescribe (Section 173.465) the performance criteria to simulate normal and rough handling conditions of transport. Typically, the Type A packaging prescribed in the regulations is the performance-based DOT Spec. 7A (Section 178.350) Type A general packaging for which each shipper must make his own assessment and certification of the particular package design against the performance requirements. The regulatory framework, therefore, provides for the use of Type A packaging without prior specific approval by DOT of the package designs via the use of DOT Spec. 7A performance specifications. Additionally, foreign-made Type A packages are acceptable internationally, provided they are so marked as Type A and comply with the requirements of the country of origin. It should be noted that the shipper of each DOT Spec. 7A is required to maintain on file for at least one year after the latest shipment, and be prepared to provide to DOT a complete certification and supporting safety analysis demonstrating that the construction methods, packaging design, and materials of construction are in compliance with the specification (see Section 173.415). The information in this file must show, through any of the methods given in Section 173.461, that all the requirements of Sections 173.24, 173.463 and 173.465 are met. The file must also relate the contents of the package(s) being shipped to the contents which were used for testing purposes.

Except for a limited number of specification Type B packagings (e.g., DOT-6M) described in the DOT regulations, all Type B package designs require PRIOR APPROVAL of the U.S. Nuclear Regulatory Commission or Department of Energy (DOE). (See Section 173.471 for standard requirements and conditions pertaining to NRC approved packages and Section 173.7 for DOE certified packages.)

"Type B Packages," "Highway Route Controlled Quantities," and "Fissile Radioactive Materials" present more unusual and specific problems for packaging and carrier's operational controls. These materials are additionally controlled by the specific packaging standards as promulgated by the Nuclear Regulatory Commission in Title 10 CFR Part 71. Operational and administrative requirements for "highway route controlled quantities" (formerly called "large quantities") are prescribed in 173.403 and 177.825.

Type B Packaging (see Figure 12.2), must meet the general packaging requirements and all of the performance standards for Type A packages. In addition, it must withstand certain serious accident damage test conditions. After the tests, there must be only limited loss of shielding capability and essentially no loss of containment. The performance criteria which the package designer must use to assess Type B packaging against these empirically established accident damage test conditions of transport are prescribed in the Nuclear Regulatory Commission regulations (10 CFR 71.73) and include the following:

1. A 30-foot free drop onto an unyielding surface.
2. A puncture test which is a free drop (over 40 inches) onto a six-inch diameter steel pin.
3. Thermal exposure at 1,475°F for 30 minutes.
4. Water immersion at 3 ft. depth for eight hours (for fissile materials packaging only).
5. Water immersion at 50 ft. for eight hours.

Table 12.6 Limited Quantities, Instruments and Articles

The A_1 and A_2 values are also used as a basis for defining the package quantity limits for limited quantities and both the item and package limits for radioactive instruments and articles, as illustrated below. Packages containing materials within these quantity limits are excepted from some of the requirements which apply to Type A packages. These exceptions include not having to provide specification packaging, shipping papers, certification, marking or labeling. However, there are a number of conditions which the limited quantity, instrument or article must meet. They include:

1. Activity limits per package and, if appropriate, per instrument or article;
2. The materials must be packed in strong, tight packages that will not leak ANY of the radioactive material during conditions normally incident to transportation;
3. The radiation level at any point on the external surface of the package cannot exceed 0.5 millirem per hour;
4. The external surface of the package must be free of significant removable contamination;
5. For instruments or articles, the radiation level at 4 inches from any point on the surface of the unpackaged instrument or article may not exceed 10 millirem per hour; and
6. A prescribed description of the contents on a document which is in or on the package or forwarded with it.

Table 12.6

Limited Quantities, Instruments and Articles (continued)

Nature of Contents ^{1/}	Instruments and Articles		Materials
	Instrument and article limits ^{1/}	Package limits	Package limits
Solids			
Special form	$10^{-2}A_1$	A_1	$10^{-3}A_1$
Other forms	$10^{-2}A_2$	A_2	$10^{-3}A_2$
Liquids			
Tritiated water < 0.1 Ci/liter	-	-	1,000 curies
0.1 Ci to 1.0 Ci/l	-	-	100 curies
> 1.0 Ci/liter	-	-	1 curie
Other liquids	$10^{-3}A_2$	$10^{-1}A_2$	$10^{-4}A_2$
Gases			
Tritium ^{2/}	20 curies	200 curies	20 curies
Special form	$10^{-3}A_1$	$10^{-2}A_1$	$10^{-3}A_1$
Other forms	$10^{-3}A_2$	$10^{-2}A_2$	$10^{-3}A$

1/ For mixture of radionuclides see Section 173.433(b).

2/ These values also apply to tritium in activated luminous paint and tritium absorbed on solid carriers.

Refer to Sections 173.421 through 173.424 for the complete requirements pertaining to these materials.

The U.S. Postal Service has revised its rules (U.S. Postal Service Publication No. 6, Dec. 1975 as amended June 30, 1983.) for mailable radioactive materials. The mailable amounts of material are now (since July 1983) one-tenth the values listed above. Other additional restrictions apply to mailable materials and the Postal Regulations should be consulted for complete specifications.

Table 12.7 Low Specific Activity (LSA) Materials

The levels of radioactive materials packaging and methods of limiting activity contents during transport, as described previously except for the "deminimus" definition of .002 uCi/gm all have one common characteristic, e.g., limitation by total activity content of the package. There is another extremely important transport classification for radioactive materials, e.g., "Low Specific Activity", or "LSA" which is controlled and limited principally on a specific activity, e.g., activity per unit of weight basis. Historically the LSA category was originally developed and premised on a basis of imposing less stringent packaging and shipment requirements on radioactive materials deemed to pose much less risk and were presumably "inherently safe". The categories of LSA have generally included solids, limited either on the specific activity basis or by name, tritiated water and surface contaminated objects. Looking at the most significant of these categories further; i.e., solids:

Solid LSA materials are limited to those in which the activity must be essentially uniformly distributed and in which the estimated average concentration per gram of material does not exceed:

1. 0.0001 millicurie of radionuclides for which the A_2 quantity is not more than 0.005 Curies;
2. 0.005 millicurie of radionuclides, for which the A_2 quantity is more than 0.05 Curies, but not more than 1 curie; or
3. 0.3 millicurie of radionuclides for which the A_2 quantity is more than 1 curie.

In the original derivation of LSA limits for solids in the international regulations, inhalation of dispersed airborne material was considered, and for modeling purposes it was assumed that the airborne materials at a very dusty (10 mg/m^3) concentration was inhaled at the breathing rate of $2 \text{ m}^3/\text{h}$ for a one-half hour exposure resulting in a 10 mg uptake. Little reliance was placed therefore on packaging requirements per se. More recently, the modeling and assumptions for solid LSA materials have been under extensive reexamination by IAEA as well as DOT/NRC. It is anticipated that in the future proposed changes to LSA requirements will be published, aimed principally at establishing more realistic models so as to control hazards of beta-emitting as well as Gamma-emitting materials. It is likely that future regulations for LSA may include limitations on activity of such materials in packages, as well as more precise packaging prescriptions.

Solid LSA wastes include a very wide range of fuel cycle, industrial and institutional wastes; contributing a major portion of the materials which are transported from waste generator facilities to the commercial low level waste burial sites.

Shipment Requirements for LSA Materials

Under the DOT regulations in 49 CFR, the specific shipment requirements for LSA materials depend upon the type of vehicle involved in the shipment:

- o Nonexclusive use shipments - "essentially Type A packages"

The first method, "nonexclusive use" transportation, requires that the material be transported in essentially a Type A package. "Essentially a Type

A" package means a package that must survive the physical tests, such as the drop and compression tests for Type A packages - but which is expected from some of the general Type A requirements. The actual test requirements are found in Section 173.465. Although the packages are excepted from certain design requirements, their integrity must be equal to a Type A.

o Exclusive use - "strong, tight package"

LSA materials which are transported by conveyances assigned for the "exclusive use" of the consignor may be shipped in packages that are of less rigorous construction. Users of the exclusive use provision MUST ENSURE that there will be no loading or unloading of the material except under the direction of the consignee or consignor. The limitation on loading and unloading, plus the requirement that the material be in exclusive use, safely allows the exception from certain packaging test requirements. Exclusive use LSA, therefore, is allowed to be made in the so-called "strong, tight package."

There are no specific test requirements for the strong, tight packages. However, a performance criteria must be met -- there can be no release of radioactive content during transportation and like any other package of hazardous material, the requirements of Section 173.24 must be met. Materials which are consigned as exclusive use LSA shipments MUST have the packages marked "Radioactive LSA." And the vehicle on which they are being transported MUST be placarded with the RADIOACTIVE MATERIAL placard.

Certified Type A Packages for LSA

In general, approval of Type A package designs, by a regulatory agency is not usually required. The shipment of Type A quantities of radioactive material is more frequently made in designs conforming to DOT Specification 7A. This specification is based solely on the performance test requirements of the regulations. Shippers utilizing such packagings are however required to maintain documentation of the results of their safety analyses of the design against the regulatory criteria.

A major exception to the above involves shipments by USNRC licensees of LSA materials in packages wherein the activity exceeds a Type A quantity. Ordinarily, under DOT regulations, LSA materials are not limited only on the basis of specific activity of the material, and not on total package activity. However, due to the provisions of 10 CFR Part 71, the shipment of LSA in packages where the quantity exceeds Type A requires the use of certified Type A packaging. This certification is obtained by submittal of an application which addresses the results of the evaluation of the package against the Type A conditions, e.g., normal conditions of transport. Effectively therefore, Type B quantities of LSA material are required to be in NRC-certified Type A packagings. This exception is extremely important to fuel cycle waste shipment considerations. The NRC has certified several dozen such Type A designs for LSA shipments. These are listed in the NRC Directory of certified packages. (NUREG-0383 "Directory of Certificates of Compliance for Radioactive Material Packagings," revised annually in three volumes). They each are similar in design and appearances to Type B packages (see Figure 12.2), but are not required to be subjected to the Type B tests.

Table 12.8 Fissile Radioactive Materials

In addition to considerations for the radioactivity content, a shipper of radioactive materials which are also fissile, i.e., capable of sustaining a nuclear chain reaction, such as enriched uranium, plutonium, or U-233; must take account in the packaging design certain additional requirements which are intended to ensure against accidental nuclear criticality during transport of the material. These specific criteria and requirements are addressed in DOT and NRC regulations. Again, as in the case of Type B non-fissile package designs, only a few "DOT Specification" packages for fissile radioactive materials are listed in 49 CFR, e.g., DOT-6L, DOT-6M, and DOT 20PF. Other designs which have been specifically approved and certified by NRC are listed in the NRC Directory of Certified Packages. (NUREG-0383 "Directory of Certificates of Compliance for Radioactive Material Packaging," revised annually in three volumes). For purposes of control of nuclear safety during transport, each design is assigned a "fissile Class" number of 1, 2, or 3, which is an indication of the degree of control to be exercised during transport to assure nuclear safety of the shipment. These controls are listed in the Table below.

Table 12.8
Shipment Controls for Fissile Radioactive Materials
(Section 173.455)

-
1. Fissile Class I - Packages may be transported in unlimited numbers (Transport Index* is based only on external radiation levels).
 2. Fissile Class II - Number of packages limited by aggregate maximum of transport indexes of 50 (50 unit rule). No single package may exceed a transport index of 10. Transport index shall be based on criticality or external radiation level basis, whichever is most restrictive.
 3. Fissile Class III - Shipments of packages which do not meet the requirements of Fissile Class I or II. Controlled by specific arrangements between the shipper and carrier. (See Section 173.457(b)).
-

* Exposure rate in mrem/h at three feet from external surface of package.

Table 12.9 Radiation Limits

The regulations set limits on the external radiation on packages and in some cases on the vehicles transporting radioactive materials packages. These limits, which depend upon whether the packages are transported as non-exclusive use (mixed freight) or as exclusive use, are listed below:

Table 12.9 Radiation Level Limits (173.441)

Packages Transported As Non-Exclusive Use:

At Surface: 200 mrem/hour
At 1 meter from package surface: 10 mrem/hr.

Packages Transported As Exclusive Use

At package surface: 1000 mrem/hour (in closed transport vehicle only)
200 mrem/hour (un open vehicle)
At 2 meters (6.6 ft.) from lateral surfaces of vehicle: 10 mrem/hour
In occupied area of vehicle: 2 mrem/hour
At outer surfaces of transport vehicle: 200 mrem/hour.

Table 12.10 Contamination Limits (173.443)

Regulatory limits are also set for the allowable removable surface contamination on packages, as measured on wipe (smear) samples. These limits are listed below:

Table 12.10 Removable External Radioactive Contamination Limits
Removable External Radioactive Contamination Limits

Contaminant	Maximum permissible limits	
	uCi/cm ²	dpm/cm ²
Beta-gamma emitting radionuclides; all radionuclides with half-lives less than ten days; natural uranium; natural thorium; uranium-235; uranium-238; thorium-232; thorium-228 and thorium-230 when contained in ores or physical concentrates	10 ⁻⁵	22
All other alpha emitting radionuclides	10 ⁻⁶	2.2

In applying the limits of this table and the assessment of the surface contamination of a package, sufficient measurements (wipes) must be taken in the most appropriate location of a package surface so as to yield a representative assessment of the non-fixed contamination levels. Averaging of wipe samples may be done only within any given 300 cm² area that is wiped. For packages transported as exclusive use, the removable contamination should not exceed ten times the levels prescribed here. Each transport vehicle used to transport packages with these higher units must be surveyed after use. Before release for other use, the vehicle must not be returned to service until the non-fixed contamination levels meet the above limits.

Table 12.11 Communications Requirements

The regulations contain a number of "communications" requirements which are intended to convey certain hazard characteristic information to package handlers, carrier personnel, receivers, and the general public. These requirements include warning labels, vehicle placarding, and shipping paper descriptions.

Warning Labels (172.403)

Each package of radioactive material, unless excepted, must be labeled on two opposite sides, with a distinctive warning label. Each of the three label types bears the unique trefoil symbol (Figure 12.3). The label alerts persons that the package contains radioactive materials and that the package may require special handling. A label with an all white background color indicates that the external radiation level is low and no special handling is required. If the upper half of the label is yellow, the package may have an external radiation level or fissile properties requiring consideration during transportation. If the package bears a yellow label with three stripes, the transport vehicle must be placarded RADIOACTIVE. Placarding is discussed in more detail below. The criteria which the shipper must consider in choosing the appropriate label are listed below:

Other package labels are illustrated in figures 12.4 and 12.5.

A vehicle placard is shown in figure 12.6 and its placement illustrated in figure 12.7.

For all labels, vertical bars on each label are in red. Each label is diamond-shaped, four inches on each side, and has a black solid-line border one-fourth inch from the edge. The background color of the upper half (within the black line) is white for the "I" label. It is yellow for the "II" and "III" labels.

Table 12.6
Radioactive Materials Packages Labeling Criteria
Section 172.403

Transport Index ^a (T.I.)	Radiation Level at Package Surface (RL)	Fissile Criteria	Label Category ^b
N/A	RL ≤ 0.5 millirem per hour (mrem/h)	Fissile Class I No Fissile Class II or III	White - I
T.I. ≤ 1.0	0.5 mrem/h < RL ≤ 50	Fissile Class I, Fissile Class II with T.I. ≤ 1.0, No Fissile Class III	Yellow - II
1.0 < T.I.	50 mrem/h < RL	Fissile Class II with 1.0 < T.I., Fissile Class III	Yellow - III

^a Exposure rate in mrem/h at three feet from external surface of package.

^b Any package containing a "Highway Route Controlled Quantity" (173.403) must be labeled as Radioactive Yellow - III.

Table 12.12 Shipping Papers

Like any shipment of regulated hazardous materials in commerce, each shipment of radioactive material must be accompanied by a properly completed and shipper-certified shipping paper (also known as bill of lading, air bill, cargo manifest, etc.) For limited quantities and excepted radioactive articles, this shipping paper/certificate may be a specially worded notice which may be in or on the package (i.e., packing list), or separately accompanying the shipment. The elements of information which must be included, as applicable, on shipping papers includes:

- (1) Proper shipping name from Section 172.101;
- (2) Hazard class (see Section 172.202(a)(2)), hazard class from Column 3, Section 172.101, except when the hazard class is contained in the shipping name;
- (3) Identification number (see Section 172.202(a)(3) from Column 3A, Section 172.101);
- (4) Net quantity of material by weight or volume as stated in Sections 172.202(a)(4) and (c). For most radioactive materials packages, it is not required to list the weight or volume. The requirements of Section 172.203(d) provide better indications of potential hazards and controls required. These requirements include the package contents as measured in curies and the transport index. A listing of weight or volume measurements for radioactive materials is usually needed only for establishing transportation charges;
- (5) Radionuclide(s) contained in package (abbreviations are allowed). For a mixture of radionuclides, only those radionuclides which comprise 1% or more of the total activity in the package must be listed;

- (6) Physical and chemical form of material, or statement that the material is "special form" (if it is special form). A generic description of material, such as protein, carbohydrate, enzyme, or organic salt, is authorized if exact chemical form is difficult to specify;
- (7) Activity in curies (Ci), millicuries (mCi), or microcuries (uCi). If the package contains a "Highway Route Controlled Quantity," those words must also be shown on the shipping papers;
- (8) Category of RADIOACTIVE labels applied to package;
- (9) Transport index of the package if labeled RADIOACTIVE Yellow-II or RADIOACTIVE Yellow-III;
- (10) The information required in Section 172.203(d)(I)(vi) must be included if the shipment is "fissile" radioactive material;
- (11) The identification markings shown on the package must appear on the shipping paper if the package is approved and certified by the Nuclear Regulatory Commission or the Department of Energy, OR is certified by DOT or other National Competent Authority for international shipment.
- (12) Other information as required by the mode of transportation or subsidiary hazard of the material. (See Section 172.203).

The regulations require that certain specific descriptive information must be included on shipping papers. While there is no specification for shipping paper format, the first three entries of the description must be in a specific order (see above). Other descriptive information is allowed, such as the functional description of the product. However, other information must not confuse or detract from the required descriptions of the hazardous materials.

Table 12.12
Most Commonly Used Shipping Names for Radioactive Material^a
(From Hazardous Materials Table, Section 172.101)

Radioactive Material, Limited Quantity, n.o.s. ^b	UN 2910
Radioactive Material, Instruments, <u>and</u> Articles ^c	UN 2911
Radioactive Material, Fissile, n.o.s.	UN 2918
Radioactive Material, Low Specific Activity <u>or</u> LSA, n.o.s.	UN 2912
Radioactive Material, Special Form, n.o.s.	UN 2974
Radioactive Material, n.o.s.	UN 2982
Uranium Hexafluoride, Fissile (<u>Containing more than 1% U-235</u>)	UN 2977
Uranium Hexafluoride, Low Specific Activity	UN 2978

^aRefer to Section 172.101 for other proper shipping names.

^bn.o.s. means "not otherwise specified."

^cUnderlined words are not part of the proper shipping name.

Table 12.13. Transportation Accident Radiological
Incident Call List

Offices may have different names in your locale; change those below to fit your situation.

Phone: _____
Local law enforcement agency

Phone: _____
State radiological health office/civil defense

Phone: _____ Name: _____
Local medical facility Physician

Phone: _____ Name: _____
Local civil defense or disaster office Civil defense officer

Phone: _____
State Governor's Office

Phone: _____ Name: _____
Mayor's office Mayor

Phone: _____
Local individual known to you to be trained as
hazardous materials expert.

Toll free: Calls from D.C. area: Calls outside U.S.:

Phone: _____ 800-424-9300 483-7616 202-483-7616
CHEMTREC*

*CHEMTREC is the Chemical Transportation Emergency Center, a public service of the Manufacturing Chemists Association, Washington, D.C. CHEMTREC operates on a 24-hour basis and is designed to deal with chemical transportation emergencies. Note: CHEMTREC is not intended to function as a general information source. For more information, write: Manager, Chemical Transportation Emergency Center, 1825 Connecticut Avenue, N.W., Washington, D.C. 20009.

Phone: _____ (617) 482-8755
NFPA*

*NFPA is the National Fire Protection Association and provides information and training related to handling hazardous materials in emergencies involving fire or the potential for fire. For more information, write: NFPA, 470 Atlantic Avenue, Boston, MA 02210.

Phone: _____ Name: _____
Additional contact*

Phone: _____ Name: _____
Additional contact*

*See Figure 12.8 and 12.9 for DOE and NRC Regional Offices.

Figure 12.1 Forms of Radioactive Materials for Transport
 From: A Review of the Department of Transportation (DOT)
 Regulations For Transportation of Radioactive Material
 (Summer 1980)

“Special Form” R.A.M. (173.403 (z) and 173.469 (a))

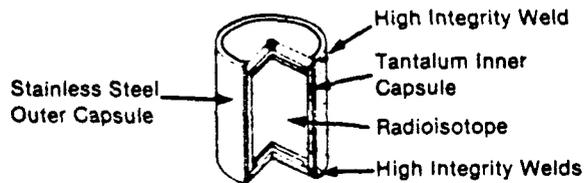
May Present a Direct Radiation Hazard if Released From Package, but
 Little Hazard Due to Contamination

“Special Form” R.A.M. May Be “Natural” Characteristic, i.e., Massive
 Solid Metal, or “Acquired” Through High Integrity Encapsulation

Massive
 Solid Metal



High Integrity
 Encapsulation
 as a Sealed Source



Normal Form Radioactive Materials 49 CFR 173.403(s)

Normal Form Materials May Be Solid, Liquid or Gaseous and Include any
 Material Which Has Not Been Qualified as Special Form

Type A Package Limits are A_2 Values



Waste Material in
 Plastic Bag



Liquid in Bottle Within
 Metal Container



Powder in Glass
 or
 Plastic Bottle



Gas in Cylinder

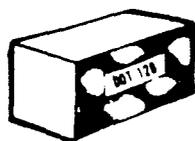
Figure 12.2. Types of Packaging
(From A Review of the Department of
Transportation (DOT) Regulations for
Transportation of Radioactive Materials
(Summer 1980))

Type A

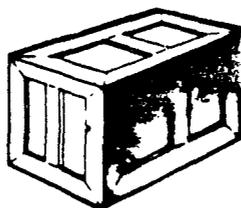
All packaging design is directed at preventing the release of the radioactive contents and damage to the radiation shielding so that a severe radiological hazard will not develop. Because of the smaller quantities of material permitted in Type A packages, accidents that might cause damage to such packages would not be likely to result in serious radiation hazards. Therefore such packaging must only withstand moderate degrees of stress. These include conditions of heat, cold, reduced air pressure, vibration, impact, water, drop, penetration, and compression. The majority of radioactive material shipments are made in Type A packages.

TYPICAL TYPE A PACKAGING

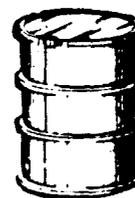
**PACKAGE MUST WITHSTAND NORMAL CONDITIONS (173.398(B))
OF TRANSPORT ONLY WITHOUT LOSS OR DISPERSAL OF THE
RADIOACTIVE CONTROL CONTENTS.**



FIBERBOARD BOX



WOODEN BOX



STEEL DRUM

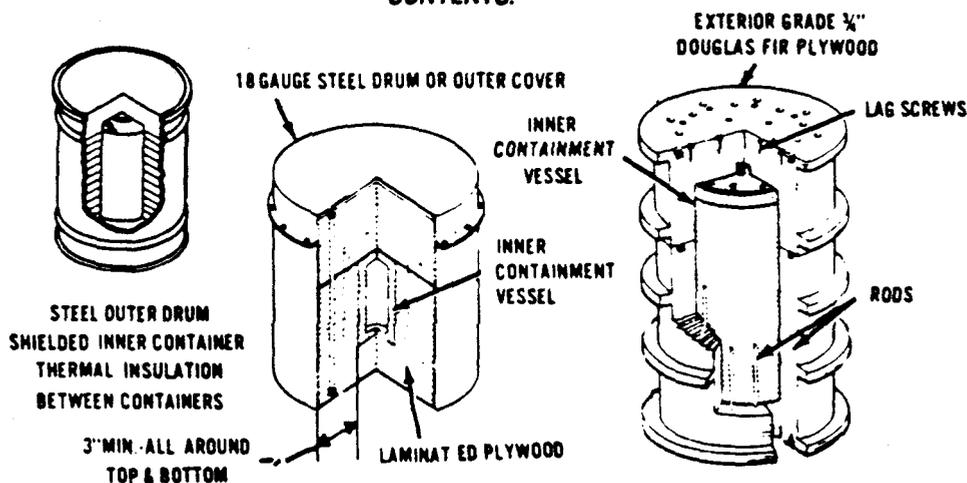
**TYPICAL SCHEMES
DOT SPECIFICATION 7A**

Figure 12.2 (Continued)

Type B

Type B packages are designed for transport of greater quantities of material. Since the potential for hazard resulting from damage to this type of package would be greater than that from a Type A package, there are additional structural design requirements. In addition to meeting standards for Type A packages, Type B packaging must withstand puncture, drop, thermal, and water immersion stresses that might be experienced under actual or hypothetical transportation accident conditions.

TYPICAL TYPE B PACKAGING SCHEMES
PACKAGE MUST STAND BOTH NORMAL (173.398(B)) AND
ACCIDENT (173.398(C)) TEST CONDITIONS WITHOUT LOSS OF
CONTENTS.



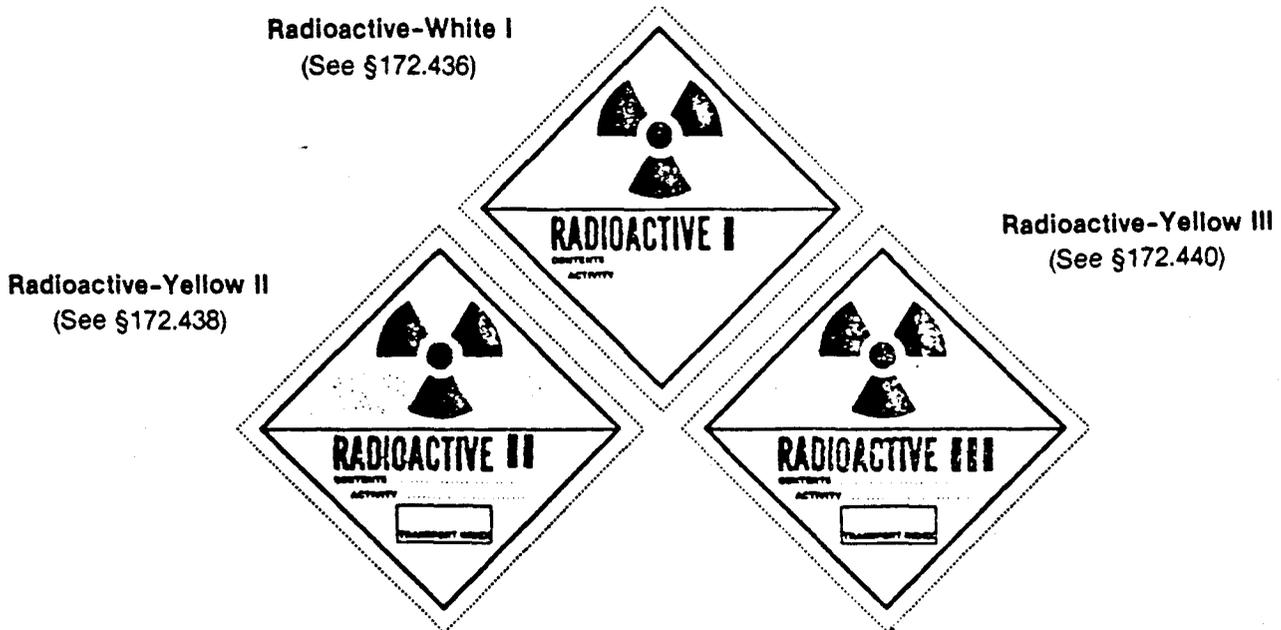
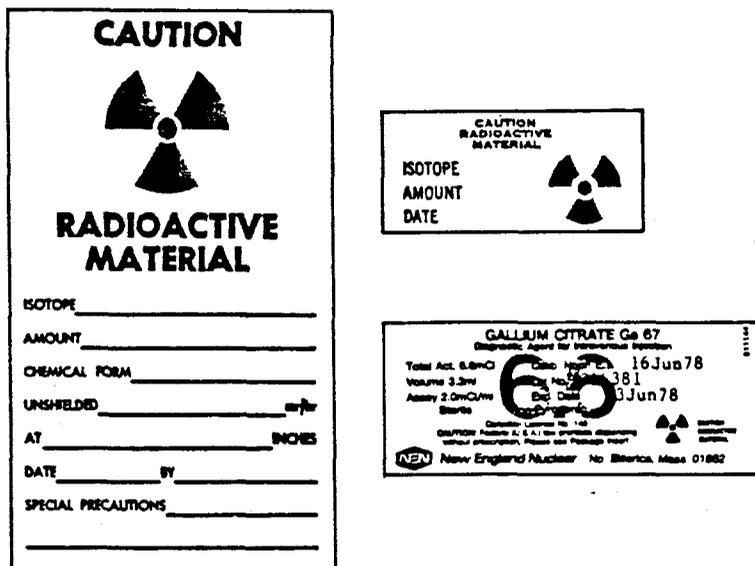


Figure 12.3 Labels Required on Exterior Package

Three different labels are used on packages for radioactive material (see above). The required label is usually determined by the external radiation level or, in some cases, the type and quantity of radionuclide within the package (see Labeling Criteria table). Package labels must specify the radionuclide (contents) and quantity (curies). In addition, Yellow II and Yellow III labels contain the transport index, which is equal to the maximum radiation level at 3 feet from the package or, for packages containing fissile material, the degree of nuclear safety control required.

Figure 12.4 Radioactive Material Warning Labels
(From DOT/RSPA/MTB-79/8)

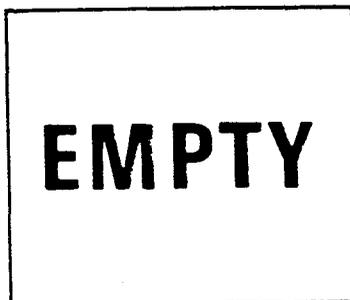
All packages of radioactive material, with the exception of those containing Limited Quantities or Low-Specific-Activity materials (which would present no severe hazard if involved in an accident), must bear two identifying warning labels affixed to opposite sides of the outer package. Limited shipments do not require outer package labeling; however, they, like all shipments of radioactive material, must have standard yellow and magenta radiation warning labels on the inner containers.



Warning Labels

Figure 12.5 Empty Label
(From DOT/RSPA/MTB-79/8)

Reusable shipping containers are frequently transported in an empty, but possibly internally contaminated condition. When in transit, these containers must bear the EMPTY label shown below. There is minimal hazard from containers displaying this label.



Typical label required to indicate empty shipping container.

Figure 12.6 Vehicle Warning Placards
(From DOT/RSPA/MTB-79/8)

Placards

The carrier must apply the RADIOACTIVE placard to the transport vehicle (rail or highway) if ANY radioactive material package on board bears a "Radioactive YELLOW-III" label (Section 172.440). The format for the placard is illustrated in Figure.12.7. The requirements for placarding are in Section 172.504 and Table 1 footnotes of that Section.

Figure 12.6



(The background color for the black trefoil in the upper half of this 12" x 12" placard is yellow.)

Vehicles transporting ANY package which contains a highway route controlled quantity must display the above placard upon the square white background with black border as specified in Section 172.507.

For shipments of LSA materials in exclusive-use vehicles, the shipper is required to placard the transport vehicle, even though the packages of LSA within the vehicle are excepted from labeling requirements.

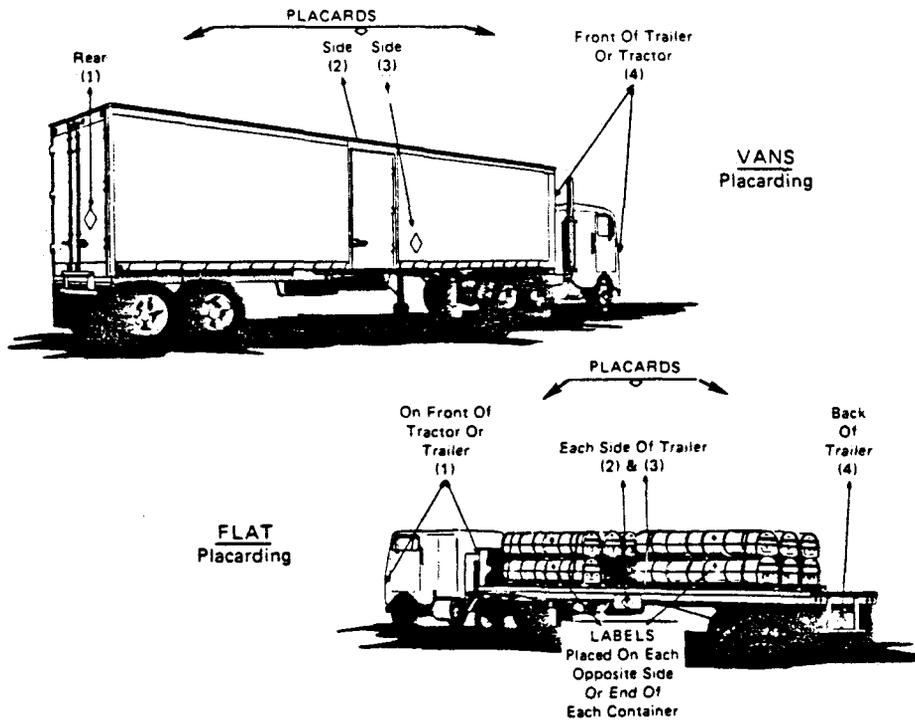
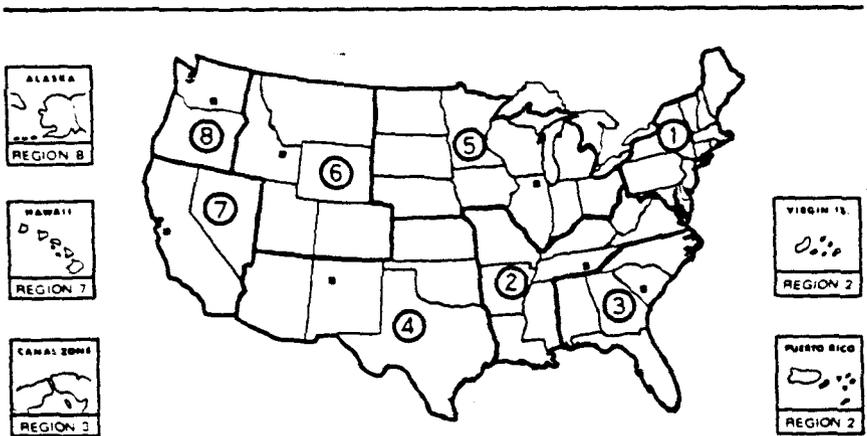


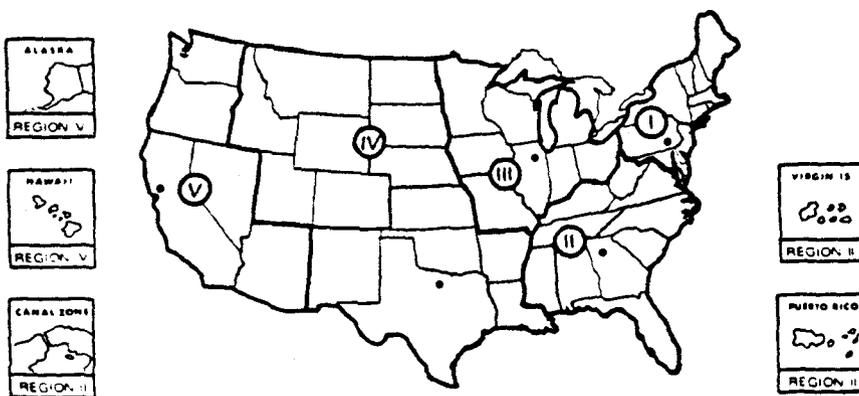
Figure 12.7 Diagrammatic representation of placard location on vans and flatbed trucks (From DOT/RSPA/MTB-81/4)

Figure 12.7 is a guide to placement of placards on motor vehicles. Where placards are impractical, i.e., on aircraft or water vessels, they are not required to be displayed.



Regional Coordinating Office	Post Office Address	Telephone
1 Brookhaven Area Office	Upton, L.I., New York 11973	(516) 345-2200
2 Oak Ridge Operations Office	P.O. Box E, Oak Ridge, Tennessee 37830	(615) 576-1005 or (615) 525-7885
3 Savannah River Operations Office	P.O. Box A, Aiken, S.C. 29801	(803) 725-3333
4 Albuquerque Operations Office	P.O. Box 5400, Albuquerque, N. M. 87115	(505) 264-4667
5 Chicago Operations Office	9800 S. Cass Ave., Argonne, Illinois 60439	(312) 972-4800 Off Duty Hrs. (312) 972-5731
6 Idaho Operations Office	P.O. Box 2108, Idaho Falls, Idaho 83401	(208) 526-1515
7 San Francisco Operations Office	1333 Broadway, Oakland, California 94612	(415) 273-4237
8 Richland Operations Office	P.O. Box 550, Richland, Washington 99352	(509) 942-7381

Figure 12.8 Department of Energy regional coordinating offices for radiological assistance and geographical areas of responsibility.



Address	Telephone	
	Daytime	Nights/Holidays
Region I, Office of Inspection and Enforcement, USNRC 631 Park Avenue, King of Prussia, Pennsylvania 19406	(215) 337-1150	(215) 337-1150
Region II, Office of Inspection and Enforcement, USNRC 230 Peachtree Street, N.W., Suite 818, Atlanta, GA 30303	(404) 526-4503	(404) 526-4503
Region III, Office of Inspection and Enforcement, USNRC 799 Roosevelt Road, Glen Ellyn, Illinois 60137	(312) 858-2660	(312) 858-2660
Region IV, Office of Inspection and Enforcement, USNRC 611 Ryan Plaza Drive, Suite 1000, Arlington, Texas 76012	(817) 334-2841	(817) 334-2841
Region V, Office of Inspection and Enforcement, USNRC 1990 N. California Blvd., Suite 202, Walnut Creek Plaza Walnut Creek, California 94596	(415) 486-3141	(415) 486-3141

Figure 12.9 United States Nuclear Regulatory Commission regional offices.

APPENDIX D
HEALTH & SAFETY PLAN

This Health and Safety Plan is Proprietary information.
It is being furnished for information only.
It is not to be released without written authorization from
Roy F. Weston, Inc.



WORK LOCATION PERSONNEL PROTECTION
AND SAFETY EVALUATION FORM

Attach Pertinent Documents/Data

Fill in Blanks As Appropriate

WO # 2029-13-02-0034

Reviewed by _____

Division DCMD

Date _____

Office Denver, Colorado

Approved by _____

Prepared by Bill Somers/Mark Selman

Date _____

Date 2/24/86

A. Work Location Description

1. Name U.S.D.O.E.
ROCKY FLATS PLANT

2. Location _____
Jefferson County, Colorado

3. Type: HW Site (X)
Spill ()

Industrial (X)
Construction ()

(X) Existing WESTON Work Location

(X) Existing Client Work Location

Other () Describe _____

4. Status existing plutonium, uranium processing facility, government owned

5. Anticipated activities: _____
water and sediment samples of Solar Pond 207A

6. Size plant buildings occupy 384 acres; total plant area is eleven square miles

7. Surrounding Population no immediate population within 2 mile radius

8. Buildings/Homes/Industry approximately 102 structures exist on the
plant site consisting of manufacturing, chemical processing, plutonium
recovery, waste treatment, storage and administrative facilities.

- 9. Topography majority of plant site exhibits flat topography;
maximum of 10% slope near manufacturing facilities
- 10. Anticipated Weather clear, cold and dry
- 11. Unusual Features _____

- 12. Site History see attached sheet

B. Hazard Description

- 1. Background Review: Complete () Partial (X)
If partial, why? no ambient air monitoring for organic vapors
- 2. Hazard Level: A () B ()
Unknown () C (X) D ()
Justification attached sheets (see section 8)
- 3. Types of Hazards: (Attach additional sheets as necessary)
A. Chemical () Inhalation (X) Explosive ()
Biological () Ingestion (X) O₂ Def. ()
Skin Contact (X) Toxic ()
Describe attached sheets (see section 8)

- B. Physical () Cold Stress (X) Noise ()
Heat Stress () Other ()

Section A(12) Work Location Description/Site History

Site History

Plant radioactive mixed waste streams are stored and treated by evaporation in solar ponds located at the northeast corner of the manufacturing complex. Waste streams entering these ponds include beryllium, plutonium processing wastes, elevated nitrate water and possible intermittent disposal of cutting oils. Monitoring data from RCRA interim status wells indicates that there may be subsurface migration of some of the more soluble solvent compounds into the groundwater from these ponds. Planned activities are to sample the liquid and sediment in Solar Pond 207A for analyses of chemical and radiological constituents.

Describe _____

C. Radiation (X)

Describe liquid in solar ponds 207A contains low level
liquid process wastes. Sediments contain plutonium and
americium radioactivity.

4. Nature of Hazards:

Air (X) Describe Ambient air monitoring indicates no airborne
radioactivity hazard. No ambient monitoring has been conducted for
organic vapors.
Soil () Describe _____

Surface Water (X) Describe No monitoring has been conducted
for volatile organics.

Groundwater () Describe _____

Other (X) Describe Analysis of sediment samples indicates
elevated levels of uranium, Plutonium, americium, and possibly a wide
variety of hazardous constituents.

5. Chemical Contaminants of Concern () N/A

<u>Contaminant</u>	<u>TLV (PPM)</u>	<u>I.D.L.H. (PPM)</u>	<u>Source/Quantity Characteristics</u>	<u>Route of Exposure</u>	<u>Symptoms of Acute Exposure</u>	<u>Instruments Used to Monitor Contaminant</u>
Sulfuric Acid	1 mg/m ³ (.25 ppm)	80 mg/m ³ (20 ppm)	unknown	inhalation ingestion	eye, nose, throat irritation	
Hydrochloric Acid				contact		
Nitric Acid	2	100	unknown		irritant eyes muc. membrane	
Chrome (VI)	.001 mg/m ³		unknown		respiratory irritant sens. derm.	
Cyanide	5 mg/m ³ (2 ppm)	50 mg/m ³ (20 ppm)			eye, skin irritant headache, asphyxia	

Procedures Used
to Monitor Hazard

Wear life vest while on raft

Location

207A

6. Physical Hazards of Concern () N/A

Description

Falling into Pond

Hazard

Falls

7. Work Location Instrument Readings (x) N/A

Location _____

% O₂ _____

Radioactivity _____

FID _____

Other _____

% LEL _____

PID _____

Other _____

Other _____

Location _____

% O₂ _____

Radioactivity _____

FID _____

Other _____

% LEL _____

PID _____

Other _____

Other _____

Location _____

% O₂ _____

Radioactivity _____

FID _____

Other _____

% LEL _____

PID _____

Other _____

Other _____

Location _____

% O₂ _____

Radioactivity _____

FID _____

Other _____

% LEL _____

PID _____

Other _____

Other _____

8. Hazards expected in preparation for work assignment. () N/A

Describe: See attached diagram showing proposed work locations and
the attached description of site activities and hazard description

1. Personnel Protective Equipment

1. Level of Protection

A () B () C (X) D () Location/Activity:
Pond 207A / sediment and water sample collection.

A () B () C () D () Location/Activity:

2. Protective Equipment (specify probable quantity required)

Respiratory () N/A

- () SCBA, Airline
- (X) Full Face Respirator
 (Cart. radionuclide)
 organic vapors
- () Escape Mask
- () None
- () Other _____
- () Other _____

Clothing () N/A

- () Fully Encapsulating Suit
- () Chemically Resistant
 Splash Suit
- () Apron, Specify _____
- () Tyvek Coverall
- (X) Saranex Coverall
- () Coverall, Specify _____
- () Other _____
- () Other _____

Head & Eye () N/A

- (X) Hard Hat
- () Goggles
- () Face Shield
- () Chemical Eyeglasses
- () None
- (X) Other safety glasses if
protection is downgraded.

Hand Protection () N/A

- (X) Undergloves latex
 Type
- (X) Gloves nitrile
 Type
- (X) Overgloves cotton or leather
 Type
- () None
- () Other _____

Foot Protection () N/A

(X) Safety Boots

() Disposable Overboots

() Other _____

3. Monitoring Equipment () N/A

() CGI

() PID

() O₂ Meter

() FID

(X) Rad Survey

() Other _____

() Detector Tubes

Type: _____

() Other _____

D. Personnel Decontamination (Attach Diagram)

Required (X)

Not Required ()

Equipment Decontamination (Attach Diagram)

Required (X)

Not Required ()

If required, describe and list equipment Soap and water wash, water rinse
of equipment, alcohol rinse, collect rinsate for proper disposal by Rockwell
personnel.

E. Personnel

	<u>NAME</u>	<u>WORK LOCATION TITLE/TASK</u>	<u>MEDICAL CURRENT</u>	<u>FIT TEST CURRENT</u>	<u>CERTIFICATION LEVEL</u>
1.	Mark Selman	Sampler	()	(X)	(B)
2.	Karen Holliway	Sampler	(X)	(X)	(B)
3.			()	()	()
4.			()	()	()
5.			()	()	()
6.			()	()	()
7.			()	()	()
8.			()	()	()
9.			()	()	()
10.			()	()	()

Site Safety Coordinator William Somers

F. Activities Covered Under this Plan

Preliminary
Schedule

Task No. Description

1 Collect water and sediment samples from
Solar Pond 207A

Mid/March

G. Subcontractor's Health and Safety Program Evaluation (X) N/A

Name and Address of Subcontractor: _____

 Activities to be Conducted by Subcontractor: _____

Item	EVALUATION CRITERIA		Comments
	Adequate	Inadequate	
Medical Surveillance Program	()	()	
Personal Protective Equipment Availability	()	()	
On-Site Monitoring Equipment Availability	()	()	
Safe Working Procedures Specification	()	()	
Training Protocols	()	()	
Ancillary Support Procedures (if needed)	()	()	
Emergency Procedures	()	()	
Evacuation Procedures Contingency Plan	()	()	
Decontamination Procedures Equipment	()	()	
Decontamination Procedures Personnel	()	()	

INADEQUATE ()

GENERAL HEALTH AND SAFETY PROGRAM EVALUATION: ADEQUATE ()

ADDITIONAL COMMENTS: _____

DATE: _____

EVALUATION CONDUCTED BY: _____



MEDICAL EMERGENCY

Name of Hospital St. Anthony North

Address: 2551 West 84th Avenue Phone No. 303-399-1211

Name of Contact Rockwell medical staff

Address: Rocky Flats Plant Phone No. 303-966-2911

Route to Hospital: (Attach Map) Medical facilities are available
on plant site, if further treatment is required Rocky Flats ambulance
will be used. In extreme emergency St. Anthony Flight For Life helicopter
can be used.

Travel Time From Site (Minutes) _____ Distance to Hospital (Miles) _____

Name/Number of 24 Hr. Ambulance Service On-site



HEALTH AND SAFETY PLAN
APPROVAL/SIGN OFF FORMAT

I have read, understood, and agreed with the information set forth in this Health and Safety Plan (and attachments) and discussed in the Personnel Health and Safety briefing.

_____	_____	_____
Name	Signature	Date
_____	_____	_____
Name	Signature	Date
_____	_____	_____
Name	Signature	Date
_____	_____	_____
Name	Signature	Date
_____	_____	_____
Name	Signature	Date

_____	_____	_____
Site Safety Coordinator	Signature	Date

_____	_____	_____
Director, Corporate Health and Safety	Signature	Date

_____	_____	_____
Project Manager	Signature	Date

_____	_____	_____
Project Director/ Department Manager	Signature	Date

Personnel Health and Safety Briefing Conducted By:

_____	_____	_____
Name	Signature	Date

ATTACHMENTS

Section B8. Hazard Description

Section C. Personnel Protective Equipment

Hazards Expected in Preparation for Work Assignment

Please refer to diagram of proposed work locations

A. Area 1 - Pond 207A

Water and sediment samples are to be collected from this pond for the purpose of determining the possible presence of a wide variety of hazardous constituents. Background information suggests the potential for encountering alpha radioactivity due to isotopes of uranium, plutonium, and americium. Metal heat treating bath solutions containing cyanides have been dumped into this pond. Analytical data indicates a CN⁻ concentration of approximately 2 ppm in the liquid. No real-time ambient air monitoring data or air samples for organic vapors have been collected in this area. Information on previous sampling conducted by the client indicates that Level C respiratory protection is sufficient for planned work activities.

1. Personnel Protective Equipment

- a) Respiratory Protection - full face, air-purifying respirator equipped with combination organic vapor radionuclide cartridges or canisters shall be used in Area 1 until potential hazards have been adequately characterized.
- b) Clothing - Saran coated Tyvek coverall with hood will be used for work activities in Area 1.
- c) Head and Eye Protection - Hard hats will be required head protection. Eye protection will be afforded by the use of full face respirators. If the safety coordinator elects to downgrade the level of protection from C to D based on air monitoring information, Safety glasses will be the required eye protection.
- d) Hand and Foot Protection - Until organic and radioactive contaminant levels are quantified, hand protection will consist of an inner PVC or Latex glove and an outer nitrile glove. Nitrile affords good protection from halogenated solvents. An outer cotton or leather work glove may be used if required. Required foot protection will be steel-toed, steel-shanked work boots and disposable latex rubber outer booties.

ii. Personnel Monitoring

- Organic vapors will be monitored using an OVA, Organic Vapor Analyzer.
- Alpha activity will be monitored by taking smears on the sample containers and checking for contamination using an air proportional detector.
- Oxygen and Combustible Gases will not be monitored because all planned activities will occur outside.

iii. Personnel Decontamination - Area 1

Each work location will be divided into three distinct work zones similar to that pictured in the attached diagram of Site Work Zones. The Work Zones are as follows:

Zone 1: Exclusion Zone - the zone where contamination does or could exist. All personnel entering the exclusion zone must wear the level of protection specified for that work area.

Zone 3: Support Zone - area of work site considered to be uncontaminated (located upwind of the Exclusion Zone). This is a storage area for support equipment and provides a point of personnel access and traffic control to the Exclusion Zone.

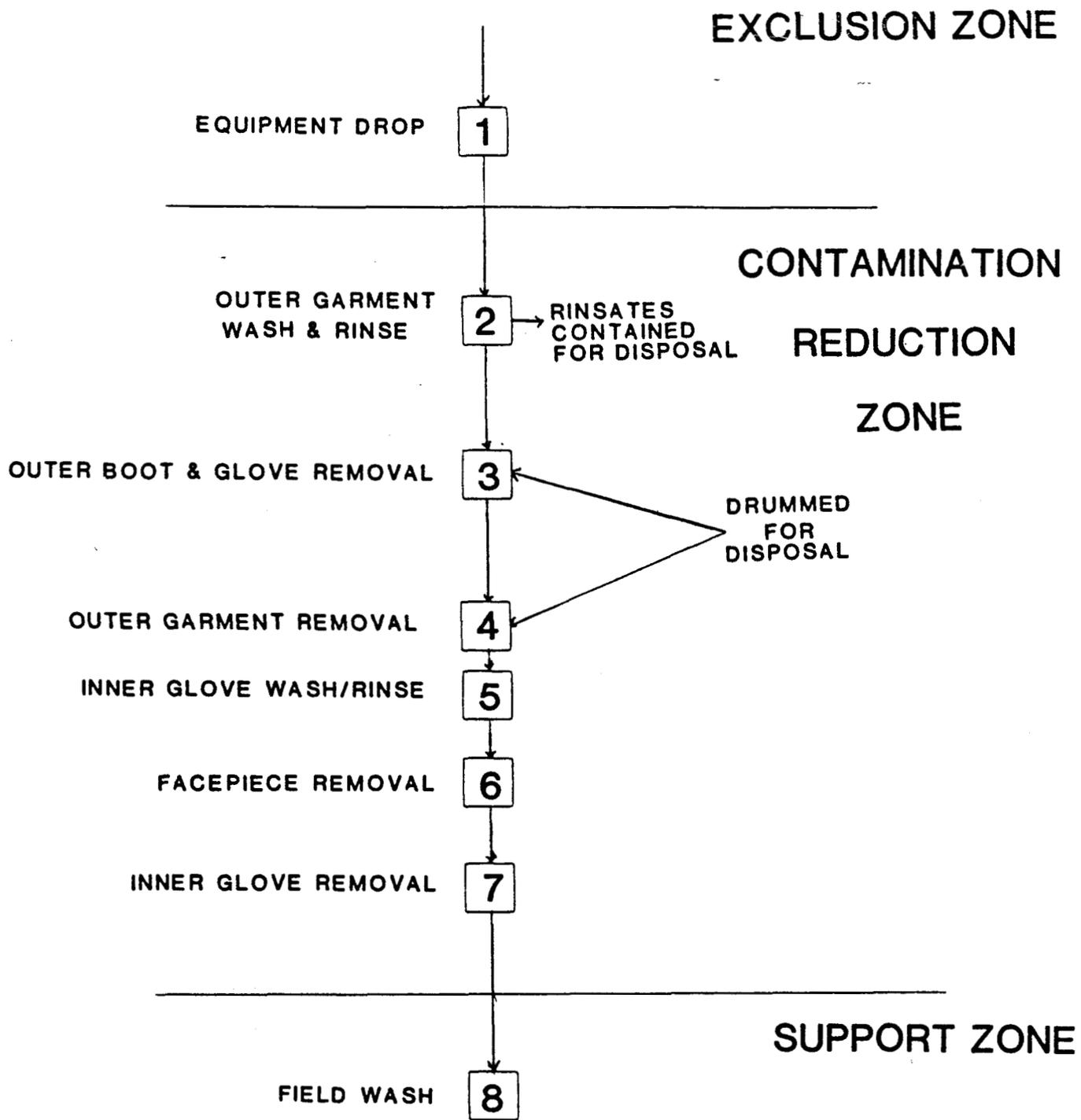
Zone 2: Contamination Reduction Zone (CRZ) - provides a transition zone between the Exclusion Zone and the Support Zone to prevent the spread of contaminants from the Exclusion Zone. Decontamination is performed in this zone.

A diagram of the minimum Level C decontamination layout is attached showing the required decontamination stages. Alpha activity will be monitored during each stage of decontamination. Personnel will repeat decontamination steps until background levels of activity are indicated.

iv. Equipment Decontamination

Equipment and sample containers will be decontaminated after use to prevent spread of contamination to adjacent areas and reduce the possibility of cross-contamination between test holes. The sediment sampler and sample containers should be the only equipment that will come in direct contact with possibly contaminated material. The following decontamination procedure should be initiated after each sample and prior to leaving the contamination reduction zone:

- Step 1 - Brush excess sediment from Teflon tube and wash with an alkaline, non-sudsing detergent.
- Step 2 - Rinse with tap water and distilled water.
- Step 3 - Rinse with methanol.
- Step 4 - Survey with the OVA probe and the alpha detector probe to determine if any residual contamination exists. If so, repeat steps 1, 2, and 3 until no contamination is detected. Proceed to next sampling location.



**MINIMUM DECONTAMINATION
LAYOUT**

LEVEL C PROTECTION