



NUREG/BR-0204
Revision 3

Instructions for Completing the U.S. Nuclear Regulatory Commission's Uniform Low-Level Radioactive Waste Manifest

Final Report

Office of Nuclear Material Safety and Safeguards

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Instructions for Completing the U.S. Nuclear Regulatory Commission's Uniform Low-Level Radioactive Waste Manifest

Final Report

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PREFACE

The U.S. Nuclear Regulatory Commission (NRC) has made the following changes between Revision 2 and Revision 3 of this document:

- updated instructions to reflect changes to the Uniform Manifest forms
- updated references to U.S. Department of Transportation (DOT) regulations to reflect the current DOT regulations
- added additional discussion on the reporting of inventories based on lower limit of detection values, the potential use of indirect methods to determine these inventories, and the use of indirect methods in waste classification calculations
- added clarification of the intent of the certification statement on Form 540
- made overall improvements to the clarity of the document

Paperwork Reduction Act

This NUREG contains information collection requirements that are subject to the Paperwork Reduction Act of 1995 (44 U.S.C. 3501 et. seq.). These information collections were approved by the Office of Management and Budget (OMB), under control numbers 3150-0164, 3150-0165, and 3150-0166. The estimated burden to complete the forms associated with this NUREG is 45 minutes for NRC Forms 540 and 540A, 3.3 hours for NRC Forms 541 and 541A, and 45 minutes for NRC Forms 542 and 542A. Send comments regarding this information collection to the Information Services Branch, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by e-mail to Infocollects.Resource@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202 (3150-0164, 3150-0165, and 3150-0166), Office of Management and Budget, Washington, DC 20503.

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INSTRUCTIONS FOR COMPLETING NRC'S UNIFORM LOW-LEVEL RADIOACTIVE WASTE MANIFEST

The U.S. Nuclear Regulatory Commission's (NRC's) Uniform Low-Level Radioactive Waste Manifest consists of the following three forms:

- (1) NRC Forms 540 and 540A:¹ Uniform Low-Level Radioactive Waste Manifest (Shipping Paper) and continuation page
- (2) NRC Forms 541 and 541A: Uniform Low-Level Radioactive Waste Manifest (Container and Waste Description) and continuation page
- (3) NRC Forms 542 and 542A: Uniform Low-Level Radioactive Waste Manifest (Manifest Index and Regional Compact Tabulation) and continuation page

The NRC defines the entities that must comply with manifesting regulations in Title 10 of the *Code of Federal Regulations* (10 CFR) Part 20, "Standards for Protection against Radiation," Appendix G, "Requirements for Transfers of Low-Level Radioactive Waste Intended for Disposal at Licensed Land Disposal Facilities and Manifests," Section I, "Manifest." Shipments of low-level radioactive waste for disposal to a licensed low-level radioactive waste land disposal facility are subject to NRC manifesting requirements. Shipments of low-level radioactive waste (as determined by the consignor within the definitions in the regulation) to waste processors or waste collectors, before disposal of the radioactive waste at a licensed land disposal facility, are also subject to these manifesting requirements, except as defined in the regulations. In accordance with 10 CFR Part 20, Appendix G, Section I—

Licensees are not required by NRC to comply with the manifesting requirements of this part when they ship: (a) [Low-level radioactive waste] for processing and expect its return (i.e., for storage under their license) prior to disposal at a licensed land disposal facility; (b) [Low-level radioactive waste] that is being returned to the licensee who is the "waste generator" or "generator," as defined in [10 CFR Part 20]; or (c) Radioactively contaminated material to a "waste processor" that becomes the processor's "residual waste."

NOTE: State or Compact manifesting requirements may encompass shipments beyond those defined by the NRC.

Shippers of low-level radioactive waste intended for disposal at a licensed land disposal facility must complete NRC Forms 540 and 541 as described above. Upon agreement between the shipper and consignee, the information required by NRC Form 541 may be transmitted electronically (10 CFR Part 20, Appendix G, Section III, "Control and Tracking").

Processors and collectors of low-level radioactive waste that are shipping low-level radioactive waste attributed to others for disposal at a licensed land disposal facility must complete NRC Form 542. Upon agreement between the appropriate parties, the information required by NRC Form 542 may be transmitted electronically (10 CFR Part 20, Appendix G, Section III). NRC

¹ Forms 540 and 540A and their respective instructions are based on U.S. Department of Transportation (DOT) regulations, including changes published in the *Federal Register* on July 11, 2014 (79 FR 40590), with a required compliance date of July 13, 2015.

Forms 540A, 541A, and 542A should be used if additional pages are needed for NRC Forms 540, 541, and 542, respectively. In this document, references to Forms 540, 541, and 542 include both the form and the “A” supplement to the form, if applicable, unless otherwise stated.

NOTE: Metric units should be used to report information on the Uniform Manifest forms. Use of metric units on NRC Form 540 is consistent with DOT regulations, though DOT also allows reporting in English units following the International System of Units (SI). NRC Forms 541 and 542 are also designed for metric reporting. NRC practice allows for both metric and English units to be used if the consignor, consignee, and others having authority over reporting requirements agree. The NRC’s policy is to list the SI units followed by the English units in parentheses in dual-unit documents.² If both metric and English units are used on the form, the shipper needs to ensure that the units are presented on the forms in a way that prevents misinterpretation.

Radioactive shipments that are not manifested under NRC regulations must continue to comply with DOT regulations.

The exhibits at the end of these instructions show sample NRC Forms 540, 541, and 542. Electronic copies of the forms can be downloaded from <http://www.nrc.gov/reading-rm/doc-collections/forms/>.

Questions about DOT shipping requirements can be directed to the DOT Hazardous Materials Information Center at 1-800-467-4922.

² On June 19, 1996, the NRC published Conversion to the Metric System; Policy Statement (61 FR 31169).

NRC FORM 540: UNIFORM LOW-LEVEL RADIOACTIVE WASTE MANIFEST (SHIPPING PAPER)

NRC Form 540 must be completed for shipments of low-level radioactive waste intended for disposal at a licensed land disposal facility. The majority of the information on NRC Form 540 is needed to meet DOT shipping paper requirements for radioactive material shipments. The following are general instructions. Details on DOT requirements can be found in 49 CFR Part 171, "General Information, Regulations, and Definitions," 49 CFR Part 172, "Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, Training Requirements, and Security Plans," and 49 CFR Part 173, "Shippers—General Requirements For Shipments and Packagings."

- 1. Emergency Telephone Number**—The shipper must provide an emergency response telephone number or numbers for use in the event of an emergency (49 CFR 172.604, "Emergency Response Telephone Number"). If a single number applies to every entry on the shipping papers, enter this number in the space provided. Enter the name of the organization responsible for providing the emergency response information. Enter the name of the person, contract number, or unique identifier assigned by the emergency response information provider in association with the organization name (49 CFR 172.604).

When multiple numbers are applicable, enter "See Item 11" into Item 1. Enter each individual emergency response number and associated emergency response information immediately following the description of the material in Item 11 (49 CFR 172.604(a)(3)).

Note that additional emergency response information must be available and presented in accordance with 49 CFR 172.602, "Emergency Response Information," and 49 CFR 172.604.

- 2. Is This an "Exclusive Use" Shipment?**—"Exclusive use" is defined in 49 CFR 173.403, "Definitions," as "sole use by a single consignor of a conveyance for which all initial, intermediate, and final loading and unloading and shipment are carried out in accordance with the direction of the consignor or consignee." The shipper answers by checking "Yes" or "No." See 49 CFR 172.203(d)(9). If "Yes," then the shipper must provide the carrier with specific instructions for maintaining exclusive-use shipment controls and must include the instructions with the shipping paper as required by the definition of "exclusive use" in 49 CFR 173.403.
- 3. Total Number of Packages Identified on This Manifest**—Indicate the total number of packages listed on this manifest.
- 4. Does EPA Regulated Waste Requiring a Manifest Accompany This Shipment?**—If the answer to this question is "Yes," the shipper completes the applicable U.S. Environmental Protection Agency (EPA) manifest and attaches it to NRC Form 540. The shipper should also identify the EPA manifest number in the space provided (if acceptable to the consignee, the manifest number appearing in Item 8 of NRC Form 540 may be identical to the EPA manifest number).

5. **Shipper**—Indicate the company or facility name, facility address, contact person, and telephone number. If applicable, indicate the permit or other similar number assigned to the shipper by the appropriate host State in which the designated licensed land disposal facility is located. Indicate whether the shipper is a waste generator, collector, or processor, as defined in 10 CFR Part 20, Appendix G, Section I, by checking the appropriate box. If you are a generator, enter one of the following letter codes in the “GENERATOR TYPE” space: Government—G, Fuel Cycle Industry—FC, Nuclear Power—NP, University (Academic)—A, Medical—M, Industrial—I, Other—O. The form provides space for a shipper identification number for the shipper to record the number, if any, assigned to the shipper by the consignee or the designated land disposal facility operator. A space provided under the heading “SHIPMENT NUMBER” is for any use the shipper deems appropriate.
6. **Carrier**—Indicate either the carrier’s name, address, contact person, and telephone number, or the carrier’s name and EPA identification number. Also include the shipping date. Upon receipt of the shipment, an authorized carrier representative should acknowledge shipment receipt by signing and dating in the space provided. If two or more carriers will be used for the shipment of low-level radioactive waste to a licensed disposal facility, generator, or processor, provide the information for the first carrier in the box for Item 6. The requested information for additional carriers should be provided in an attachment to the form(s) in chronological order. Include the page count for any such attachment in the total pages for “Additional Information” in Item 7.
7. Enter the total number of pages for **EACH** set of NRC forms (i.e., Forms 540 and 540A, Forms 541 and 541A, and Forms 542 and 542A). In addition, identify the number of pages of additional information that requires a separate page or pages and is a part of this manifest. If an EPA manifest accompanies the NRC forms, do not include its pages in Item 7.

If NRC Form 542 or additional pages are not part of this manifest, enter “None” in the appropriate blank.

If only NRC Form 540 (and 540A, if necessary) is intended to physically accompany the shipment (e.g., the shipper is electronically or otherwise providing NRC Forms 541 and 542 and any additional information separately to the consignee), indicate this by checking the box under “Electronic” for NRC Forms 541, 542, and additional information, as appropriate.
8. **Manifest Number**—The shipper should enter a manifest number that can include numbers, letters, and special characters (e.g., space or hyphen). The consignee of the low-level radioactive waste (e.g., the waste processor, waste collector, or licensed disposal site operator) may dictate the manifest number before shipment.
9. **Consignee**—Indicate the company or facility name, address, contact person, and telephone number. Upon receipt of the shipment, an authorized person at the facility must acknowledge receipt of the shipment by signing and dating in the space provided (10 CFR Part 20, Appendix G, Section III).
10. **Certification**—An authorized representative of the waste generator, processor, or collector must sign and date the certification statement on the manifest

(49 CFR 172.204(d), 10 CFR 20.2006(c), and 10 CFR Part 20, Appendix G, Section II, "Certification"). The certification statement on NRC Form 540 consists of a statement based on the DOT's certification statement requirement in 49 CFR 172.204, "Shipper's Certification," and statements based on the NRC's certification statement requirement in 10 CFR Part 20, Appendix G, Section II, which refers to both DOT and Commission regulations.

- 11. U.S. Department of Transportation Description (Including UN ID Number, Proper Shipping Name, Hazard Class, and Any Additional Information)**—The DOT regulations at 49 CFR 172.202, "Description of Hazardous Material on Shipping Papers," contain the requirement for providing this information. For purposes of transportation in commerce, the DOT regulations at 49 CFR 172.101, "Purpose and Use of Hazardous Materials Table," list hazardous materials. If this information is required, the shipper must use the exact descriptors, in the order specified, in the DOT regulations.

If the package contains fissile Class 7 (radioactive) material, include the words "fissile excepted" or the criticality safety index for the package, as appropriate (see 49 CFR 172.203(d)(6)). For packages approved by the U.S. Department of Energy (DOE) or the NRC, include a notation of the package identification marking as prescribed in the applicable DOE or NRC approval (49 CFR 172.203(d)(7)).

For highway route controlled quantities, as defined in 49 CFR 173.403, include the words "Highway route controlled quantity" or "HRCQ."

Additional description requirements (e.g., indication of Reportable Quantity and NRC Certificate of Compliance, if applicable) are specified at 49 CFR 172.203, "Additional Description Requirements."

As is described in the guidance for Item 1, when multiple emergency response numbers are applicable, each individual emergency response number should be entered immediately following the description of the material in Item 11 (49 CFR 172.604(a)(3)). Enter associated emergency response information (i.e., the name of the organization responsible for providing the emergency response information and the name of the person, contract number, or unique identifier assigned by the emergency response information provider) immediately adjacent to the emergency response numbers. The emergency response numbers should be formatted in a manner to allow the information to be easily and quickly found (e.g., use of bold font or highlighting). Additional information, such as the emergency response guide number, can also be identified in Item 11. If the shipper chooses to enter the guide number under this item, it should be formatted to be easily and quickly found.

- 12. DOT Labels**—See the DOT regulations at 49 CFR 172.203(d)(4) and 49 CFR 172.403, "Class 7 (Radioactive) Material." Indicate the type of radioactive label that appears on the package (WHITE-I, YELLOW-II, YELLOW-III, and FISSILE (if applicable)). The shipper does not need to repeat the word "RADIOACTIVE" for the WHITE-I, YELLOW-II, and YELLOW-III labels.

If DOT does not require a label, place "NA" in this column.

13. **Transport Index**—See the DOT regulations at 49 CFR 173.403 and 49 CFR 172.203(d)(5). The Transport Index is required for shipments containing packages bearing Radioactive YELLOW-II or YELLOW-III labels. This is a dimensionless number, which is equivalent to the radiation dose rate in millirem per hour at 1 meter from the surface of the package. The Transport Index is placed on the label of a package to designate the degree of control necessary during transportation. If reporting of the Transport Index is not required, place “NA” in this column.
14. **Physical and Chemical Form**—See the DOT regulations at 49 CFR 172.203(d)(2). Describe the physical form of the contents of the package as “Solid,” “Liquid,” or “Gas.” List the most prevalent chemical form (e.g., cellulose, cement, metallic oxides). Include additional generic information on material description, as needed, to satisfy requirements of shipment consignee (e.g., to meet the land disposal facility waste acceptance criteria (WAC)). Further information on the physical and chemical description of the waste is required on NRC Form 541. For special form materials, list the words “special form,” unless the words already appear in the proper shipping name in accordance with 49 CFR 172.203(d)(2).
15. **Individual Radionuclides**—See the DOT regulations at 49 CFR 172.203(d)(1) and example abbreviations at 49 CFR 173.435, “Table of A1 and A2 Values for Radionuclides.” List the radionuclides (as determined by 49 CFR 173.433(g)) that are present in the transport package.³ The radionuclide’s mass number may immediately follow the element symbol (i.e., a dash between the symbol and mass number is not needed). A semicolon and space should separate the listing of multiple radionuclides. Individual consignees (e.g., land disposal facility operators) may require a more extensive reporting of the individual radionuclides than what DOT requires.
16. **Maximum Package Activity in SI Units**—Report the maximum activity in the transport package in SI units (e.g., megabecquerels (MBq)). If desired, also report this activity in units of millicuries in parentheses below the listing in SI units in accordance with 49 CFR 172.203(d)(3).⁴
17. **Total Weight or Volume**—Using the most appropriate units, identify the total weight or total volume of the material identified in Item 11. (Note that the volume of the shipping container, volume of the waste, combined weight of the waste and shipping container,⁵ and the weight of the waste will be entered on NRC Form 541, including for uncontainerized waste.)
18. **Identification Number of Package**—For each package, a package identification number that is unique among the individual package identification numbers within the shipment should be provided. You may use both numbers and letters. For waste that is shipped by rail, the reporting mark and number should also be included in this item (49 CFR 172.203(g)).

³ The radionuclides that should be reported on Form 540 are based on risk during transport or during handling of the waste, while the radionuclides that should be reported on Form 541 are based on the long-term dose at the disposal facility.

⁴ The purpose of the “Maximum Package Activity” reported in Item 16 on NRC Form 540 is to ensure safety during transit and compliance with DOT regulations, while the purpose of the reported activity in Item 16 of Form 541 is to support the management of long-term risk at the disposal facility. For this reason, the values reported on Form 540, Item 16, may be different from those reported on Form 541, Item 16. The shipper should follow the specific instructions for Item 16 on NRC Form 540 and Item 16 for NRC Form 541.

⁵ For uncontainerized waste, enter the weight of the waste (10 CFR Part 20, Appendix G (I)(D)(1)).

The area labeled “for consignee use only” has been left blank intentionally to allow each consignee to record details such as discrepancies and burial information. The individual consignee should determine the information appropriate for this space.

Use NRC Form 540A if additional space is needed to describe this shipment. Indicate the page number, total number of pages for Forms 540 and 540A, and the manifest number reported in Item 8.

NRC FORM 541: UNIFORM LOW-LEVEL RADIOACTIVE WASTE MANIFEST (CONTAINER AND WASTE DESCRIPTION)

NRC Form 541 must be completed for shipments of low-level radioactive waste intended for disposal at a licensed land disposal facility. Upon agreement between the shipper and consignee, this information may be transmitted electronically, as noted on pages 4 and 5 of these instructions.

For shipments of containerized waste to a consignee other than a land disposal facility operator, NRC regulations do not require the information requested under Items 5 through 11 of “DISPOSAL CONTAINER DESCRIPTION” and Item 17, “Waste Classification.” (Note, however, that the consignee may require container information.)

For all shipments of uncontainerized waste, Items 5, 6, 11, and 13 are not applicable; report the volume of the waste in Item 7, the weight of the waste in Items 8 and 9, and surface radiation levels in Item 10. For uncontainerized wastes shipped to a consignee other than the land disposal facility operator, NRC regulations also do not require the information requested in Items 10 and 17.

- 1. Manifest Totals**—Indicate the total number of low-level radioactive waste disposal containers described on this manifest (the total number of packages may be listed if the consignee is not the operator of a licensed low-level radioactive waste land disposal facility), the total net waste volume (cubic meters), and the total net weight ⁶ (kilograms).

Indicate the total individual manifested quantity of uranium (U)-233, U-235, and plutonium (Pu) in special nuclear material (grams). Note that the quantity requested is the quantity of the U-233, U-235, and Pu in the special nuclear material, not the total mass of the material itself. Also, report the total sum of the masses of U-233, U-235, and Pu in special nuclear material in grams. Indicate the total number of disposal containers containing each type of special nuclear material in parenthesis after the quantity listing.

In 10 CFR Part 20, Appendix G (I)(B)(4), the NRC requires the reporting of the total radionuclide activity in the shipment. The reported total radionuclide activity should represent the best estimate of the total activity and should consider the measured activity, the activity based on the lower limit of detection (LLD) values, or indirect methods, as applicable. In 10 CFR Part 20, Appendix G (I)(B)(5), the NRC requires separate manifest totals for tritium (H-3), carbon (C)-14, technetium (Tc)-99, iodine (I)-129, U-233, U-235, and Pu, as well as U and thorium (Th) in source material. For H-3, C-14, Tc-99, and I-129, enter the totals in MBqs in the appropriate boxes. If the radionuclides are known to be absent based on process knowledge, place “NP” for “not present” in the appropriate space. If the radionuclides are present in the waste in detectable quantities, report the total activity based on the measured activity. If the radionuclides could be present in the waste, and the measured activity is less than the LLD in any portion of the shipment, the shipper can use indirect methods to determine the activity to report or the shipper can report the activity for that portion of the shipment

⁶ Although kilogram is a unit of mass not weight, the term “weight” is used in the instructions for NRC Form 541 to be consistent with 10 CFR Part 20, Appendix G.

based on the LLD value and the amount of waste.⁷ Indirect methods can be used to determine the activity of the radionuclides present at less than the LLD values if there is reasonable assurance that the indirect method can be correlated with actual measurements. Regulatory Issue Summary 2015-02, "Reporting of H-3, C-14, Tc-99, and I-129 on the Uniform Waste Manifest," dated February 18, 2015, provides more information on the use of indirect methods to report the activity of H-3, C-14, Tc-99, and I-129. Alternatively, the shipper can enter an activity based on the laboratory-reported value for the LLD and the amount of waste. Any value based on an LLD should be entered in parenthesis.

The activities for the shipment reported in Item 1 should include the sum of the activity developed based on measurements, LLD values, and indirect methods, as applicable. If any portion of the reported activity was determined based on LLD values or indirect methods, mark the reported activity with an asterisk and provide additional details on the method used to determine the activity under Item 16 as described below. Providing the basis for the reported activities of H-3, C-14, Tc-99, and I-129 is important because they are often risk significant at land disposal facilities. This information allows the land disposal facilities to better understand and evaluate the uncertainty associated with the reported activity.

Report the total amount of U and Th in source material (kilograms), including U and Th in unimportant quantities, as defined in 10 CFR 40.13, "Unimportant Quantities of Source Material."

2. **Manifest Number**—Transfer the manifest number from NRC Form 540, Item 8.
3. **Page __ of __ Page(s)**—Include the total number of pages for Forms 541 and 541A.
4. **Shipper Name and ID Number**—Provide same information from Item 5 of NRC Form 540.

NOTE: See previous discussion to determine which of Items 5 through 11 on Form 541 should be completed for uncontainerized waste.

5. **Container Identification Number/Generator ID Number(s)**—Provide a disposal container identification number unique among the individual container identification numbers within the shipment (10 CFR Part 20, Appendix G (I)(C)(1)). Both numbers and letters may be used as well as special characters (e.g., space, hyphen). Also, indicate identification (ID) number(s) of the generator or generators contributing waste to the disposal container. If more than one disposal container is assigned to a single generator, there is no need to repeat the generator ID number. Note that the definition of "generator" identified in this item includes (a) "waste generators" as defined in 10 CFR Part 20, Appendix G, and (b) those licensees to which waste can be reasonably attributed, in the context of the Low-Level Radioactive Waste Policy Amendments Act of 1985, as a result of processing, decontamination, or transfers of radioactive materials.

⁷ It is generally not acceptable to assume a value of zero for the inventory of a radionuclide that has a concentration less than its LLD value in the performance assessment for the disposal site unless there is adequate justification that the radionuclide is not present in the waste. The activity derived based on the LLD or on an indirect method should be used in the performance assessment.

For disposal containers with mixtures of waste from different generators, list each generator on a separate row (10 CFR Part 20, Appendix G (I)(E)). Additionally, use separate rows for blendable waste and for each discrete waste type, as defined in 10 CFR Part 20, Appendix G (I)(E) (i.e., activated material, contaminated equipment, mechanical filters, sealed source/devices, and wastes in solidification/stabilization media), within the same container. Discrete items as defined in the 2015 Branch Technical Position on Concentration Averaging and Encapsulation⁸ (i.e., activated metals, sealed sources, cartridge filters,⁹ contaminated materials, and components incorporating radioactivity into their design) should also be listed on separate rows. Individual consignees (e.g., land disposal facility operators) may require more extensive breakdowns of radiological descriptions.

6. **Container Description**—Using the codes found in Note 1 at the bottom of NRC Form 541, describe the disposal container (10 CFR Part 20, Appendix G (I)(C)(2)). When Code 13 (High-Integrity Container) is used, also identify the manufacturer and the model number. The NRC or host State Certificate of Compliance Number(s) should be identified, as appropriate. Enter “11–Bulk Unpackaged Waste” for uncontainerized bulk waste. If Code 19, “Other,” is used, describe the container in Item 6. If the explanation is not entered in Item 6 (the preferred method), enter “See additional page” and provide the description on that page. The additional page should be included in the “additional information” total pages reported in Item 7 of NRC Form 540. If the container and waste require disposal in an approved structural overpack, “-OP” should be entered after the appropriate code number.
7. **Volume (Cubic Meters)**—In 10 CFR Part 20, Appendix G (I)(C)(3), the NRC requires the reporting of the volume displaced by the disposal container. Consignees (e.g., land disposal facility operators) may specify the required sensitivity of measurement. For volumes of less than 1 cubic meter, always include a zero in front of the decimal. For bulk unpackaged waste or unpackaged components or equipment, enter the estimated volume of the waste (10 CFR Part 20, Appendix G (I)(D)(1)).
8. **Waste and Container Weight (Kilograms)**—List the combined weight, in kilograms, of the container plus the contents (10 CFR Part 20, Appendix G (I)(C)(4)). The weight listed should include all fill materials in the container. For uncontainerized waste, provide the weight of the waste (10 CFR Part 20, Appendix G (I)(D)(1)). Consignees may require specific sensitivities of measurement.
9. **Waste Weight (Kilograms)**—List the weight, in kilograms, of the waste. Include the weight of fill material when the reported concentrations in the waste are based on averaging over the fill material in accordance with applicable guidance (e.g., the 2015 Branch Technical Position on Concentration Averaging and Encapsulation and applicable State guidance).

⁸ The NRC issued the final version of the Branch Technical Position on Concentration Averaging and Encapsulation, Revision 1, in February 2015. Volume 1 (Agencywide Documents Access and Management System (ADAMS) Accession No. [ML12254B065](#)) is the actual guidance document, and Volume 2 (ADAMS Accession No. [ML12326A611](#)) contains responses to stakeholder comments and the technical basis. The current list of questions and answers is available at ADAMS Accession No. [ML16237A374](#).

⁹ In some cases, the cartridge filters may be treated as blendable waste for the purpose of concentration averaging (see Section 3.3.3, “Alternative Treatment of Certain Cartridge Filters,” in the 2015 branch technical position). However, as stated in that technical position, if a cartridge filter is treated as blendable waste, the reporting requirements for filters in 10 CFR Part 20, Appendix G (I)(C)(10) continue to apply.

10. **Surface Radiation Level ($\mu\text{Sv/hr}$ or mSv/hr)**—Indicate the maximum radiation level at the surface of the disposal container or uncontainerized waste (10 CFR Part 20, Appendix G (I)(C)(5) and (I)(D)(6)). If this level does not represent the highest radiation level on the disposal container because of operational limitations or other factors, provide additional descriptive information to help the disposal facility or processing staff appropriately manage the waste. “BKG” should not be used to reference background levels unless the background level is indicated in this column.
11. **Surface Contamination ($\text{MBq}/100 \text{ cm}^2$): Alpha, Beta-Gamma**—Record the results of contamination surveys performed on the disposal container. “BKG” should not be used to reference background levels unless the background level is indicated in this column. Estimated values are acceptable if potential occupational exposures limit survey data collection.
12. **Waste Descriptor**—In 10 CFR Part 20, Appendix G (I)(C)(6) and (I)(D)(2), the NRC requires the reporting of a physical and chemical description of the waste. Using the codes found in Note 2 at the bottom of NRC Form 541, indicate the codes that most specifically describe the type of waste. As described in Item 5 above, for different waste types within the same container, the waste descriptor for the different waste types should be written on a separate row to allow for the provision of radiological descriptions on an individual waste descriptor and individual solidification or stabilization media basis. Individual consignees (e.g., land disposal facility operators) may require more extensive breakdowns of radiological descriptions. If Code 59, “Other,” is used, a written explanation should be provided. The preferred option is to include the explanation in Item 12, but if additional space is required, enter “See additional page” in Item 12. The additional page should be included in the “additional information” total pages in Item 7 of NRC Form 540.
13. **Approximate Waste Volume(s) in Container**—Indicate the approximate volume in cubic meters of containerized waste by generator and waste type, as applicable and as described in the instructions for Items 5 and 12 above (10 CFR Part 20, Appendix G (I)(C)(8)). “>85%” may be entered if (1) the disposal container “fill volume” exceeds 85 percent, (2) the disposal container does not contain discrete wastes (as defined in Item 5 above), together or mixed with other waste types, and does not contain more than one solidification/stabilization media, and (3) the external volume reported in Item 7 is approximately equal to the internal disposal container volume. The waste volume reported should be consistent with the volume that is averaged over for the purpose of determining the concentration in the waste. Note that Table 4 of the 2015 Branch Technical Position on Concentration Averaging and Encapsulation states that if a waste container with a single blendable waste stream is more than 90-percent full of waste (by volume), the nominal interior volume (“fill volume”) of the container may be used. If this 90-percent criterion is used to determine the concentration, the fill volume should be reported as “>90%” rather than “>85%.” Individual consignees (e.g., land disposal facilities) may have additional requirements for the manner in which the waste volume is reported.
14. **Sorbent, Solidification, Stabilization Media**—In 10 CFR Part 20, Appendix G (I)(C)(9), the NRC requires the reporting of the sorbing and solidification media, if any, for containerized waste. For uncontainerized waste, any sorbing or solidification media should also be reported here. All shipments should use the codes found in Note 3 at the

bottom of NRC Form 541 to identify the material used to solidify or absorb waste material. The spacing between the vertical listings of media descriptors (if more than one media descriptor is included in a single disposal container) allows for the provision of radiological descriptions on an individual "media-descriptor" basis. Individual consignees may require more extensive breakdowns of radiological descriptions. Similarly, individual land disposal facilities may require solidification of certain wastes (e.g., oil) in specified media and may require identification of media vendor (manufacturer) and brand name. If Codes 89 or 99, "Other," is used, a written explanation should be provided. The preferred option is to include the explanation in Item 14, but if additional space is required, enter "See additional page" in Item 14. This additional page should be included in the "additional information" total pages in Item 7 of NRC Form 540.

If the solidification process is intended to stabilize the waste in accordance with applicable NRC regulations in 10 CFR 61.56(b), "S" should be entered after the appropriate code number. Additionally, "S" should also be entered if the solidification process is required to meet land disposal facility requirements. For all wastes reported to meet the aforementioned stability requirements through solidification, identify the vendor (manufacturer) and the brand name of the solidification media in this column.

- 15. Chemical Description**—In 10 CFR Part 20, Appendix G (I)(C)(6) and (I)(D)(2), the NRC requires the reporting of a chemical description of the waste. In this description, the most prevalent chemical forms of the waste should be listed. Information in Item 15 should expand upon the chemical form description in Item 14 of NRC Form 540. If animal carcasses were coded in Item 12, the chemical form should include the word "LIME" in addition to any other significant chemicals. Also, indicate the name of the chelating agents that are present in amounts greater than 0.1 percent by weight of waste. Specify the percent in the column under the heading "Weight % Chelating Agent if >0.1%." If the waste does not contain chelating agents, indicate "NP" for "not present." If chelating agents represent less than 0.1 percent by weight, indicate "<0.1%." If wastes were generated from large chemical decontamination processes, indicate the process in this column. If an additional sheet describing the content of these wastes is needed, include this sheet in the pages reported in Item 7 of NRC Form 540.
- 16. Radiological Description**—In 10 CFR Part 20, Appendix G (I)(C)(10) and (I)(D)(5), the NRC requires the reporting of the identities and activities of individual radionuclides in each container (for containerized waste) or in the waste (for uncontainerized waste).¹⁰ This information may be presented (1) by listing the activity of all significant radionuclides present in the waste or (2) by reporting the total activity and entering the percent by activity of each radionuclide. The DOT regulations at 49 CFR 172.203(d)(3) authorize the use of abbreviations for the radionuclides. (See also example abbreviations at 49 CFR 173.435.)

¹⁰ The purpose of the "Maximum Package Activity" reported in Item 16 on Form 540 is to ensure safety during transit and compliance with DOT regulations, while the purpose of the reported activity in Item 16 of Form 541 is to support the management of long-term risk at the disposal facility. For this reason, the values reported on Form 540, Item 16, may differ from those reported on Form 541, Item 16. The shipper should follow the specific instructions for Item 16 on NRC Form 540 and Item 16 for NRC Form 541.

A radionuclide is “significant” if it is contained in the waste in concentrations¹¹ greater than 0.01 times the concentration of that radionuclide listed in Table 1 of 10 CFR 61.55, “Waste Classification,” or 0.01 times the smallest concentration of that radionuclide listed in Table 2 of 10 CFR 61.55. For waste being shipped to a land disposal facility, radionuclides that are present at more than 0.01 times the WAC, if applicable, at the land disposal facility are significant and should also be reported. The lower of the value developed from the tables in 10 CFR Part 61, “Licensing Requirements for Land Disposal of Radioactive Waste,” or the WAC, if applicable, should be used in determining whether a radionuclide is “significant.” A radionuclide other than one listed in the 10 CFR 61.55 tables or the land disposal facility WAC, if applicable, is considered significant if it is contained in the waste in concentrations greater than 0.26 MBq per cubic centimeter. Furthermore, any radionuclide whose activity represents a reportable quantity under DOT regulations (see 49 CFR 172.101, Appendix A, “Office of Hazardous Materials Transportation Color Tolerance Charts and Tables,”) or is 0.01 or more of the total activity within the disposal container should be listed, even if the above concentration criteria are not exceeded. Listing only the most abundant radionuclides or using the category “mixed fission products” is not acceptable.

The NRC recognizes that in some cases the threshold for a radionuclide being “significant” based on the above criteria may be below a practical detection level.¹² In accordance with 10 CFR 61.55(a)(8), the reported activity of a radionuclide can be derived from the LLD value or through the use of indirect methods (e.g., scaling factors). The use of indirect methods is acceptable as long as there is reasonable assurance that the indirect methods can be correlated with actual measurements.

When using the first approach (i.e., listing the activity of all significant radionuclides present in the waste), all significant radionuclides present in the waste should be listed followed by their respective activities in MBqs for each container. If waste from more than one generator is contained in a single container, the activity for each significant radionuclide for each generator should be reported for the container. Progeny should be either individually reported or, if within a factor of 2 of being in equilibrium with its (their) parent, can be reported as the parent with its activity listed, but with the symbol “D” or “NAT” for “daughter” or “natural,” respectively, and indicating progeny in equilibrium (e.g., cesium-137D or ThNAT). For waste included within a single container, report the significant radionuclides and their respective activities separately for discrete waste types (i.e., activated materials, contaminated equipment, mechanical filters, and sealed source/devices and wastes in solidification/stabilization media). Other wastes may be described by a combination of waste descriptor codes and, as a result, the radionuclides and activities may be reported as a combined total.

If the reported activity is developed based on an LLD value or the use of indirect methods, the activity should be marked with parentheses for LLD-based values and with

¹¹ The average concentration in the container (for containerized waste) or in the waste (for uncontainerized waste) should be used to determine whether the radionuclide is “significant.” The NRC provided guidance on the determination of the average concentration in the 2015 Branch Technical Position on Concentration Averaging and Encapsulation.

¹² The NRC’s 1983 Branch Technical Position on Waste Classification and Waste Form (ADAMS Accession No. ML033630755) states that the LLD should be no more than 0.01 times the concentration for that radionuclide listed in Table 1 of 10 CFR 61.55 or 0.01 times the smallest concentration of that radionuclide listed in Table 2 of 10 CFR 61.55. Land disposal facilities may have additional requirements for the LLD values.

a pound (#) sign for values based on indirect methods. If more than one method is used to develop the activity (e.g., a portion of the activity for a radionuclide is developed based on actual measurements and a portion is developed based on an indirect method or LLD value), write the activity for the radionuclide developed using each method separated by a slash (/) and mark the activity as described above as appropriate. Table 1 provides examples for reporting the activity.

Table 1 Examples for Reporting a 10,000-MBq Activity on the Uniform Waste Manifest

Method Used to Develop Radionuclide Specific Activity for Shipment	How To Mark Activity
Reported activity is based on actual measurements	10,000
Reported activity is developed based on LLD values	(10,000)
Reported activity is developed based on the use of indirect methods	10,000#
Reported activity for shipment is calculated based on a combination of both indirect methods and LLD values*	5,000# / (5,000)
Reported inventory is developed based on a combination of actual measurements, indirect methods, and LLD values**	5,000 / 2,500# / (2,500)

* In this example, half of the reported activity is based on LLD values and half is based on indirect methods.

** In this example, half of the reported inventory is based on actual measurements, a quarter of the inventory is based on LLD values, and a quarter is based on indirect methods.

For containerized waste, after listing the individual radionuclides as described above, enter the word “Total” on a new line and enter the total activity contained in the container. In 10 CFR Part 20, Appendix G (I)(C)(11), the NRC requires the reporting of the total activity in the container, so this activity should represent the best estimate of the total activity and should include the activity derived based on the LLD or indirect methods, as applicable.

To use the second approach (i.e., reporting the total activity in each container and entering the percent by activity of each radionuclide), for containers containing a single waste type, enter the total MBqs in the container (for each waste generator if waste from more than one generator is included in a single container) and enter the percent of each significant radionuclide by activity. Always include the “%” sign when using this option. If any of the activity is based on the use of an LLD value or an indirect method, mark the percentages as described above.

Individual consignees (e.g., land disposal facility operators) may require more extensive breakdowns of radiological descriptions or may not allow the second method of reporting described above.

NOTE: The activity for U and Th in source material and U-233, U-235, and Pu in special nuclear material should be reported in MBq in Item 16. The quantity of these radionuclides should also be reported in kilograms for source material—including the abbreviation “kg,”—and in grams for special nuclear material—including the abbreviation “g.” The mass quantities should be reported in brackets, either adjacent to the activity listing or below the radionuclide listing.

- 17. Waste Classification**—Using the following codes, indicate the waste class and the structural stability of the waste in accordance with applicable NRC requirements or the radioactive material license applicable at the disposal facility to which the waste will be consigned. Radionuclides listed in 10 CFR 61.55 that were identified as “significant”¹³ in Item 16 should be considered in determining the waste class. Waste generators shipping to processors need not complete this item and should enter NA in this block.

AS	Class A Stable
AU	Class A Unstable
B	Class B
C	Class C

Use BU or CU (unstable Class B or C) to classify waste requiring appropriate handling or processing at a disposal facility to achieve required stability.

If greater-than-Class-C wastes are shipped, use “GTCC.”

Use NRC Form 541A if additional space is needed to describe this shipment. Indicate the page number, total number of pages for Forms 541 and 541A, and the manifest number from NRC Form 540, Item 8.

¹³ For radionuclides that were identified as “significant” but were present at concentrations less than the LLD value, the activity assumed in the determination of the waste class should be based on the LLD value or an indirect method, unless there is adequate justification (e.g., based on process knowledge) that the radionuclide is not present in the waste. It is generally not appropriate to assume a value of zero for the activity of a radionuclide that could be present in the waste when determining the waste class.

NRC FORM 542: UNIFORM LOW-LEVEL RADIOACTIVE WASTE MANIFEST (MANIFEST INDEX AND REGIONAL COMPACT TABULATION)

Processors and collectors of low-level radioactive waste that are shipping low-level radioactive waste attributed to others for disposal at a licensed land disposal facility must complete NRC Form 542.

- 1. Waste Collector/Processor**—Complete the collector's or processor's name, shipper ID number, and the shipping date. The form also includes space for any use the shipper deems appropriate.

As defined in 10 CFR Part 20, Appendix G, a waste collector or processor is an entity operating under a Commission or Agreement State license, whose principal purpose for possessing the radioactive material or waste is as follows:

- A collector collects and consolidates waste generated by others and transfers this waste, without processing or repackaging, to another waste collector, processor, or licensed land disposal facility.
- A processor processes, repackages, or otherwise treats low-level radioactive material or waste generated by others before the eventual transfer of the waste, or waste residue, to a licensed land disposal facility.

- 2. Manifest Number**—Transfer the manifest number from NRC Form 540, Item 8.
- 3. Page ___ of ___ Page(s)**—Include the total number of pages for Forms 542 and 542A.
- 4. Generator Identification Number**—Each row should include one of the generator ID numbers from NRC Form 541, Item 5. This column should include all generator numbers associated with generators to whom low-level radioactive waste is being attributed. List one, and only one, generator, and accompanying information, in each block. Provide the generator information requested in Items 5 through 11 in the same row.
- 5. Generator Name, Permit Number (if Applicable), and Telephone Number**—Specify the generator name, permit number (if applicable), and telephone number for the generator to whom waste is being attributed.¹⁴ If the permit number is reported in Item 4, it need not be repeated here.
- 6. Generator Facility Address**—List the complete address of the generator's facility that has contributed low-level radioactive waste to the shipment. List one, and only one, generator address in the block consistent with the generator information provided in Item 5.
- 7. Preprocessed Waste (or Material) Volume**—Indicate the approximate volume in cubic meters (not including the container) of the preprocessed waste or material. This is the

¹⁴ The NRC defines "generator" and "waste generator" in 10 CFR Part 20, Appendix G, Section I.

volume of waste or material received from the consignor's facility. This information may be that indicated on the consignor's NRC Form 541, Item 13, or the shipping paper used to facilitate the transfer of radioactive material.

- 8. Manifest Number(s) Under Which Waste (or Material) Received and Date of Receipt**—List the previous manifest number(s) applicable to the low-level radioactive waste attributed to the generator listed in Item 5 and date or dates of waste or material receipt by the shipper identified in Item 5 of NRC Form 540.
- 9. Waste Code: Processed or Collected**—Indicate the proper waste code, "P" or "C," using the definitions of waste processor and waste collector in 10 CFR Part 20, Appendix G. Do not mix processed and collected waste on the same line; list them separately.
- 10. Originating Compact Region or State**—Identify the originating Compact region or unaffiliated State for the original generator of the waste, as defined in 10 CFR Part 20, Appendix G, Section I. State abbreviations may be used. Compact abbreviations may be used when they cannot be confused with State abbreviations (i.e., do not use two-letter Compact abbreviations). In addition, note the Compact Export Permit numbers, if applicable, in this block. Permit numbers issued by the receiving State (e.g., an out of State access number) may also be noted in this block.
- 11. As Processed/Collected Total**—For each original generator in Item 5, list the total source material (in kilograms), special nuclear material (in grams), activity (in MBqs) contained in the waste, and the volume (in cubic meters) attributed to that generator. The NRC defines special nuclear material and source material in 10 CFR 70.4, "Definitions," and 10 CFR 40.4, "Definitions," respectively.

Use NRC Form 542A if additional space is needed to describe this shipment. Indicate the page number, total number of pages for Forms 542 and 542A, and the manifest number from NRC Form 540, Item 8.

APPROVED BY OMB: NO. 3150-0164 Estimated burden per response to comply with this information collection request: 45 minutes. This uniform manifest is required by NRC to meet reporting requirements of Federal and State Agencies for the safe transportation and disposal of low-level waste. Send comments regarding burden estimate to the Information Services Branch (1-2 F43), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by e-mail to InfoCollect.Resource@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0164), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

EXPIRES: (MM/DD/YYYY)

NRC FORM 540 U.S. NUCLEAR REGULATORY COMMISSION UNIFORM LOW-LEVEL RADIOACTIVE WASTE MANIFEST SHIPPING PAPER See NUREG/BR-0204 for detailed instructions for completing this form: http://www.nrc.gov/reading-rm/doc-collections/nuregs/brochures/br0204/		5. Shipper - Name and Facility Shipper ID Number <input type="checkbox"/> Collector <input type="checkbox"/> Processor <input type="checkbox"/> Generator Type (Specify)		7. NRC Form 540 and 540A Page 1 of NRC Form 541 and 541A NRC Form 542 and 542A Additional Information		8. Manifest Number Electronic Page(s) <input type="checkbox"/> Page(s) <input type="checkbox"/> Page(s) <input type="checkbox"/> Page(s) <input type="checkbox"/> Contact	
1. Emergency Telephone Number (Include area code)		6. Carrier - Name and Address EPA I.D. Number Shipping Date		9. Consignee - Name and Facility Address Signature - Authorized consignee acknowledging waste receipt Date		10. CERTIFICATION This is to certify that the herein-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, the Commission, and equivalent state regulations. For materials that are consigned to a land disposal facility or waste collector, this certifies that the materials are classified per the applicable requirements of 10 CFR Part 61, meet the land disposal facility's waste acceptance criteria, and are in proper condition for disposal as described in accordance with the applicable requirements of 10 CFR Parts 20 and 61, or equivalent state regulations. A collector in signing the certification is certifying that nothing has been done to the collected waste which would invalidate the waste generator's certification.	
2. Is this an "Exclusive Use" Shipment? Yes <input type="checkbox"/> No <input type="checkbox"/>		3. Total Number of packages identified on this manifest?		13. Transport Index		16. Maximum Package Activity in SI Units	
4. Does EPA regulated waste requiring a manifest accompany this shipment? (If "Yes," provide Manifest Number). Yes <input type="checkbox"/> No <input type="checkbox"/>		EPA Manifest Number		14. Physical and Chemical Form		17. Total Weight or Volume (Use appropriate units)	
11. U. S. Department of Transportation Description (Including UN ID number, proper shipping name, hazard class, and any additional information)		12. DOT Labels		15. Individual Radionuclides		18. Identification Number of Package	

For Consignee Use Only

BIBLIOGRAPHIC DATA SHEET

(See instructions on the reverse)

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Revision 3

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10. SUPPLEMENTARY NOTES

R. Gladney

11. ABSTRACT (200 words or less)

NUREG/BR-0204 contains guidance for completing the Uniform Low-Level Radioactive Waste Manifest (NRC Forms 540, 541, and 542). The document includes an explanation or reference for each item to assist you in properly completing each form. Exhibits at the end of these instructions show sample NRC Forms 540, 541, and 542.

The changes between Revision 2 and Revision 3 of these instructions are (1) updated instructions to reflect changes to the Uniform Manifest Forms, (2) updated references to U.S. Department of Transportation (DOT) regulations to reflect the current DOT regulations, (3) additional discussion on the reporting of inventories based on lower limit of detection values, the potential use of indirect methods to determine these inventories, and the use of indirect methods in waste classification calculations, (4) added clarification of the intent of the certification statement on Form 540, and (5) made overall improvements to the clarity of the document.

12. KEY WORDS/DESCRIPTORS (List words or phrases that will assist researchers in locating the report.)

Low-Level Radioactive Waste, Transportation, Uniform Low-Level Waste Manifest

13. AVAILABILITY STATEMENT

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14. SECURITY CLASSIFICATION

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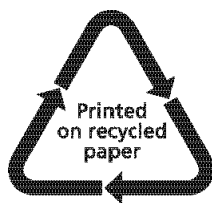
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**Instructions for Completing the U.S. Nuclear Regulatory Commission's Uniform
Low-Level Radioactive Waste Manifest**

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