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Congressional Committees

Nuclear Waste: DOE Needs to Improve Transparency in Planning for Disposal of Certain Low-Level Waste

Accessible Version

GAO Highlights

Highlights of [GAO-22-105636](#), a report to congressional committees

Why GAO Did This Study

GTCC and GTCC-like waste currently do not have a legal pathway for disposal. NRC is responsible for regulating disposal of GTCC waste, but not GTCC-like waste because it is not a legal category and no regulations specifically govern its disposal. DOE is responsible for identifying a pathway for and carrying out disposal of both types of waste. DOE developed an environmental impact statement to evaluate various options for disposing of the wastes; this statement does not include a final decision on which option DOE will use.

The Senate report accompanying the National Defense Authorization Act for Fiscal Year 2022 includes a provision for GAO to review several aspects of GTCC waste disposal. This report examines, among other things, (1) DOE estimates of GTCC waste, (2) alternatives DOE has identified for GTCC waste disposal, and (3) barriers to GTCC waste disposal. GAO reviewed laws, regulations, and DOE's environmental impact statement; and interviewed agency and state officials.

What GAO Recommends

GAO recommends that Congress consider (1) clarifying regulatory authority over GTCC disposal; and (2) providing direction to DOE, so that it can proceed with a decision on GTCC waste disposal. GAO also recommends that DOE update its guidance for environmental analyses to (1) quantify uncertainty and (2) enhance transparency. DOE agreed with GAO's recommendations.

View [GAO-22-105636](#). For more information, contact Nathan Anderson at (202) 512-3841 or andersonn@gao.gov.

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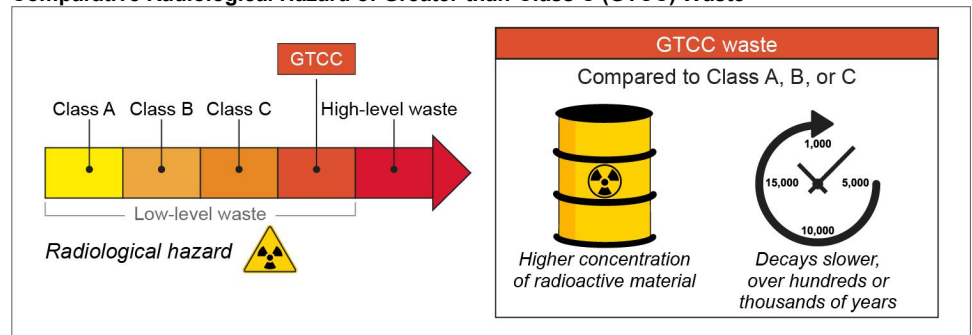
NUCLEAR WASTE

DOE Needs to Improve Transparency in Planning for Disposal of Certain Low-Level Waste

What GAO Found

The Department of Energy (DOE) is responsible for disposing of greater-than-Class C (GTCC) waste, a type of commercial low-level nuclear waste from decommissioned nuclear reactors and disused medical and industrial equipment. It is also responsible for disposing of government waste with similar characteristics, which it calls GTCC-like waste. In a 2016 environmental impact statement, DOE used its most recent estimates of the volumes and radiological characteristics of these wastes to evaluate the potential environmental impacts of various disposal alternatives. Specifically, DOE estimated that 12,000 cubic meters would be generated through 2083 and require disposal. Of this amount, 1,100 cubic meters were already in storage. However, GAO found that DOE did not quantify uncertainties in its estimates, and DOE guidance does not include quality assurance steps related to quantifying uncertainty. Adding such steps would better ensure the agency provides stakeholders with needed information.

Comparative Radiological Hazard of Greater-than-Class C (GTCC) Waste



Source: GAO analysis of Nuclear Regulatory Commission documents. | [GAO-22-105636](#)

In its environmental impact statement, DOE selected three preferred options for GTCC and GTCC-like waste disposal: (1) the Waste Isolation Pilot Plant in New Mexico, the nation's only geologic repository; (2) commercial land disposal facilities; or (3) both. However, DOE did not explain the rationale for its selection in the statement. GAO reviewed DOE guidance for environmental analyses and found that it did not include specific steps to ensure the agency implements regulatory provisions related to transparency, such as explaining the rationale for its selections. By adding such steps to its guidance, DOE would better ensure its future environmental analyses are transparently documented. This may give stakeholders more confidence in DOE's decisions.

DOE faces both regulatory and statutory barriers to disposing of this waste. The Nuclear Regulatory Commission (NRC) has taken steps to address certain regulatory barriers, including (1) preparing to update its regulations that restrict near-surface disposal of GTCC waste and (2) planning to clarify whether NRC can relinquish regulatory authority related to GTCC waste disposal to states. However, without clarification of NRC's statutory ability to relinquish this authority, NRC could face litigation. This could delay disposal and lead to continued costs and risks. Additionally, DOE is required by statute to await congressional direction before proceeding with a decision on GTCC disposal.

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The federal government is responsible for disposal of certain low-level radioactive waste, including greater-than-Class C (GTCC) waste. This waste, which is commercially generated, does not currently have a legal disposal option. It includes radioactive metals from decommissioned commercial nuclear facilities and radioactive material sealed in industrial and medical equipment that is no longer in use—commonly referred to as sealed sources—such as blood irradiators previously used for medical purposes.¹ The federal government is also responsible for government-owned or -generated waste with similar characteristics to GTCC waste, such as from certain environmental cleanup sites; this waste is referred to as “GTCC-like.”² Until a legal disposal option becomes available, GTCC and GTCC-like waste will continue to be stored at the sites where it was generated or at storage facilities, incurring environmental and security risks as well as storage costs. For example, sealed sources pose a threat to national security because they can be used to make explosive devices known as dirty bombs.³

The Nuclear Regulatory Commission (NRC) and the Department of Energy (DOE) each have roles in the disposal of GTCC waste. NRC regulates disposal facilities that accept commercially generated waste, including by establishing technical requirements and issuing licenses for them. NRC is responsible for approving a facility for the disposal of GTCC waste. DOE is responsible for identifying a disposal pathway for GTCC waste, then disposing of the waste after NRC approves a facility.⁴

¹Nuclear reactors contain metals that become activated during reactor operations. Activated metals are primarily steel, stainless steel, and a number of specialty alloys that become radioactive when neutron radiation from the reactor ‘activates’ the iron, cobalt, and nickel atoms in the materials through a nuclear reaction to create a radioactive isotope. The Nuclear Regulatory Commission’s and others’ analyses of waste generated from decommissioning nuclear reactors project that the volume of waste classified as GTCC will be much lower than the volumes of other types of low-level waste.

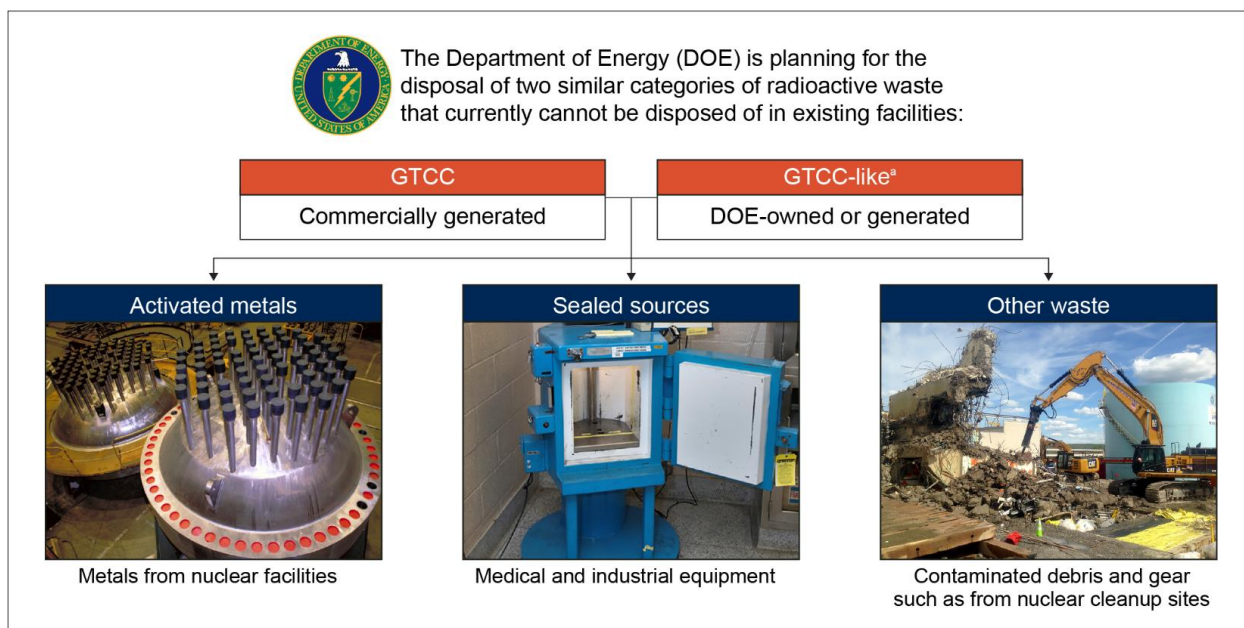
²GTCC-like waste generally does not include waste generated from defense activities. It includes certain waste from cleanup of non-defense nuclear waste sites, operation of DOE-owned nuclear reactors, and production of radioactive isotopes for space exploration.

³Dirty bombs use conventional explosives to spread radioactive material. Beyond the harm caused by the explosives, a dirty bomb detonation would likely result in significant social and economic harm from public panic, decontamination costs, and denial of access for extended periods to the area in which the detonation took place. See GAO, *Security of Radioactive Materials*, [GAO-22-105498](#) (Washington, D.C.: Apr. 5, 2022).

⁴The federal government is responsible for GTCC disposal under the Low-Level Radioactive Waste Policy Amendments Act of 1985 (1985 Act). Pub. L. No. 99-240 § 102, 99 Stat. 1842, 1844 (1986) (codified at 42 U.S.C. § 2021c(b)(1)(D)). DOE’s Office of Environmental Management carries out this responsibility.

In addition to disposing of GTCC waste, DOE is responsible for disposing of GTCC-like waste (see fig. 1). NRC regulations do not specify requirements for GTCC-like waste because GTCC-like waste is government-owned rather than commercial and “GTCC-like” is not a legal or regulatory concept,⁵ but a DOE term. As with GTCC waste, GTCC-like waste does not currently have a disposal pathway. DOE is considering using similar approaches to dispose of both types of waste.

Figure 1: Types of Greater-than-Class C (GTCC) and GTCC-Like Waste



Sources: GAO analysis; images from Nuclear Regulatory Commission, Brookhaven National Laboratory, and DOE. | GAO-22-105636

^aGTCC-like waste is generally non-defense. According to DOE officials, none of the waste included in the agency’s estimates of GTCC-like waste had been determined to be defense waste at the time of the estimates. It is possible some of the waste could be characterized as such in the future, which could enable it to be disposed of in an existing facility.

The Senate Report accompanying a bill for the National Defense Authorization Act for Fiscal Year 2022 includes a provision for us to review several aspects of GTCC waste disposal.⁶ This report examines (1) laws and regulations governing GTCC waste, (2) DOE estimates of GTCC and GTCC-like waste, (3) alternatives DOE has identified for GTCC and GTCC-like waste

⁵Because NRC regulations apply to NRC-licensed disposal facilities, if GTCC-like waste were disposed of at a commercial disposal facility licensed by NRC, NRC regulations would apply.

⁶S. Rpt. No. 117-39, at 363 (2021).

disposal, and (4) barriers to GTCC and GTCC-like waste disposal. It addresses 10 discrete questions related to these objectives.

To examine laws and regulations governing GTCC waste, we reviewed relevant sections of the Atomic Energy Act of 1954, as amended (AEA);⁷ the Low-Level Radioactive Waste Policy Amendments Act of 1985 (1985 Act);⁸ the Energy Policy Act of 2005;⁹ and NRC's regulations located at parts 61 and 72 of title 10 of the *Code of Federal Regulations*. We also reviewed DOE and NRC documents, such as DOE's Environmental Impact Statement (EIS) for GTCC and GTCC-like waste¹⁰ and NRC's Draft Regulatory Basis on the Disposal of GTCC and Transuranic Waste.¹¹ In addition, we interviewed relevant DOE and NRC officials to determine how these laws and regulations define agencies' roles in GTCC and GTCC-like waste disposal.

To examine DOE's estimates of GTCC and GTCC-like waste, we reviewed DOE's EIS and the source documents for the estimates, including a 2010 inventory of GTCC waste.¹² We reviewed the estimates, as well as requirements of the National Environmental Policy Act of 1969 (NEPA), its implementing regulations, and related DOE guidance. We also interviewed relevant DOE officials, including officials from four sites the EIS identified as storing GTCC-like waste.

To examine DOE's identification of alternatives for GTCC and GTCC-like waste disposal, we reviewed DOE's EIS and NEPA requirements relevant to transparency in decision making. We also interviewed state regulatory officials in five states with sites that DOE evaluated for

⁷Act of Aug. 30, 1954, ch. 1073, § 1, 68 Stat. 919 (codified as amended at 42 U.S.C. § 2011 through 2297g-4).

⁸Pub. L. No. 99-240, § 102, 99 Stat. 1842, 1843 (1986) (codified at 42 USC 2021c).

⁹Pub. L. No. 109-58, § 631, 119 Stat. 594, 788.

¹⁰Department of Energy, *Final Environmental Impact Statement for the Disposal of Greater-Than-Class C (GTCC) Low-Level Radioactive Waste and GTCC-Like Waste*, EIS-0375 (Washington, D.C.: January 2016). DOE completed a draft of the EIS in 2011 and solicited public comments, 76 Fed. Reg. 10,574 (Feb. 25, 2011), as required by the National Environmental Policy Act of 1969 (NEPA), 42 U.S.C. § 4332(C).

¹¹Nuclear Regulatory Commission, *Disposal of Greater-than-Class C (GTCC) and Transuranic Waste Draft Regulatory Basis – For Public Comment* (Washington, D.C.: July 22, 2019).

¹²Sandia National Laboratories, *Basic Inventory for Greater-Than-Class-C Low-Level Radioactive Waste Environmental Impact Statement Evaluations*, rev. 1 (Albuquerque, N.Mex.: May 2008); and Argonne National Laboratory Environmental Science Division, *Supplement to Greater-Than-Class C (GTCC) Low-Level Radioactive Waste and GTCC-Like Waste Inventory Reports* (Lemont, Ill.: October 2010).

potential GTCC and GTCC-like waste disposal and representatives of the two disposal facilities DOE identified in its NEPA reviews.¹³

To examine barriers to GTCC and GTCC-like waste disposal, we reviewed pertinent laws and regulations, including relevant sections of the 1985 Act, relevant laws from states with potential disposal sites, and parts 61 and 150 of title 10 of the *Code of Federal Regulations*. We also reviewed other related documentation, such as a report DOE submitted to Congress in 2017 and NRC's draft regulatory basis and other relevant staff papers.¹⁴ We also interviewed DOE, NRC, and state regulatory officials, and disposal facility representatives. For reporting purposes, we focused on barriers that have an immediate impact on the federal government's ability to proceed with identifying a disposal pathway for GTCC and GTCC-like waste. See enclosure I for additional details on our scope and methodology.

We conducted this performance audit from January 2022 to September 2022 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Laws and Regulations Governing GTCC Waste

How do regulations define GTCC waste?

NRC regulations define GTCC as a type of low-level radioactive waste. The regulations categorize low-level wastes based on radiological hazard as Classes A, B, or C;¹⁵ or GTCC (see fig. 2).¹⁶ GTCC is the most radiologically hazardous within the low-level radioactive waste classification. The regulations define each category based on concentration limits of certain

¹³We requested interviews with regulatory officials from the six states that DOE evaluated for GTCC and GTCC-like waste disposal. We interviewed officials from Texas, Washington, South Carolina, and Idaho. Nevada officials provided documents related to potential GTCC waste disposal in their state, and New Mexico officials did not respond to our requests.

¹⁴Department of Energy, *Alternatives for the Disposal of Greater-Than-Class C Low-Level Radioactive Waste and Greater-Than-Class C-Like Waste Report to Congress* (Washington, D.C.: November 2017).

¹⁵10 C.F.R. § 61.55(a)(2).

¹⁶10 C.F.R. § 72.3.

radioactive isotopes and describe the relative isolation measures NRC believes are warranted based on the radiological characteristics of the waste.¹⁷

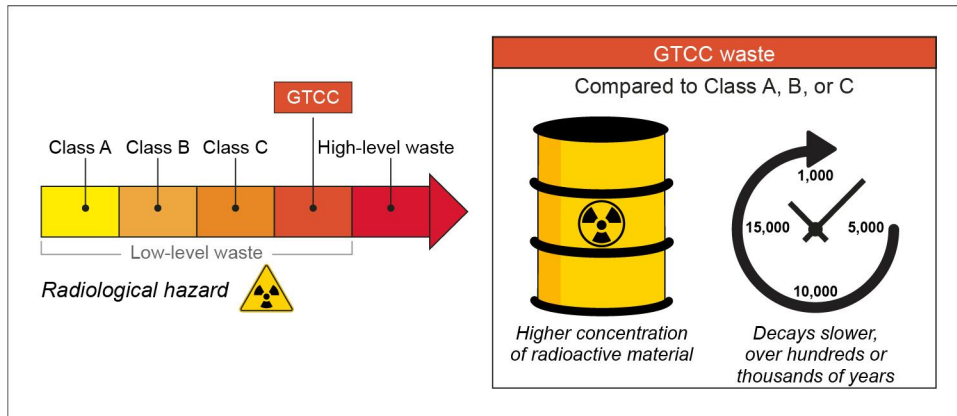
- **Class A** has the lowest radiological hazard and contains mostly relatively short-lived radionuclides that decay to background levels within a few decades.
- **Class B** contains higher concentrations of short-lived radionuclides than Class A.
- **Class C** contains higher concentrations of both short-lived and long-lived radionuclides.
- **GTCC** has concentrations of certain radionuclides that exceed the Class C limits listed in NRC's Licensing Requirements for Land Disposal of Radioactive Waste, which appear in part 61 of title 10 of the *Code of Federal Regulations*.¹⁸ According to NRC, some, but not all, GTCC waste streams contain transuranic radionuclides.¹⁹

¹⁷10 C.F.R. § 61.55(a)(2). NRC regulations do not provide a definition of GTCC in part 61 of title 10 of the *Code of Federal Regulations*. Instead, a definition appears in part 72 of that title referencing the limits in part 61.

¹⁸10 C.F.R. § 72.3 (*Greater than Class C waste or GTCC waste*).

¹⁹In July 2019, NRC published a notice in the *Federal Register*, requesting comments on a draft regulatory basis to support a rulemaking to, among other things, amend its definition of low-level radioactive waste to include transuranic waste. 84 Fed. Reg. 35,037 (July 22, 2019). The AEA defines transuranic waste as "material contaminated with elements that have an atomic number greater than 92, including neptunium, plutonium, americium, and curium, and that are in concentrations greater than 10 nanocuries per gram [nCi/g], or in such other concentrations as the [NRC] may prescribe to protect the public health and safety." 42 U.S.C. § 2014(ee). In 1979, EPA determined it could raise the concentration limit from 10 to 100 nCi/g without exceeding the safety limits for radiation dose (500 mrem/yr). The Environmental Protection Agency (EPA) and DOE subsequently changed the activity concentration for the definition of transuranic waste to 100 nCi/g (PECOS, 2010). EPA's definition of transuranic waste encompassed concentrations greater than 100 nCi/g of alpha-emitting transuranic isotopes with half-lives greater than 20 years. 40 C.F.R. § 191.02.

Figure 2: Comparative Radiological Hazard of Greater-than-Class C Waste



Source: GAO analysis of Nuclear Regulatory Commission documents. | GAO-22-105636

Notes: NRC regulations categorize low-level wastes based on radiological hazard. One way to consider radiological hazard is by the level of radioactivity. The GTCC and GTCC-like waste in the Department of Energy's (DOE) estimates would have a total radioactivity of approximately 160 million curies at the time it is ready for disposal, according to a DOE document. A curie is a unit to measure the radioactivity of a radioisotope, or the rate at which that isotope decays in time; one curie equals 37 billion radioactive decays per second. Other types of low-level waste have a much lower level of radioactivity, with about 1 million curies disposed of annually. In contrast, spent nuclear fuel from commercial nuclear reactors—a type of high-level waste that can have much greater concentrations of radioactive material—has a combined activity of about 19 billion curies, according to DOE estimates of projected waste through 2046. Like GTCC and GTCC-like waste, spent nuclear fuel from commercial reactors has no disposal pathway.

NRC regulations stipulate that GTCC waste is not generally acceptable for near-surface disposal—defined as within the upper 30 meters of the earth's surface. As such, GTCC waste must be disposed of in a geologic repository unless NRC approves an alternative disposal facility on a case-by-case basis.²⁰ The regulations stipulate that, in such cases, the disposal methods be more stringent than those required for Class C waste.²¹

In contrast, there are no statutory or regulatory definitions of GTCC-like waste. As described above, GTCC-like waste is not a legal or regulatory concept, but a term DOE uses to describe waste that

- is not commercially generated,
- has radiological characteristics similar to GTCC waste,

²⁰In contrast to near-surface disposal facilities, the Waste Isolation Pilot Plant (WIPP), the nation's only geologic repository, stores packaged defense waste 2,150 feet (about 655 meters) underground. NRC defines a "geological repository" as an excavated, underground facility designed, constructed, and operated for safe and secure permanent disposal of high-level radioactive waste. Such repositories use an engineered barrier system and a portion of the site's natural geology, hydrology, and geochemical systems to isolate the radioactivity of the waste.

²¹10 C.F.R. § 61.55(a)(2)(iv). Methods required for Class C waste include, for example, intruder barriers such as steel-reinforced concrete that are designed to last at least 500 years.

- DOE is responsible for disposing of, and
- does not have a disposal pathway.

GTCC-like waste primarily comprises non-defense waste from nuclear cleanup sites, such as contaminated debris from buildings, piping, and equipment from the West Valley Demonstration Project site in New York.

Which laws provide for federal agencies' roles related to GTCC and GTCC-like wastes?

Several statutes assign responsibilities for regulation and disposal of GTCC and certain low-level waste:

- **The Atomic Energy Act of 1954, as amended.** Under the AEA, NRC regulates the safety and security of the generation, storage, transportation, and disposal of commercial low-level waste.²² The law also authorizes NRC to enter into agreements with states (called agreement states) so they assume, and NRC relinquishes during the duration of the agreement, regulatory authority over specified radioactive materials.²³
- **The Low-Level Radioactive Waste Policy Amendments Act of 1985.** The 1985 Act assigns the federal government responsibility for the disposal of GTCC waste and certain low-level waste generated by the federal government, including GTCC-like waste.²⁴ The act requires that all GTCC waste be disposed of in an NRC-licensed facility that NRC has determined to be adequate to protect public health and safety.²⁵
- **The Energy Policy Act of 2005.** This act requires the Secretary of Energy to provide Congress with notification of the final designation of a DOE entity as responsible for

²²42 U.S.C. § 2201(b).

²³42 U.S.C. § 2021(b).

²⁴Pub. L. No. 99-240, § 102, 99 Stat. at 1844 (codified at 42 U.S.C. § 2021c(b)(1)). As described above, GTCC-like waste is not a legal concept—it does not appear in statute.

²⁵Pub. L. No. 99-240, § 102, 99 Stat. at 1844 (codified at 42 U.S.C. § 2021c(b)(2)). The 1985 Act amended provisions of the Low-Level Radioactive Waste Policy Act, which was enacted in 1980. Pub. L. No. 96-573, 94 Stat. 3347.

completing the activities needed to provide a facility for the safe disposal of GTCC waste.²⁶ DOE has designated its Office of Environmental Management as this responsible entity.

- **National Environmental Policy Act of 1969, as amended (NEPA).** NEPA and the subsequent Council on Environmental Quality regulations implementing NEPA set out an environmental review process.²⁷ The process has two principal purposes: (1) to ensure that an agency carefully considers information concerning the potential environmental effects of proposed development projects, and (2) to ensure that this information is made available to the public. This generally requires federal agencies to evaluate the potential environmental effects of actions they propose to carry out, fund, or approve by preparing analyses of different comprehensiveness depending on the significance of a proposed project's effects on the environment. Such analyses range from the most detailed EIS to less comprehensive environmental assessments. According to NEPA implementing regulations, an environmental assessment shall result in either a finding of no significant environmental impact—which explains why an action will not have a significant effect on the environment—or the decision to prepare an EIS.²⁸ In the EIS, the agency shall identify the preferred alternative,²⁹ but this does not constitute a final decision. At the time of a decision, the agency is to prepare and publish a public record of decision in a timely manner.³⁰

See enclosure II for a summary of laws and regulations that apply to the disposal of GTCC and GTCC-like waste, and enclosure III for how these overlap with laws and regulations governing other types of waste.

DOE's Estimates of GTCC and GTCC-Like Waste

²⁶Pub. L. No. 109-58, § 631(a).

²⁷Pub. L. No. 91-190, 83 Stat. 852 (1970) (codified as amended at 42 U.S.C. §§ 4321-4347); 40 C.F.R. pts. 1500-1508. DOE has adopted its own regulations to establish procedures the agency will use to comply with NEPA and its implementing regulations. 10 C.F.R. pt. 1021. These regulations, among other things, adopt the implementing regulations and state that it is DOE's policy to follow the letter and spirit of NEPA and to comply fully with the implementing regulations. 10 C.F.R. §§ 1021.101, 1021.103.

²⁸40 C.F.R. § 1508.1(h).

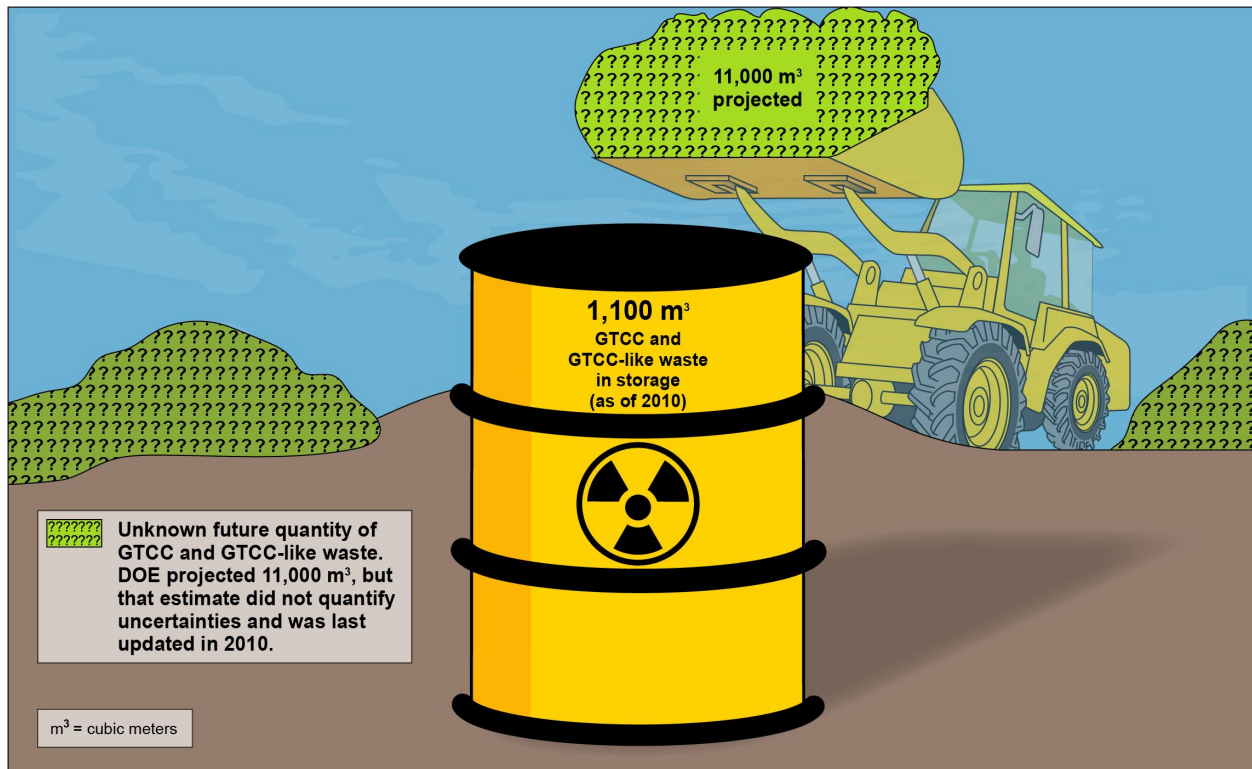
²⁹40 C.F.R. § 1502.14(d).

³⁰40 C.F.R. § 1505.2.

How much GTCC and GTCC-like waste does DOE estimate will require disposal?

About 12,000 cubic meters (m³) of GTCC and GTCC-like waste has been or will be generated by 2083 and require disposal, according to DOE's most recent estimates.³¹ DOE last updated these estimates in 2010 and used them for developing its 2016 EIS for GTCC and GTCC-like waste disposal alternatives.³² DOE estimated that of this total, 1,100 m³ was in storage, and the rest had not yet been generated (see fig. 3).

Figure 3: Department of Energy (DOE) Estimates of Greater-than-Class C (GTCC) and GTCC-Like Waste



Source: GAO analysis of DOE data. | GAO-22-105636


Of the 1,100 m³ in storage, 880 m³ of GTCC-like waste was being stored at the West Valley Demonstration Project site in New York, according to DOE's estimates (see fig. 4). This site hosted the nation's only commercial reprocessing facility for spent (used) nuclear fuel until it

³¹We identified a key limitation to DOE's estimates, which we discuss in this section.

³²DOE used 2083 as the end point for its estimates because that was when it assumed the last waste from the 33 planned nuclear reactors would become available for disposal. DOE officials told us they do not plan to update the 2010 estimated inventory until a disposal facility applies for a license to dispose of GTCC and GTCC-like waste. DOE wrote in the EIS that it reviewed the waste quantity data and determined that the expected waste quantity estimates remained valid and were conservative and bounding for the comparative analysis.

closed in 1976. DOE continues to decommission facilities and remediate contaminated soil across the site. The waste expected to be generated through these cleanup activities, together with the waste already in storage on site, accounted for more than half of the approximately 12,000 m³ of GTCC and GTCC-like waste in DOE's estimates.³³

Figure 4: Cleanup Efforts at the West Valley Demonstration Project Site



The Department of Energy (DOE) is responsible for helping clean up significant amounts of nuclear waste. This includes greater-than-Class C (GTCC) and GTCC-like waste at the West Valley Demonstration Project site in western New York, 35 miles south of Buffalo.

The state of New York established the West Valley facility in the 1950s as the nation's only commercial reprocessing facility, which converted spent (used) nuclear fuel from commercial reactors into reusable nuclear material. In 1976, citing rising costs and uncertain regulatory requirements, the company operating the facility closed it and returned it to the state. At the time, the facility contained more than 600,000 gallons of liquid high-level radioactive waste, contaminated structures and soil, and other radioactive waste in two underground disposal areas.

The West Valley Demonstration Project Act, enacted in 1980, required DOE to assist with cleanup of the significant amount of nuclear waste at the site. We reported in January 2021 that DOE cleanup efforts were ongoing, with certain activities expected to be completed by 2030.

DOE plans to make a decision in 2023 about the extent of additional decommissioning activities at West Valley, including whether to excavate two disposal areas, as we also reported in January 2021. DOE estimated that excavating these areas would generate 4,300 cubic meters of predominantly GTCC and GTCC-like waste.

DOE has estimated that more than half of the total amount of GTCC and GTCC-like waste needing disposal is located at West Valley. There is no disposal pathway for GTCC waste that is currently feasible under federal and state laws and regulations.

Source: GAO analysis of DOE documents; GAO-21-115; DOE (photo). | GAO-22-105636

DOE's estimates of actual and projected GTCC waste also took into account the decommissioning of nuclear facilities as a significant source of such waste. Specifically, DOE factored in the 104 commercial nuclear reactors operating at the time, 18 decommissioned reactors, and 33 planned new reactors not yet constructed in 2010, when DOE last updated its estimates. As these reactors are decommissioned, the resulting GTCC waste will be stored at the site of generation until a disposal pathway becomes available.³⁴

³³DOE only considers the waste to be generated once it is packaged and characterized, based on physical, chemical and radiological properties, in preparation for storage or disposal.

³⁴For example, as part of decommissioning commercial nuclear reactors at the Oyster Creek nuclear power plant in New Jersey and the Pilgrim plant in Massachusetts in 2022, Holtec International transferred GTCC waste from reactors into storage canisters that remain onsite. NRC has recently considered and issued licenses for facilities where GTCC waste may be consolidated and stored temporarily. Specifically, in 2021, NRC issued a license to Interim Storage Partners, a joint venture between Waste Control Specialists and Orano CIS LLC, for a proposed interim storage facility to store such reactor-generated GTCC waste, along with spent nuclear fuel, in Texas. A July 2022 EIS that NRC published for a proposed interim storage facility in New Mexico, to be constructed and operated by Holtec International, recommended issuing a license authorizing the initial phase of the project.

Do DOE's estimates have limitations?

We reviewed the estimates DOE presented in its EIS on GTCC and GTCC-like waste disposal and identified a key limitation—that DOE did not quantify uncertainties in these estimates. Uncertainty accounts for the fact that no scientific estimate can be made with perfect accuracy. In its EIS, which DOE completed under a schedule required by the Energy Policy Act of 2005 and in accordance with NEPA, and in its underlying inventory reports, DOE acknowledged uncertainties in its estimates of GTCC and GTCC-like waste.³⁵ However, DOE did not quantify these uncertainties in accordance with generally accepted research methods. The uncertainties DOE acknowledged include the following:

- Higher uncertainty for estimates of waste that could be generated as a result of potential activities, such as specific proposed cleanup activities that may or may not occur. For example, DOE estimated that if it were to exhume waste buried in certain sections of the West Valley Demonstration Project site, an estimated 4,300 m³ of mostly GTCC waste and a small amount of GTCC-like waste could be generated. DOE grouped estimates with less uncertainty into what it called “Group 1” and estimates with higher uncertainty—which were based on potential activities—separately into “Group 2.”³⁶
- A high level of uncertainty for estimates of sealed sources, because there is no national tracking database for sealed sources containing GTCC material.³⁷ DOE primarily used historical recovery rates for the Off-Site Source Recovery Program to project future waste for sealed sources.

³⁵The Energy Policy Act of 2005 required DOE to provide a plan for completing an EIS for a permanent disposal facility for GTCC waste. Pub. L. No. 109-58, § 631(b)(1)(B)(i). NEPA requires environmental impact statements for major federal actions significantly affecting the quality of the human environment. Pub. L. No. 91-190, § 102(C), 83 Stat. 852, 853 (1970) (codified at 42 U.S.C. § 4332(C)).

³⁶According to DOE's EIS, Group 1 consists of wastes from currently operating facilities that are either already in storage or expected to be generated from these facilities. Group 2 consists of projected wastes from proposed actions or planned facilities not yet in operation.

³⁷NRC tracks high radioactivity sources in its National Source Tracking System, but these do not include many sources that would be categorized as GTCC waste. We previously recommended that NRC consider how it could design and implement this database to improve DOE's ability to identify and track sealed radiological sources that could need DOE recovery and disposal. GAO, *Nuclear Security: DOE Needs Better Information to Guide Its Expanded Recovery of Sealed Radiological Sources*, [GAO-05-967](#) (Washington, D.C.: Sept. 22, 2005). DOE agreed with our recommendation. NRC did not agree or disagree with the recommendation and did not implement it. In 2009, NRC did not reach consensus in approving a rulemaking that would have expanded the National Source Tracking System to include additional source quantities, which would likely have included some GTCC waste.

- Low uncertainty for activated metal waste generated by nuclear reactors, because the radioactivity level of the waste will not change significantly based on the reactor's total operating time.
- Uncertainties associated with other potential unknowns, such as generators of waste DOE has not yet identified, or changes to industrial practices, such as the use of different decommissioning techniques, which could impact waste generation.

DOE acknowledged these and some other uncertainties in its estimates but did not quantify them; as a result, the EIS does not transparently present the variation in the precision of DOE's estimates.

As discussed above, NEPA generally requires federal agencies to evaluate the potential environmental effects of actions they propose to carry out, fund, or approve.³⁸ Such analyses may include detailed environmental impact statements or less comprehensive environmental assessments. NEPA's implementing regulations specify the requirements for these reviews.³⁹ For example, agencies should disclose in an EIS when information is incomplete or unavailable.⁴⁰ If the agency cannot obtain complete information, it must evaluate environmental impacts based on theoretical approaches or research methods generally accepted in the scientific community. It is a generally accepted practice that when an agency identifies uncertainties, it should also quantify those uncertainties. Reliably quantifying uncertainties expresses the level of precision in scientific measurements to allow users to appropriately apply those measurements to draw valid conclusions.

We identified generally accepted practices for quantifying uncertainty from key sources that reflect the consensus of the greater scientific community.⁴¹ One key principle for quantifying

³⁸Pub. L. No. 91-190, § 102(C) (codified at 42 U.S.C. § 4332(C)).

³⁹40 C.F.R. pts. 1500-1508.

⁴⁰40 C.F.R. § 1502.21(a). At the time DOE prepared the EIS, the applicable regulatory provision read in part that "[i]f the information relevant to reasonably foreseeable significant adverse impacts cannot be obtained because ... the means to obtain it are not known, the agency shall include ... [a] statement that such information is incomplete or unavailable ... and ... the agency's evaluation of such impacts based upon theoretical approaches or research methods generally accepted in the scientific community." 40 C.F.R. § 1502.22(b) (2015). According to the regulations currently in effect, agencies have to "make clear that such information is lacking." 40 C.F.R. § 1502.21(a).

⁴¹A GAO physical scientist, in consultation with another physical scientist, identified studies that establish the practice of quantifying uncertainties as a generally accepted practice from academia, government, and our prior work. See John R. Taylor, *An Introduction to Error Analysis: The Study of Uncertainties in Physical Measurements* (Sausalito, Calif.: University Science Books, 1997). GAO, *Air Cargo Security: TSA Field Testing Should Ensure Screening Systems Meet Detection Standards*, [GAO-21-105192](#) (Washington, D.C.: July 29, 2021). Department of Defense,

uncertainty is clearly indicating the amount of uncertainty associated with significant estimates, so readers do not assume a similar level or lack of uncertainty in the values. The EIS assigns groups to estimates (i.e., Group 1, Group 2) according to low uncertainty or higher uncertainty. However, DOE does not quantitatively evaluate this uncertainty, such as by quoting a range of potential values or a percentage tied to how likely a value is to occur. For example, if DOE presents a given estimate as 100, uncertainty could be demonstrated with a range, such as 100 ± 25 , representing 75 to 125, or a percentage suggesting a likelihood that the actual value will be within a certain range. However, DOE's estimates of GTCC and GTCC-like waste do not have any ranges or percentages.

We reviewed DOE procedures and guidance for NEPA reviews and found that they did not specify quality assurance steps for implementing the requirements specified in the NEPA regulations. For example, DOE officials and the contractors who developed the EIS used procedures from the quality assurance project plan for the EIS, which included language consistent with NEPA requirements: that the work is performed consistent with established technical standards and that data uncertainties are adequately explained. However, these procedures do not include steps specific to quantifying uncertainty.⁴² DOE's general guidance for preparing an EIS, pursuant to NEPA requirements, recommends acknowledging uncertainty and notes that quantifying uncertainty may be appropriate in certain situations; however, it does not specify what those situations might be.⁴³

Policymakers and stakeholders use DOE's estimates of GTCC and GTCC-like waste to plan for potential disposal of the waste. For example, information on the volumes and characteristics of GTCC waste is necessary to determine and evaluate the alternatives and costs for disposal of

Memorandum for Users of the Director, Operational Test and Evaluation (DOT&E) Test and Evaluation Master Plan (TEMP) Guidebook (Washington, D.C.: Jan. 19, 2017).

⁴²Argonne National Laboratory for the Department of Energy, Office of Environmental Management, *Quality Assurance Project Plan for the Environmental Impact Statement for the Disposal of Greater-Than-Class-C Low-Level Radioactive Waste* (Lemont, Ill.: February 2007).

⁴³Department of Energy, *Recommendations for the Preparation of Environmental Assessments and Environmental Impact Statements*, 2nd ed. (Washington, D.C.: Dec. 23, 2004). Specifically, the guidance recommends explaining how the uncertainty affects the analysis, where the uncertainty is significant or a major factor in understanding the impacts. According to the guidance, while it is appropriate to explain uncertainty qualitatively in some cases (e.g., by discussing the factors that make the estimate uncertain and considering that uncertainty when comparing impact estimates), in other cases, a more detailed analysis might be necessary.

the waste, as DOE acknowledged in a report to Congress.⁴⁴ Among other reasons, disposal facilities may be limited—by statute, license, or permits—in the volume and radioactivity they are allowed to accept. Consequently, underestimating the total amount of GTCC and GTCC-like waste requiring disposal could result in exceeding a selected facility’s limits before disposal is complete.⁴⁵ Conversely, overestimating the total amount of waste could overstate the potential impact to the environment and human health, making potential disposal alternatives appear unsuitable. Without quantified uncertainties, policymakers and stakeholders—such as state regulators and local communities—cannot have confidence in the level of precision in DOE’s estimates. Quantifying uncertainties would provide Congress, DOE, and stakeholders with better information—such as the range of total potential waste—as they consider the various limits in place at disposal alternatives. Updating general guidance and associated procedures for environmental impact statements to include steps for quantifying uncertainty would help DOE ensure its NEPA reviews provide the agency and other stakeholders with the information needed to make decisions.

Alternatives DOE Has Identified for GTCC and GTCC-Like Waste Disposal

What disposal alternatives has DOE identified for GTCC and GTCC-like wastes?

In its EIS, DOE identified and evaluated seven federally owned sites, the generic category of commercial facilities, and a no-action alternative, as follows:

- For six of the seven federally owned sites,⁴⁶ DOE evaluated the impact of three different disposal methods on these sites: a borehole, trench, or above-ground vault disposal facility (see fig. 5).
- For the Waste Isolation Pilot Plant (WIPP), the seventh federally owned site, DOE’s evaluation focused on the existing facility.

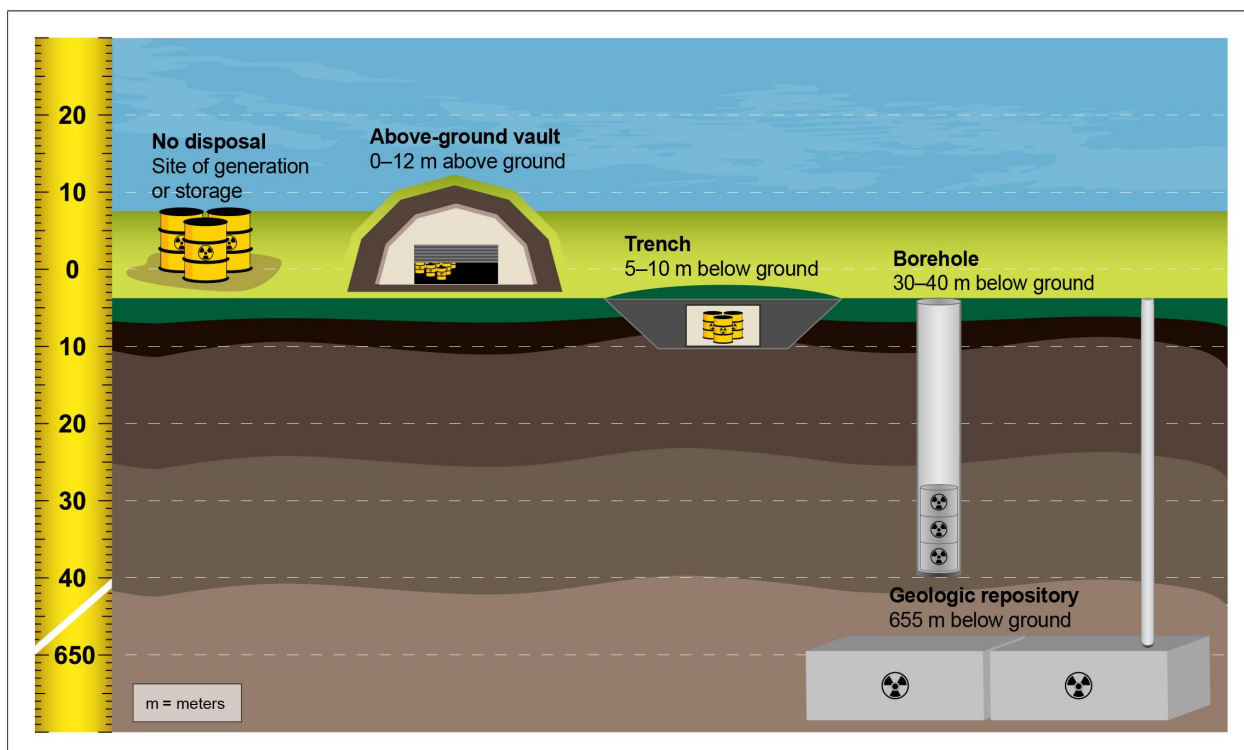
⁴⁴Department of Energy, *Recommendations for Management of Greater-Than-Class-C Low-Level Radioactive Waste*, Report to Congress in Response to Public Law 99-240 (Washington, D.C.: Feb. 1987).

⁴⁵See GAO, *Nuclear Waste Disposal: Better Planning Needed to Avoid Potential Disruptions at Waste Isolation Pilot Plant*, [GAO-21-48](#) (Washington, D.C.: Nov. 19, 2020).

⁴⁶These six sites are the Hanford site in Washington; Idaho National Laboratory; Nevada National Security Site; Savannah River Site in South Carolina; Los Alamos National Laboratory; and a site in New Mexico, near WIPP (“WIPP vicinity”). Land disposal in the WIPP vicinity may require land managed by the Bureau of Land Management to be reclassified as a waste management area.

- DOE did not evaluate any specific commercial facility because no specific facilities volunteered information about their site characteristics while DOE was preparing the EIS. Rather, DOE used regional characteristics, such as annual precipitation and groundwater depth, to evaluate the potential impacts of borehole, trench, and above-ground vault disposal methods for the generic category of commercial facilities.
- DOE also considered a no-action alternative, as required by NEPA regulations.⁴⁷ This alternative involves the continued, indefinite storage of GTCC and GTCC-like waste where it is presently located.

Figure 5: Methods the Department of Energy Evaluated in Its Final Environmental Impact Statement for the Disposal of Greater-than-Class C (GTCC) and GTCC-Like Waste



Source: GAO analysis of Department of Energy Final Environmental Impact Statement for the Disposal of GTCC and GTCC-Like Waste. | GAO-22-105636

While DOE was preparing its EIS, Waste Control Specialists LLC (WCS)—a commercial facility in Andrews County, Texas—filed a petition for rulemaking with the state of Texas to remove from the state’s administrative code the prohibitions on GTCC waste disposal. DOE then completed an environmental assessment for disposal of GTCC and GTCC-like waste at that

⁴⁷40 C.F.R. § 1502.14(c).

facility in 2018. DOE officials said they have not yet made a decision to issue a finding of no significant impact based on that environmental assessment or to prepare a more detailed EIS specific to WCS.⁴⁸ Figure 6 shows the locations DOE evaluated in its EIS and environmental assessment.

Figure 6: Locations the Department of Energy (DOE) Evaluated for Greater-than-Class C (GTCC) and GTCC-Like Waste Disposal



Source: GAO analysis of DOE documents. | GAO-22-105636

Notes: DOE currently operates low-level radioactive waste disposal facilities at all the federally owned sites on this map, except at WIPP and in the WIPP vicinity. In its 2016 Environmental Impact Statement (EIS), DOE assumed construction of a new borehole, trench, or above-ground vault. The agency also noted that an existing borehole, trench, or above-ground vault that meets the conceptual designs described in the EIS could be used. DOE used these four regions to evaluate commercial facilities as a generic category for the 2016 EIS, in the absence of data provided by specific commercial facilities. DOE evaluated Waste Control Specialists LLC, a commercial facility, in a 2018 environmental assessment. The Western Region also includes Alaska and Hawaii. The Southeastern Region also includes Puerto Rico and the Virgin Islands.

⁴⁸As previously noted, NEPA implementing regulations stipulate that an environmental assessment shall result in either a finding of no significant environmental impact or the decision to prepare an EIS. 40 C.F.R. § 1508.1(h).

In its EIS, DOE selected WIPP, land disposal at commercial facilities, or both, as its preferred alternative for GTCC and GTCC-like waste disposal. Land disposal includes three options: boreholes, trenches, and above-ground vaults (see fig. 5 above).⁴⁹ Selecting a preferred alternative does not constitute a final decision, which would involve additional steps, including a record of decision.⁵⁰ DOE officials said they would consider both the EIS and the WCS environmental assessment when preparing a record of decision. The Energy Policy Act of 2005 requires DOE to await congressional action before making a final decision on GTCC disposal.

DOE did not indicate a preference for any one disposal method in its discussion of its preferred alternative. Rather, DOE determined that a variety of methods could be used to dispose of GTCC and GTCC-like waste, and that different disposal methods might be better suited to different waste types. For example, according to DOE's EIS, boreholes might be best suited for disposal of sealed sources, while trenches and vaults might be better suited for larger activated metal waste.

What factors did DOE consider when evaluating disposal alternatives?

In its EIS and the 2018 environmental assessment for WCS, DOE evaluated disposal alternatives against 11 factors related to the environment:⁵¹

- **Human health**, such as estimated radiation doses for workers and the public (i.e., the radiation they would be expected to absorb) during and after disposal. DOE estimated the radiation dose to a hypothetical farmer and used this dose as a basis to compare long-term impacts to human health on the public across the sites and disposal methods assessed. DOE found that a hypothetical farmer would not absorb any radiation in the first 10,000 years after the disposal site closed at or near WIPP, Nevada National Security Site, or in generic commercial facilities in the Western region.


⁴⁹NRC regulations define "land disposal facility" as the land, building, and structures, and equipment intended to be used for the disposal of radioactive wastes and note that a "geologic repository" as defined in NRC regulations is not considered a land disposal facility. 10 C.F.R. § 61.2 (*land disposal facility*).

⁵⁰As previously noted, at the time of a decision in cases requiring an EIS, the agency is to prepare and publish a public record of decision in a timely manner. 40 C.F.R. § 1505.2.

⁵¹DOE's EIS refers to these 11 factors as "environmental resource areas."

- Transportation**, such as the number of shipments and miles traveled by rail and truck to transport the waste from storage to a disposal facility and estimated dose rates for workers and the public (see fig. 7). For example, because rail transportation can accommodate more waste packages than truck transportation, this method requires less than half the number of shipments for the same amount of waste. In another example, because the majority of the estimated GTCC and GTCC-like inventory is stored or projected to be generated at the West Valley site in New York, a disposal site closer to New York—requiring transportation over a shorter total distance—would result in a smaller estimated dose to workers and the public during transportation activities, according to the EIS.

Figure 7: Transportation of Greater-than-Class C (GTCC) and GTCC-Like Waste



The Department of Energy (DOE) regulates its own transportation and would regulate its transportation of GTCC and GTCC-like waste. The Department of Transportation (DOT) or the Nuclear Regulatory Commission (NRC) would regulate non-government entities' transportation of such wastes.

Transportation regulations dictate packaging requirements for radioactive waste based primarily on the total level of radioactivity. GTCC and GTCC-like waste would require the use of either a Type A transportation package that meets DOT package performance requirements or a Type B transportation package certified by NRC or DOE.

Type A packages. Designed for transporting waste with low radioactivity levels, these include 55-gallon drums and standard waste boxes. Type A packages usually do not require special handling or equipment, and they are self-certified by the shipper.

Type B packages. Designed for higher levels of radioactivity, these are engineered to withstand accidents. NRC evaluates outcomes of hypothetical accident testing for package design and content, and it issues certificates of compliance for approved designs. Any entity using a Type B package must have a quality assurance program in place. DOE issues certificates of compliance for its activities involving transportation of Type B packages.

NRC officials said the current regulatory framework is suitable to accommodate the transportation of GTCC and GTCC-like waste. NRC officials also said GTCC and GTCC-like waste would more often require using Type B packages.

DOE classifies radioactive waste as either able to be contact-handled by workers or as needing to be remote-handled based on the radiation dose rate on the surface of the package. DOE estimates that about half of GTCC and GTCC-like waste will need to be remote-handled.

Source: GAO analysis of DOE, NRC, and DOT information; NRC (photo). | GAO-22-105636

- Climate, air quality, and noise**, such as average precipitation at a disposal site, potential pollutant emissions from construction and operation of a disposal facility, and noise during construction. For example, DOE found that carbon dioxide and other emissions during construction would be low for all disposal alternatives evaluated.
- Geology and soils**, such as the amount of land disturbance and erosion at a disposal site over time. For example, DOE found erosion would be worse at the Savannah River Site compared to federally owned sites in the western United States.
- Water resources**, such as water usage during construction and operation of a disposal site and potential impacts on nearby groundwater and surface waters. For example, DOE said the leaching of GTCC waste could impact groundwater quality and result in


concentrations of radionuclides at the Hanford Site, Idaho National Laboratory Site, Los Alamos National Laboratory, and Savannah River Site. DOE did not evaluate the Savannah River Site for the use of boreholes because of the shallow depth of its groundwater.

- **Ecology**, such as consideration of threatened and endangered species at a disposal site. For example, DOE noted in the EIS that the Los Alamos National Laboratory was a potential habitat for the federally and state-listed endangered southwestern willow flycatcher.
- **Socioeconomics**, such as the number of jobs created at a disposal site and annual income amounts. For example, DOE estimated that a new above-ground vault facility would directly create about 51 jobs, the most among the land disposal methods DOE evaluated.
- **Environmental justice**, such as whether minority or low-income populations in the vicinity of a disposal site could be disproportionately impacted. DOE expected no disproportionate impacts on such populations from any of the disposal alternatives. However, the agency noted that subsequent site-specific NEPA reviews would also consider environmental justice impacts and other factors.
- **Land use**, such as the amount of land required and current land use designations of sites. For example, DOE found that Los Alamos National Laboratory, Savannah River Site, and the site near WIPP would likely require reclassification as waste management areas.
- **Cultural resources**, such as consideration of sites eligible for listing on the National Register of Historic Places and consultation with local Tribes. For example, among the land disposal methods DOE evaluated, boreholes require the most land and have the greatest potential to affect cultural resources.
- **Waste management**, such as the volumes of wastes generated during construction and operation of the site. For example, among the land disposal methods DOE evaluated, boreholes would generate the least waste and above-ground vaults the most.

DOE evaluated these 11 factors across the construction, operations, and post-closure phases of each disposal alternative (see fig. 8 for a discussion of post-closure oversight). In the EIS, DOE stated it also considered other factors in selecting a preferred alternative, including public comments, national security concerns, national and state priorities, construction and operating

costs, the projected timing of waste generation, compliance with agreements, and applicable laws and other requirements.⁵²

Figure 8: Post-closure Oversight of Greater-than-Class C (GTCC) and GTCC-Like Waste Disposal Facilities



Greater-than-Class C (GTCC) and GTCC-like waste will remain radioactive for thousands of years. For two facilities that the Department of Energy (DOE) discussed in its environmental reviews for disposal of these wastes, DOE would be responsible for oversight after the facilities cease operations.

Waste Isolation Pilot Plant (WIPP). DOE identified WIPP, a DOE facility, as a preferred alternative in its EIS. The federal government would be responsible for oversight of WIPP throughout disposal and after closure. WIPP is subject to Environmental Protection Agency regulations on nuclear waste disposal. Additionally, the Waste Isolation Pilot Plant Land Withdrawal Act requires the Secretary of Energy to develop a plan for the management of the site after its decommissioning.

Waste Control Specialists LLC (WCS). DOE identified commercial facilities, in general, as a preferred alternative in its EIS, and later completed an environmental assessment on WCS, a commercial facility. The state of Texas licenses this facility as a Nuclear Regulatory Commission (NRC) agreement state (a state to which NRC has relinquished regulatory authority over specified radioactive materials in accordance with the Atomic Energy Act of 1954, as amended). DOE and Texas have an agreement for the state to transfer ownership and oversight of the federal waste portion of the WCS facility to DOE upon its decommissioning, as required by Texas law.

Sources: GAO analysis of DOE and NRC documents; DOE (photo). | GAO-22-105636

To what extent did DOE’s EIS explain the selection of its preferred alternative?

We analyzed DOE’s EIS and found that it did not transparently explain its rationale for selecting the preferred alternative of disposal at WIPP or land disposal (borehole, trench, or above-ground vault) at generic commercial disposal facilities. DOE evaluated most of the alternatives it considered in substantial depth against 11 environmental factors. However, it did not clearly link its selection to these or other factors it considered, or otherwise explain its rationale for selecting its preferred alternative. Furthermore, DOE was not able to evaluate commercial facilities against 10 of the 11 factors, but the agency did not explain in the EIS why it nonetheless selected commercial facilities as part of its preferred alternative.

The EIS did not explain how, if at all, some potentially adverse environmental impacts DOE identified in its evaluation of federally owned sites influenced DOE’s selection. For example, DOE determined that disposal at the Hanford site could cause groundwater contamination. However, DOE said limiting disposal at the Hanford site to certain streams of GTCC waste could mitigate this potential impact. Also, DOE determined that the higher natural water filtration rate at the Savannah River Site could hasten groundwater contamination but said the use of robust engineering designs could delay or minimize such contamination. Nevertheless, for these

⁵²DOE listed cost as one of the four key factors in identifying a preferred disposal method—i.e., deep geologic, borehole, trench, or vault. The other key factors were minimizing inadvertent human intrusion, having successful past construction and operational experience with similar wastes, and minimizing the potential need for long-term post-closure care.

and the other sites considered, the EIS did not provide a way to trace these evaluations and the impacts identified and connect them with DOE's preferred alternative.

Furthermore, DOE evaluated commercial facilities in a limited manner, as a generic category, in the EIS and did not explain how the limited evaluation informed its selection of such facilities as a preferred alternative. Specifically, DOE did not collect and analyze information about a particular commercial facility, and it evaluated the category of commercial facilities for only one of the 11 factors—human health impacts. Because DOE did not collect information on any specific commercial facilities, it instead partially evaluated human health impacts using region-wide characteristics such as groundwater depth for the Western, Midwestern, Southeastern, and Northeastern regions of the United States.⁵³ For the other 10 factors, DOE determined in the EIS that land disposal at commercial facilities could have similar impacts as land disposal at federally owned sites. DOE also stated in the EIS that its evaluation of human health impacts could have been a deciding factor in its selection. However, DOE did not explain in the EIS how the human health data it presented contributed to its selection of land disposal at commercial facilities as a preferred alternative over land disposal at any of the six federally owned sites that DOE evaluated for a new facility.

An EIS is developed pursuant to NEPA and is subject to its implementing regulations and guidance, which include specifications related to transparency in analyses. The NEPA implementing regulations in effect when DOE prepared the EIS stated that an EIS should devote substantial treatment to each alternative considered in detail, so that reviewers can evaluate their comparative merits and provide a clear basis for choice among alternatives by the decision maker and the public.⁵⁴ The procedures DOE and contractors used to guide their development of the EIS include similar provisions related to transparency.⁵⁵

⁵³DOE used region-wide inputs to evaluate human health impacts for commercial facilities based on the regions NRC defines for its regulatory responsibilities. DOE noted that the actual values for inputs like groundwater depth differ within each region, and that site-specific evaluations would be needed once a commercial facility is identified. DOE conducted such a site-specific evaluation in its environmental assessment of WCS in 2018.

⁵⁴40 C.F.R. § 1502.14 (2015). Current NEPA regulations, published in 2020, state that agencies shall “[d]iscuss each alternative considered in detail, including the proposed action, so that reviewers may evaluate their comparative merits.” 40 C.F.R. § 1502.14(b).

⁵⁵Argonne National Laboratory for the Department of Energy, Office of Environmental Management, *Quality Assurance Project Plan for the Environmental Impact Statement for the Disposal of Greater-Than-Class-C Low-Level Radioactive Waste* (February 2007). The plan says an explicit objective of the GTCC EIS project was to “prepare the EIS, the technical basis reports, and other NEPA documents in a manner that provides a logical, defensible, and traceable record to support DOE decisions.”

While NEPA regulations and related DOE procedures include provisions related to transparency, DOE's general guidance for preparing an EIS and its procedures for this particular EIS did not include specific steps for implementing these provisions. By updating DOE guidance and associated procedures for environmental impact statements to include specific steps related to the transparency provisions for NEPA compliance, DOE would better ensure future environmental impact statements explain DOE's selection of preferred alternatives in a transparent and traceable manner. Without doing so, stakeholders and decision makers may have less confidence in or may not be able to follow the rationale in DOE's decisions.⁵⁶

Barriers to GTCC and GTCC-Like Waste Disposal

What barriers exist to GTCC and GTCC-like waste disposal?

Based on our analysis of laws, regulations, and agency documents, and on our interviews, we identified a combination of statutory and regulatory barriers to GTCC and GTCC-like waste disposal. Current federal and state laws and regulations collectively preclude any pathway for disposal of GTCC and GTCC-like waste, including at commercial facilities. Moreover, NRC regulations require that GTCC waste be disposed of in a geologic repository unless NRC approves an alternative disposal site that it licenses on a case-specific basis. However, WIPP, the nation's sole geologic repository, is legally authorized to accept only transuranic waste generated by atomic energy defense activities, whereas GTCC and GTCC-like wastes are generally non-defense.

Barriers to Disposal at Commercial Facilities

NRC regulations stipulate that GTCC waste is not generally acceptable for near-surface disposal—defined as within 30 meters of the earth's surface—unless more stringent requirements are in place than those for Class C waste. Requirements for Class C waste specify that the waste either be disposed of (1) so that the top of the waste is a minimum of 5 meters below the top surface of the cover, or (2) with intruder barriers that are designed to protect against an inadvertent intrusion for at least 500 years.⁵⁷ NRC officials told us that if GTCC

⁵⁶As previously noted, DOE has yet to issue a record of decision for GTCC waste disposal. Records of decision are subject to separate regulatory requirements that include provisions related to transparency. Specifically, in a record of decision, agencies shall specify the alternative considered environmentally preferable and identify and discuss all factors that the agency balanced in making its decision and state how those considerations entered into its decision. 40 C.F.R. § 1505.2(a)(2).

⁵⁷10 C.F.R. § 61.52.

waste were to be considered for near-surface disposal, NRC could require adherence to both of these requirements.

While the WCS commercial disposal facility in Andrews County, Texas, may be able to meet such requirements, federal and state regulatory requirements together appear to effectively prohibit GTCC storage in the state. Specifically, WCS's federal waste facility (1) can place waste up to 120 feet (slightly less than 37 meters) below the surface, and (2) uses an engineered cover system. However, under NRC regulations the WCS facility is considered a near-surface facility, and Texas regulations prohibit near-surface disposal of GTCC waste.⁵⁸

In 2014, WCS petitioned the Texas Commission on Environmental Quality to remove state prohibitions on GTCC waste disposal. In response, in January 2015, the Texas Commission on Environmental Quality requested clarification from NRC about regulatory authority over GTCC waste disposal. As previously described, the AEA allows NRC to relinquish its regulatory authority via agreement to states such as Texas, but the 1985 Act requires that GTCC waste be disposed of in a facility licensed by NRC.⁵⁹ The Texas Commission on Environmental Quality noted that in order to engage in a well-informed rulemaking process—such as that would be needed to amend Texas code to lift prohibitions on GTCC waste disposal—it was critical to have accurate information on whether an agreement state could regulate GTCC disposal. However, NRC did not provide such clarification at that time. In 2015, NRC considered clarifying regulatory roles over GTCC waste disposal. However, two commissioners acknowledged that doing so could lead to litigation,⁶⁰ and some NRC staff have raised concerns about allowing agreement states to regulate such waste.⁶¹

⁵⁸30 Tex. Admin. Code § 336.362(a)(2)(D), (4)(D) (stipulating that GTCC waste is unsuitable for near-surface disposal); 30 Tex. Admin. Code § 336.701(b)(4), (5) (stating that a licensee authorized to dispose of low-level radioactive waste shall not accept for disposal waste that exceeds Class C limitations as specified in 30 Tex. Admin. Code § 336.362).

⁵⁹Pub. L No. 99-240, § 102, 99 Stat. at 1844 (codified at 42 U.S.C. § 2021c(b)(2)). In addition, the AEA limits what regulatory authority NRC may relinquish to agreement states, such as over certain special nuclear material (which some GTCC waste is expected to contain). 42 U.S.C. § 2021(c), (d).

⁶⁰Nuclear Regulatory Commission, *Historical and Current Issues Related to Disposal of Greater-Than-Class-C Low-Level Radioactive Waste*, SECY-15-0094 (Washington, D.C.: Dec. 22, 2015).

⁶¹Nuclear Regulatory Commission, *Differing Views on Path Forward and Recommendations for Certain Low-Level Radioactive Waste Disposal Rulemakings* (Washington, D.C.: Oct. 21, 2020).

Barriers to Disposal at WIPP

A portion of the GTCC and GTCC-like waste in DOE's estimates may not be suitable for near-surface disposal, according to preliminary evaluations by NRC, and is likely to require disposal in a geologic repository. For example, certain industrial and medical sources containing americium-241, used for oil well logging,⁶² and plutonium-238, used for space exploration and pacemakers, likely are not suitable for near-surface disposal because they may remain radioactive for thousands of years. However, these commercial sources may not meet the acceptance criteria for WIPP, the nation's sole geologic repository, which is legally authorized to accept only defense-generated transuranic waste.

Under certain circumstances, waste from materials used commercially may qualify as defense waste. DOE's Off-Site Source Recovery Program, which recovers commercial radioactive sealed sources that pose a risk to national security, health, and safety, has disposed of certain commercial-origin transuranic materials at WIPP on the basis that the materials originated from a U.S. defense program (see fig. 9).⁶³ However, DOE has determined that foreign-origin sources cannot be categorized as defense waste and cannot be disposed of at WIPP. Such sources would be characterized as GTCC or GTCC-like waste. According to DOE estimates, about 20,000 sealed sources containing foreign-origin radioactive materials will need disposal by 2025.

⁶²Americium-241, a transuranic isotope, is mixed with beryllium in order to create a neutron source—commonly referred to as an AmBe source—that can be used to search for oil and gas deposits underground.

⁶³The Off-Site Source Recovery Program may also dispose of sealed sources containing non-transuranic radioactive materials at the Nevada National Security Site. Once the program takes ownership of the sources, they are reclassified as government-owned.

Figure 9: The Off-Site Source Recovery Program (OSRP) and Greater-than-Class C Waste Security Risks



The Department of Energy's (DOE) Off-Site Source Recovery Program recovers commercial sealed sources that pose national security, health, and safety risks. These sources, which would often be classified as greater-than-Class C (GTCC) waste, contain concentrations of radioactive material that exceed the limits for disposal at commercial facilities. The high level of radioactivity and portability of sealed sources make them susceptible to misuse, improper disposal, and theft. If these sources fell into the wrong hands, they could be used in fabricating crude but potentially dangerous radiological weapons, called dirty bombs.

OSRP recovers sealed sources from around the United States, as well as sources used internationally that contain U.S.-origin radioactive materials. OSRP prioritizes the recovery of registered sealed sources with the highest levels of radioactivity. OSRP packages and then consolidates sealed sources for disposal at the Waste Isolation Pilot Plant

(WIPP) or Nevada National Security Site. The program covers the cost of packaging, transportation, and disposal. WIPP is the only DOE facility able to dispose of waste with significant concentrations of transuranic isotopes, such as americium-241 and plutonium-238.

Since its inception in 1997, OSRP has recovered over 45,000 sealed sources, as of April 2022. OSRP only recovers sealed sources with a disposal pathway and does not indefinitely store any sealed sources, such as GTCC waste, without a disposal pathway.

OSRP also supports DOE's Cesium Irradiator Replacement Project, which incentivizes commercial medical facilities to dispose of their cesium blood irradiators and replace them with X-ray blood irradiators.

Source: GAO analysis of DOE information; Los Alamos National Laboratory (photo). | GAO-22-105636

Legal and regulatory changes at the federal and state levels would be necessary to enable disposal of GTCC waste at WIPP. Specifically, in its EIS, DOE noted that legislation would be needed to dispose of GTCC waste at WIPP. Furthermore, a 1988 agreement between DOE and New Mexico, and the New Mexico hazardous waste permit under which DOE operates WIPP, in addition to the state's laws and regulations, would need to be revised. In response to DOE's draft EIS in September 2011, the governor of New Mexico wrote to DOE encouraging the agency to support WIPP as a preferred alternative for GTCC and GTCC-like waste disposal. However, it is currently unclear whether the state of New Mexico continues to support consideration of WIPP as an option for GTCC and GTCC-like waste disposal, as well as the associated changes in laws, agreements, and permits that would be necessary to enable disposal of the waste at WIPP. For example, in December 2021, the New Mexico Environment Department wrote to us expressing concern about DOE seeking to expand the scope of waste streams that could be sent to WIPP and cited DOE's efforts regarding americium-241 as an example.

Furthermore, regulatory authority over GTCC waste disposal at WIPP is unclear. The 1985 Act specifies that GTCC waste must be disposed of in an NRC-licensed facility. However, according to DOE, unless specifically provided by law, NRC does not have authority to license and regulate facilities operated by or on behalf of DOE, such as WIPP.

What steps has NRC taken toward a disposal pathway, and what barriers may NRC face?

NRC has taken steps to update its regulatory framework to address certain barriers to GTCC waste disposal. In 2015, the Commission directed NRC staff to prepare a regulatory basis—an analysis that describes the technical, legal, and policy information that supports potential changes to NRC’s regulations—for the disposal of GTCC waste through means other than deep geologic disposal, including near-surface disposal.⁶⁴ The Commission also directed staff to analyze whether the disposal of GTCC waste presents a hazard and, therefore, whether NRC should retain authority over its disposal, in accordance with the AEA. NRC issued a draft regulatory basis in 2019 stating that approximately 80 percent of the total volume of all GTCC waste is potentially suitable for near-surface disposal, as long as appropriate controls are implemented and a sufficient site-specific analysis is conducted.⁶⁵ NRC also determined that approximately 95 percent of the volume of GTCC waste determined to be potentially suitable for near-surface disposal could be safely regulated by an agreement state.

In April 2022, the Commission voted to proceed with rulemaking—a process to change the existing rule—and develop guidance specifically for the near-surface disposal of GTCC waste. According to the memorandum announcing the decision to proceed with rulemaking,⁶⁶ the Commission intends to clarify in the rulemaking that agreement states may regulate GTCC disposal, rather than NRC retaining this authority.⁶⁷ According to Texas Commission on Environmental Quality documents and officials, such a clarification would enable Texas Commission on Environmental

⁶⁴NRC consists of the Commission and the staff. The Commission, which formulates policies, develops regulations, issues orders to licensees, and adjudicates legal matters, comprises five Commissioners. NRC staff provide assistance to the Commission, including by preparing documents. 42 U.S.C. § 5841; 10 C.F.R. § 2.1505.

⁶⁵The draft regulatory basis was published for public comment in July 2019. Greater-than-Class-C and Transuranic Waste, 84 Fed. Reg. 35,037 (July 22, 2019).

⁶⁶Nuclear Regulatory Commission, *Memorandum: “Staff Requirements – SECY-20-0098 – Path Forward and Recommendations for Certain Low-Level Radioactive Waste Disposal Rulemakings”* (Washington, D.C.: Apr. 5, 2022). As of September 2022, NRC’s proposed publication date for the proposed rule is May 27, 2024 and its proposed publication date for the final rule is November 27, 2025.

⁶⁷NRC is considering additional changes in its regulations to facilitate the disposal of GTCC waste. For example, NRC is considering various changes to part 150 of title 10 of the *Code of Federal Regulations*, through which it implements Section 274b of the AEA. Section 274b does not allow agreement states to regulate special nuclear material (such as plutonium) in quantities sufficient to form a critical mass. Because the state of Texas is an agreement state, it currently regulates the disposal of low-level waste at WCS, so the changes NRC is considering would avoid dual regulation by NRC and the state of Texas, should GTCC waste containing allowed concentrations of special nuclear material be disposed of at WCS.

Quality officials to consider potential amendments to Texas rules that currently prohibit GTCC waste disposal in the state.⁶⁸

NRC considered clarifying regulatory roles for GTCC waste disposal in 2015. A 2020 NRC staff policy paper discussed two possible interpretations of the agreement state issue: (1) a plain language interpretation of the 1985 Act, which restricts GTCC waste disposal to NRC-licensed facilities, or (2) a broad interpretation that considers the 1985 Act along with the AEA.⁶⁹ The staff recommended the broad interpretation, which provides the basis for agreement-state regulation of disposal. As noted above, some commissioners and staff acknowledged the potential for litigation if NRC allowed agreement states to regulate GTCC waste disposal.⁷⁰ NRC officials told us there was some risk of litigation if NRC proceeded with the rulemaking based on this interpretation, but that the risk was low. NRC officials did not take a position on legislation (such as the 1985 Act) but said that amending the law to clarify jurisdiction could mitigate any remaining risk of litigation.

Clarifying regulatory authority over GTCC waste disposal—both with regard to WIPP and commercial facilities in agreement states—would remove a key barrier to identifying a disposal pathway for such waste. This, in turn, could reduce costs and mitigate ongoing security and environmental risks associated with continued storage. Moreover, decreasing the risk of litigation could further reduce the risk of delays and associated costs.

What steps has DOE taken, and what barriers remain to its ability to take further steps?

As previously noted, DOE issued an EIS evaluating the environmental impacts of disposing of GTCC and GTCC-like waste at WIPP and six other federally owned sites, as well as an environmental assessment for WCS. In the EIS, DOE identified a preferred alternative—disposal at WIPP or land disposal at a commercial facility—but this does not reflect a final decision.

⁶⁸If NRC rulemaking results in allowing agreement states to license GTCC and GTCC-like waste disposal, Texas could then conduct its rulemaking process to determine whether to change the Texas rules. If Texas issues a final rule to remove the prohibition on GTCC waste disposal, WCS may apply for a license amendment that would, if approved, allow for the disposal of these waste streams.

⁶⁹Nuclear Regulatory Commission, *SECY-20-0098: Path Forward and Recommendations for Certain Low-Level Radioactive Waste Disposal Rulemakings* (Washington, D.C.: 2020).

⁷⁰Nuclear Regulatory Commission, *Historical and Current Issues; and Differing Views on Path Forward*. One of the two commissioners who acknowledged the litigation risk in the 2015 document left the Commission in 2016.

DOE cannot move forward on making a final decision on disposal of GTCC and GTCC-like waste without congressional direction. In 2017, DOE submitted a statutorily required report to Congress that listed legislative actions required for DOE to be able to implement its preferred alternative.⁷¹ These actions include clarifying certain sections of the 1985 Act with regard to regulatory authority. Additionally, the Energy Policy Act of 2005 requires DOE to await congressional direction before making a final decision on which disposal alternative or alternatives it will implement. Even if NRC and states address the regulatory barriers described above, DOE still cannot move forward in disposing of GTCC and GTCC-like waste without congressional action. Without such action, the federal government will continue to face the growing costs and risks of indefinitely storing these wastes.

DOE faces other barriers to disposing of some GTCC and GTCC-like waste. Although NRC's rulemaking could alleviate some regulatory barriers, DOE will still need to identify another disposal option for some GTCC and GTCC-like waste that likely will remain unsuitable for near-surface disposal for various reasons, including high concentrations of transuranic waste. Such waste, which may require disposal in a geologic repository, may not meet WIPP's acceptance criteria, as discussed above. In addition to foreign-origin transuranic waste, some of the West Valley Demonstration Project's transuranic waste does not meet criteria for disposal at WIPP because it does not qualify as defense waste.

We have previously suggested congressional action related to waste at West Valley that could help address barriers DOE faces to the disposal of the site's GTCC and GTCC-like waste. In January 2021, we reported that DOE officials estimated the cost of storing GTCC and GTCC-like waste at West Valley at about \$1.2 million annually (as of 2020).⁷² We also reported that continued storage of these wastes at West Valley could pose a risk to human health and the environment, in part because the facility where the waste is stored is vulnerable to severe weather. Specifically, the waste is housed in two structures built in the 1990s and that were not designed to withstand winds over 80 mph, even though tornadoes with winds in excess of 80

⁷¹Department of Energy, *Alternatives for the Disposal of Greater-Than-Class C Low-Level Radioactive Waste and Greater-Than-Class C-Like Waste Report to Congress* (November 2017). This report was required by the Energy Policy Act of 2005. Pub. L. No. 109-58, § 631(b)(1)(B)(i).

⁷²See GAO, *Nuclear Waste: Congressional Action Needed to Clarify a Disposal Option at West Valley Site in New York*, [GAO-21-115](#) (Washington, D.C.: Jan. 13, 2021).

mph are known to occur in the area.⁷³ Furthermore, DOE officials told us in April 2022 that the continued presence of GTCC and GTCC-like waste could complicate future DOE cleanup work at the site. For example, according to these officials, DOE cannot decommission the West Valley site's waste repackaging or storage facilities because it will need them for the site's GTCC and GTCC-like waste when a disposal pathway becomes available.

In our January 2021 report, we suggested that Congress create a legal disposal option for West Valley's transuranic waste.⁷⁴ Without congressional action on West Valley waste disposal, some GTCC and GTCC-like wastes will remain without a legal pathway for disposal, and the government will continue to incur storage costs and risks to human health and the environment.

Conclusions

GTCC waste, the most radiologically hazardous type of commercial low-level waste, does not have a disposal pathway. The indefinite storage of GTCC and GTCC-like waste—government waste with characteristics similar to GTCC waste—creates environmental and security risks and incurs ongoing storage costs to the federal government. Successful disposal of GTCC and GTCC-like waste will require clear, transparent communication between DOE and various stakeholders, such as governments and citizens of states and localities with disposal sites that DOE is considering.

Although DOE evaluated the environmental impacts of various disposal options in its 2016 EIS, the EIS did not quantify uncertainties for its estimates of GTCC and GTCC-like waste that would require disposal. The EIS also did not transparently explain DOE's selection of a preferred alternative. These limitations could prevent stakeholders from accepting DOE's rationales for its decisions. DOE's quality assurance procedures for environmental impact statements do not include steps to quantify uncertainty and ensure transparency, creating risk that DOE's future environmental impact statements will also include such limitations. By updating its guidance and associated procedures to include specific steps related to quantifying uncertainty and explaining its selections in a transparent and traceable manner, DOE could enhance credibility and trust with stakeholders and provide the basis for meaningful conversations with decision makers, including legislators and state regulators.

⁷³[GAO-21-115](#).

⁷⁴[GAO-21-115](#).

In April 2022 NRC, which would be responsible for approving a disposal facility for GTCC waste, decided to proceed with proposed rulemaking that could facilitate the near-surface disposal of GTCC and GTCC-like waste by clarifying the roles of NRC and agreement states in regulating such waste. However, NRC is proceeding based on a legal interpretation that two commissioners had said may expose it to an increased risk of litigation. By clarifying jurisdiction over GTCC waste disposal, Congress would remove a key barrier to identifying a disposal pathway for such waste. It could also reduce NRC's exposure to litigation and the potential for further delays, costs, and security and environmental risks.

Lastly, DOE has taken some steps to identify potential sites that could dispose of much of the GTCC and GTCC-like waste. However, the Energy Policy Act of 2005 requires DOE to await congressional direction before making a final decision on which disposal alternatives it will implement. In addition, as we found in January 2021, without congressional action, GTCC and GTCC-like waste at the West Valley Demonstration Project site will remain without a legal pathway for disposal, imposing storage costs on the government and potential risks to human health and the environment.

Matters for Congressional Consideration

We are recommending the following two matters for congressional consideration:

Congress should consider clarifying NRC's legal authority to relinquish regulation of GTCC waste disposal to agreement states, as well as clarifying its regulatory role for any DOE facility that may accept GTCC waste. (Matter for Consideration 1)

Congress should consider providing direction to DOE on GTCC waste disposal, so that DOE can proceed with a decision. (Matter for Consideration 2)

Recommendations for Executive Action

We are making the following two recommendations to DOE:

The Assistant Secretary for Environmental Management should update the guidance and associated procedures DOE and contractors use to implement NEPA reviews to include quality-assurance steps on quantifying and reporting on uncertainty. (Recommendation 1)

The Assistant Secretary for Environmental Management should update the guidance and associated procedures DOE and contractors use to implement NEPA reviews to include quality-

assurance steps on transparency in analyses, including steps to ensure DOE's selection of its preferred alternative is transparently explained and traceable. (Recommendation 2)

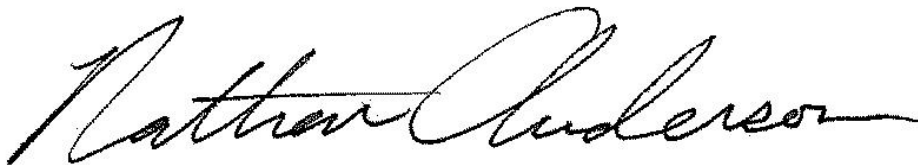
Agency Comments

We provided a draft of this report to DOE and NRC for review and comment. In its comments, reproduced in enclosure IV, DOE agreed with our recommendations and stated that EM will coordinate with DOE's Office of NEPA Compliance to review and make appropriate updates to its guidance and procedures. DOE also provided technical comments, which we incorporated as appropriate. In NRC's letter, reproduced in enclosure V, NRC stated that it was providing technical comments, which we also incorporated as appropriate. NRC noted that the report does not contain recommendations to NRC, and NRC did not comment on the findings or recommendations.

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We are sending copies of this report to the appropriate congressional committees, the Secretary of Energy, the Chairman of the NRC, and other interested parties. In addition, this report is available at no charge on the GAO website at <http://www.gao.gov>.

If you or your staff have any questions about this report, please contact me at (202) 512-3841 or andersonn@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. GAO staff who made key contributions to this report are listed in enclosure VI.

A handwritten signature in black ink that reads "Nathan Anderson". The signature is written in a cursive, flowing style.

Nathan Anderson
Director, Natural Resources and Environment

Enclosures – (6)

List of Committees

The Honorable Jack Reed
Chairman
The Honorable James M. Inhofe
Ranking Member
Committee on Armed Services
United States Senate

The Honorable Dianne Feinstein
Chairman
The Honorable John Kennedy
Ranking Member
Subcommittee on Energy and Water Development
Committee on Appropriations
United States Senate

The Honorable Adam Smith
Chairman
The Honorable Mike Rogers
Ranking Member
Committee on Armed Services
House of Representatives

The Honorable Marcy Kaptur
Chairwoman
The Honorable Michael K. Simpson
Ranking Member
Subcommittee on Energy and Water Development,
and Related Agencies
Committee on Appropriations
House of Representatives

Enclosure I: Objectives, Scope, and Methodology

The Senate Report accompanying a bill for the National Defense Authorization Act for Fiscal Year 2022 includes a provision for us to review several aspects of greater-than-Class C (GTCC) waste disposal.¹ Our report examines (1) laws and regulations governing GTCC waste, (2) Department of Energy (DOE) estimates of GTCC and GTCC-like waste, (3) alternatives DOE has identified for GTCC and GTCC-like waste disposal, and (4) barriers to GTCC and GTCC-like waste disposal.

To examine the laws and regulations governing GTCC waste, we reviewed relevant sections of the Low-Level Radioactive Waste Policy Amendments Act of 1985 (1985 Act);² the Atomic Energy Act of 1954, as amended (AEA);³ the Energy Policy Act of 2005;⁴ and the Waste Isolation Pilot Plant Land Withdrawal Act, as amended (WIPP Land Withdrawal Act).⁵ We reviewed the implementing regulations for the 1985 Act⁶ and regulations on certain licensing requirements for radioactive waste.⁷ We also reviewed DOE and Nuclear Regulatory Commission (NRC) documents, such as DOE's 2016 Environmental Impact Statement (EIS) for GTCC and GTCC-like waste⁸ and NRC's Draft Regulatory Basis on the Disposal of GTCC and Transuranic Waste,⁹ to determine how the laws and regulations we examined define agencies' roles in GTCC waste disposal. We interviewed officials from DOE, NRC, and the states with sites that DOE evaluated for potential GTCC and GTCC-like waste disposal. We spoke to these

¹S. Rpt. No. 117-39, at 363 (2021).

²Pub. L. No. 99-240, § 102, 99 Stat. 1842, 1844 (1986) (codified at 42 U.S.C. § 2021c).

³Act of Aug. 30, 1954, ch. 1073, § 1, 68 Stat. 919 (codified as amended at 42 U.S.C. § 2011 through 2297g-4).

⁴Pub. L. No. 109-58, § 631.

⁵Pub. L. No. 102-579, 106 Stat. 4777 (1992) *as amended by*, Pub. L. No. 104-201 div. C, tit. XXXI, subtit. F, 110 Stat. 2422, 2851 (1996).

⁶10 C.F.R. pt. 61.

⁷10 C.F.R. pt. 72.

⁸Department of Energy, *Final Environmental Impact Statement for the Disposal of Greater-Than-Class C (GTCC) Low-Level Radioactive Waste and GTCC-Like Waste*, EIS-0375 (Washington, D.C.: January 2016). DOE completed a draft of the EIS in 2011 and solicited public comments, 76 Fed. Reg. 10,574 (Feb. 25, 2011), as required by the National Environmental Policy Act of 1969 (NEPA), 42 U.S.C. § 4332(C).

⁹Nuclear Regulatory Commission, *Disposal of Greater-than-Class C (GTCC) and Transuranic Waste Draft Regulatory Basis – For Public Comment* (Washington, D.C.: July 22, 2019).

officials about relevant federal and state laws and regulations pertaining to transportation, storage, and disposal of these wastes, including about agency roles.¹⁰

To examine DOE estimates of GTCC and GTCC-like waste, we reviewed DOE's EIS and the source documents for the estimates in the EIS, including a 2010 inventory of GTCC and GTCC-like waste.¹¹ We interviewed officials from DOE's Office of Environmental Management about the estimates and the methodology DOE used to produce them, including how the agency measured uncertainties. We interviewed officials from the four DOE sites that the EIS identified as storing GTCC or GTCC-like waste to obtain information, including updated data about inventories in storage and projections of future waste. We reviewed relevant sections of the National Environmental Policy Act of 1969 (NEPA),¹² its implementing regulations that were in effect at the time the 2016 EIS was prepared,¹³ and DOE procedures and guidance for environmental impact statements.¹⁴ These NEPA regulations called for the use of research methods generally accepted in the scientific community when evaluating environmental impacts with incomplete information. We identified quantifying uncertainties as a generally accepted practice for expressing a level of precision in estimates to allow users to appropriately apply those estimates to draw valid conclusions.¹⁵

¹⁰We reached out to interview state regulatory officials from the six states with sites that DOE evaluated for GTCC and GTCC-like waste disposal. We interviewed officials from Texas, Washington, South Carolina, and Idaho. We received documentation from Nevada officials, and New Mexico officials did not respond to our requests.

¹¹Department of Energy, *Final Environmental Impact Statement*; Sandia National Laboratories, *Basic Inventory for Greater-Than-Class-C Low-Level Radioactive Waste Environmental Impact Statement Evaluations*, rev. 1 (Albuquerque, N.Mex: May 2008); and Argonne National Laboratory Environmental Science Division, *Supplement to Greater-Than-Class C (GTCC) Low-Level Radioactive Waste and GTCC-Like Waste Inventory Reports* (Lemont, Ill.: October 2010).

¹²Pub. L. No. 91-190, § 102, 83 Stat. 852, 853 (1970) (codified at 42 U.S.C. § 4332(C)).

¹³40 C.F.R. pt. 1502 (2015).

¹⁴Department of Energy, *Order 451.1B: National Environmental Policy Act Compliance Program*, chg. 3 (Washington, D.C.: January 2012). Argonne National Laboratory for the Department of Energy, Office of Environmental Management, *Quality Assurance Project Plan for the Environmental Impact Statement for the Disposal of Greater-Than-Class-C Low-Level Radioactive Waste* (Lemont, Ill.: February 2007). Other DOE and Council on Environmental Quality NEPA guidance used by DOE can be found at: <https://www.energy.gov/nepa/guidance-and-requirements-table>.

¹⁵NEPA regulations direct that agencies disclose the fact of incomplete or unavailable information in an EIS. If the agency cannot obtain complete information, it must evaluate environmental impacts based upon theoretical approaches or research methods generally accepted in the scientific community. We identified reliably quantifying uncertainties as a generally accepted practice based on the discussion of its importance in John R. Taylor, *An Introduction to Error Analysis: The Study of Uncertainties in Physical Measurements* (Sausalito, Calif.: University Science Books, 1997). Also see GAO, *Air Cargo Security: TSA Field Testing Should Ensure Screening Systems Meet Detection Standards*, [GAO-21-105192](https://www.gao.gov/products/GAO-21-105192) (Washington, D.C.: July 2021); and Department of Defense, *Memorandum for Users of the Director*,

To conduct our analysis, one GAO physical scientist reviewed three reports that DOE commissioned from national laboratories to provide estimates of GTCC and GTCC-like waste. The physical scientist assessed the extent to which these reports detailed the steps, if any, DOE and the laboratories took to quantify acknowledged uncertainties, and the scientist did not find any such steps in the reports. Another GAO physical scientist independently assessed the evidence and also found that DOE did not quantify acknowledged uncertainties in its estimates in these reports. In light of this assessment, we asked DOE officials whether they had quantified uncertainties; these officials did not provide evidence of having quantified uncertainties. We determined that DOE's estimates were sufficiently sound to report on them at a high level with the necessary caveats. In light of the limitations we found, we did not report on more specific results from the estimates.

To examine alternatives DOE identified for GTCC and GTCC-like waste disposal, we reviewed DOE's draft and final EIS and 2018 environmental assessment for the commercial Waste Control Specialists (WCS) facility in Texas.¹⁶ We also interviewed DOE and NRC officials as well as state regulatory officials.¹⁷ In addition, we interviewed officials from DOE's Waste Isolation Pilot Plant in New Mexico and representatives from WCS. We selected WIPP because DOE identified the facility as a preferred alternative in its EIS. We selected WCS because it is a commercial facility and DOE identified commercial facilities, in general, as a preferred alternative in its EIS. The agency later conducted an environmental assessment of WCS as a potential disposal facility.

To evaluate DOE's selection of its preferred alternatives in the EIS, we compared information in the EIS to relevant sections of NEPA implementing regulations in effect at the time the EIS was prepared and to NEPA guidance from the Council on Environmental Quality.¹⁸ To determine the extent to which DOE's selection of its preferred alternative aligned with NEPA's requirements

Operational Test and Evaluation (DOT&E) Test and Evaluation Master Plan (TEMP) Guidebook (Washington, D.C.: Jan. 19, 2017).

¹⁶Department of Energy, Office of Environmental Management, *Environmental Assessment for the Disposal of Greater-Than-Class C (GTCC) Low-Level Radioactive Waste and GTCC-Like Waste at Waste Control Specialists, Andrews County, Texas* (Washington, D.C.: October 2018).

¹⁷As previously noted, we reached out to interview state regulatory officials from the six states with sites that DOE evaluated for GTCC and GTCC-like waste disposal. We interviewed officials from Texas, Washington, South Carolina, and Idaho. We received documentation from Nevada officials, and New Mexico officials did not respond to our requests.

¹⁸Council on Environmental Quality, *Memorandum for Heads of Federal Departments and Agencies on Effective Use of Programmatic NEPA Reviews* (Washington, D.C.: Dec. 18, 2014).

and guidance relevant to transparency, two analysts independently assessed the evidence and came to an agreement. In cases when the first two analysts disagreed, a third analyst weighed in to resolve differences. There was full agreement on all assessments at the conclusion of our analysis.

To examine barriers to GTCC and GTCC-like waste disposal, we reviewed pertinent laws and regulations, including the 1985 Act, the AEA, the Energy Policy Act of 2005, the WIPP Land Withdrawal Act, Texas Administrative Code,¹⁹ implementing regulations for the 1985 Act, and NRC regulations on exemptions and continued regulatory authority in agreement states. We also reviewed DOE documentation such as DOE's EIS and 2017 report to Congress.²⁰ We reviewed relevant NRC documentation issued, such as NRC's draft regulatory basis and staff papers on issues related to GTCC waste disposal²¹ and the path forward on recommendations.²² We also interviewed DOE, NRC, and state officials, and disposal facility representatives, as described above, to identify barriers to disposal. For reporting purposes, we focused on barriers that have an immediate impact on the federal government's ability to proceed with identifying a disposal pathway for GTCC and GTCC-like waste.

We conducted this performance audit from January 2022 to September 2022 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

¹⁹30 Tex. Admin. Code § 336.362(a)(2)(D), (4)(D) (stipulating that GTCC waste is unsuitable for near-surface disposal); 30 Tex. Admin. Code § 336.701(b)(4), (5) (stating that a licensee authorized to dispose of low-level radioactive waste shall not accept for disposal waste that exceeds Class C limitations as specified in 30 Tex. Admin. Code § 336.362).

²⁰Department of Energy, *Alternatives for the Disposal of Greater-Than-Class C Low-Level Radioactive Waste and Greater-Than-Class C-Like Waste Report to Congress* (Washington, D.C.: November 2017).

²¹Nuclear Regulatory Commission, *Historical and Current Issues Related to Disposal of Greater-Than-Class-C Low-Level Radioactive Waste*, SECY-15-0094 (Washington, D.C.: Dec. 22, 2015).

²²Nuclear Regulatory Commission, *SECY-20-0098: Path Forward and Recommendations for Certain Low-Level Radioactive Waste Disposal Rulemakings* (Washington, D.C.: 2020).

Enclosure II: Federal Laws and Regulations Related to Greater-than-Class C (GTCC) Waste

A number of federal laws and regulations provide a governance framework for GTCC waste.¹

Federal Laws

The Atomic Energy Act of 1954, as amended (AEA). Under the AEA, the Nuclear Regulatory Commission (NRC) regulates the safety and security of the generation, storage, transportation, and disposal of commercial low-level waste.² The AEA authorizes NRC to enter into agreements with states (called agreement states) so they assume, and NRC relinquishes for the duration of the agreement, regulatory authority over certain byproduct, source, and small quantities of special nuclear materials.³ The AEA does not permit NRC to relinquish regulatory authority over special nuclear material in quantities sufficient to form a critical mass.

The AEA defines transuranic waste as “material contaminated with elements that have an atomic number greater than 92, including neptunium, plutonium, americium, and curium, and that are in concentrations greater than 10 nanocuries per gram [nCi/g], or in such other concentrations as the [NRC] may prescribe to protect the public health and safety.”⁴

National Environmental Policy Act of 1969, as amended (NEPA). NEPA and the subsequent Council on Environmental Quality regulations implementing NEPA set out an environmental review process. The process has two principal purposes: (1) to ensure that an agency carefully considers information concerning the potential environmental effects of proposed development projects, and (2) to ensure that this information is made available to the public. This generally requires federal agencies to evaluate the potential environmental effects of actions they propose to carry out, fund, or approve by preparing analyses of different comprehensiveness depending on the significance of a proposed project’s effects on the environment. Such analyses range from the most detailed environmental impact statements (EIS) to less comprehensive environmental assessments. According to NEPA implementing regulations, an environmental

¹The Department of Energy (DOE) uses the term “GTCC-like” waste to refer to waste of similar characteristics to GTCC waste. Because GTCC-like waste is not a legal or regulatory concept or term, it is not discussed in this enclosure.

²42 U.S.C. § 2201(b).

³42 U.S.C. § 2021(b).

⁴Pub. L. No. 102-579, § 2(18), as amended by Pub. L. No. 104-201, § 3182, 110 Stat. at 2851. The change from 10 nCi/g specified in the AEA reflects an Environmental Protection Agency (EPA) conclusion in 1979 that a limit of 100 nCi/g would keep doses below 500 mrem/year.

assessment shall result in either a finding of no significant environmental impact—which explains why an action will not have a significant effect on the environment—or the decision to prepare an EIS.⁵ In the EIS, the agency shall identify the preferred alternative,⁶ but this does not constitute a final decision. At the time of a decision, the agency is to prepare and publish a public record of decision in a timely manner.⁷

Department of Energy National Security and Military Applications of Nuclear Energy Authorization Act of 1980. This act authorized the Department of Energy’s (DOE) Waste Isolation Pilot Plant (WIPP) as a research and development facility to demonstrate the safe disposal of radioactive waste from defense activities and programs of the United States not regulated by NRC.⁸ The act specifies that “none of the funds authorized to be appropriated by this or any other Act may be used for any purpose related to licensing of any defense activity or facility of the Department of Energy by the Nuclear Regulatory Commission.”⁹

Low-Level Radioactive Waste Policy Amendments Act of 1985 (1985 Act). The 1985 Act defines low-level radioactive waste generally as radioactive waste that is not high-level waste, spent fuel, or byproduct material.¹⁰ Unlike the original Low-Level Radioactive Waste Policy Act that was enacted in 1980, the 1985 Act—which amended the 1980 Act—does not specifically exclude transuranic waste from the statutory definition of “low-level radioactive waste.”¹¹ The 1985 Act assigns the federal government responsibility for the disposal of GTCC waste and certain low-level waste generated by the federal government.¹² The 1985 Act also requires that

⁵40 C.F.R. § 1508.1(h).

⁶40 C.F.R. § 1502.14(d).

⁷40 C.F.R. § 1505.2.

⁸Pub. L. No. 96-164, § 213, 93 Stat. 1259, 1265.

⁹Pub. L. No. 96-164, § 210, 93 Stat. at 1264.

¹⁰Pub. L. No. 99-240, § 102, 99 Stat. 1842, 1843 (1986) (codified at 42 U.S.C. § 2021b(9)).

¹¹*Compare* Pub. L. No. 99-240, § 102, 99 Stat. at 1843 (codified at 42 U.S.C. § 2021b(9)) *with* Pub. L. No. 96-573, § 2(2).

¹²Pub. L. No. 99-240, § 102, 99 Stat. 1842 at 1844 (codified at 42 U.S.C. § 2021c(b)(2)). DOE refers to some low-level, government-generated waste (that does not have a disposal pathway) as GTCC-like waste. As previously noted, “GTCC-like waste” is not a legal or regulatory concept.

the disposal of low-level radioactive waste result in “permanent isolation.”¹³ The act requires that all GTCC waste be disposed of in an NRC-licensed facility that NRC has determined to be adequate to protect public health and safety.¹⁴

Nuclear Waste Policy Act of 1982, as amended (NWPAA). The NWPAA defines high-level waste as the “highly radioactive material resulting from the reprocessing of spent nuclear fuel” and “other highly radioactive material that the [NRC], consistent with existing law, determines by rule requires permanent isolation.”¹⁵ The act provides a pathway for high-level waste to be permanently disposed of in a deep geologic repository. The act also defines the term atomic energy defense activity as any activity of the Secretary performed in whole or in part in carrying out any of the following functions: naval reactors development; weapons activities including defense inertial confinement fusion; verification and control technology; defense nuclear materials production; defense nuclear waste and materials by-products management; defense nuclear materials security and safeguards and security investigations; and defense research and development.¹⁶

The Waste Isolation Pilot Plant Land Withdrawal Act, as amended.¹⁷ This act limits disposal at WIPP to defense-origin transuranic waste, which would exclude GTCC and GTCC-like waste. The act defines “transuranic waste” as waste containing more than 100 nanocuries of alpha-emitting transuranic isotopes per gram of waste, with half-lives greater than 20 years, except for (A) high-level radioactive waste; (B) waste that the Secretary of Energy has determined, with the concurrence of the [Administrator of the Environmental Protection Agency], does not need the degree of isolation required by the disposal regulations; or (C) waste that the NRC has

¹³Pub. L. No. 99-240, § 102, 99 Stat. at 1843 (codified at 42 U.S.C. § 2021b(7)).

¹⁴Pub. L. No. 99-240, § 102, 99 Stat. at 1844 (codified at 42 U.S.C. § 2021c(b)(2)). The 1985 Act does not refer to GTCC waste specifically, but stipulates that “All radioactive waste designated a Federal responsibility pursuant to subparagraph (b)(1)(D) that results from activities licensed by the Nuclear Regulatory Commission under the AEA, as amended, shall be disposed of in a facility licensed by the Nuclear Regulatory Commission that the Commission determines is adequate to protect the public health and safety.” 42 U.S.C. § 2021c(b)(2). Subparagraph (b)(1)(D) refers to “any other low-level radioactive waste with concentrations of radionuclides that exceed the limits established by the Commission for class C radioactive waste, as defined by section 61.55 of title 10, *Code of Federal Regulations*, as in effect on January 26, 1983.” 42 U.S.C. § 2021c(b)(1)(D).

¹⁵42 U.S.C. § 10101(12).

¹⁶42 U.S.C. § 10101(3).

¹⁷Pub. L. No. 102-579, 106 Stat. 4777 (1992), *as amended by*, Pub. L. No. 104-201, div. C, tit. XXXI, subtit. F, 110 Stat. 2422, 2851 (1996).

approved for disposal on a case-by-case basis in accordance with part 61 of title 10, *Code of Federal Regulations*.¹⁸

The Energy Policy Act of 2005. This act requires the Secretary of Energy to provide Congress with notification of the designation of a DOE entity responsible for completing the activities needed to provide a facility for the safe disposal of GTCC waste.¹⁹ The act also requires DOE to provide a plan for completing an Environmental Impact Statement for a permanent disposal facility for the disposal of GTCC waste and to await congressional direction before proceeding with disposal.

Regulations

NRC Licensing Requirements for Land Disposal of Radioactive Waste (10 C.F.R. Part 61).

This regulation categorizes low-level wastes based on radiological hazard as Classes A, B, or C.²⁰ The regulation defines each category based on concentration limits of certain radioactive isotopes and describes the relative isolation measures NRC believes are warranted based on the radiological characteristics of the waste.²¹

- **Class A.** This waste has the lowest radiological hazard and contains mostly relatively short-lived radionuclides that decay to background levels within a few decades.
- **Class B.** This waste contains higher concentrations of short-lived radionuclides than Class A.
- **Class C.** This waste contains higher concentrations of both short-lived and long-lived radionuclides. Requirements for Class C waste specify that the waste either be disposed of (1) so that the top of the waste is a minimum of 5 meters below the top surface of the

¹⁸Pub. L. No. 102-579, § 2(18), as amended by Pub. L. No. 104-201, § 3182, 110 Stat. at 2851. The change from 10 nCi/g specified in the AEA reflects an EPA conclusion in 1979 that a limit of 100 nCi/g would keep doses below 500 mrem/year.

¹⁹Pub. L. No. 109-58, § 631(a), 119 Stat. 594, 788.

²⁰10 C.F.R. § 61.55(a)(2)(i), (ii), (iii).

²¹10 C.F.R. § 61.55(a)(2). NRC regulations do not provide a definition of GTCC in 10 C.F.R. pt. 61. Instead, a definition appears in 10 C.F.R. pt. 72, referencing the limits in part 61. 10 C.F.R. § 72.3 (*Greater than Class C waste or GTCC waste*).

cover, or (2) with intruder barriers that are designed to protect against an inadvertent intrusion for at least 500 years.²²

NRC regulations on Licensing Requirements for Independent Storage of Spent Nuclear Fuel, High-Level Radioactive Waste, and Reactor-Related Greater Than Class C Waste. (10 C.F.R. Part 72). These regulations define GTCC waste as waste that has concentrations of certain radionuclides that exceed the Class C limits listed in NRC's Licensing Requirements for Land Disposal of Radioactive Waste (10 C.F.R. Part 61).²³

NRC regulations on Exemptions and Continued Regulatory Authority in Agreement States and in Offshore Waters under Section 274 (10 C.F.R. Part 150). These implement Section 274 of the AEA, which authorizes NRC to enter into agreements with states so they assume, and NRC relinquishes, regulatory authority over specified radioactive materials.²⁴

NRC regulations on Packaging and Transportation of Radioactive Material (10 C.F.R. Part 71). These include certification requirements for Type B packages. NRC evaluates outcomes of hypothetical accident testing for package design and content and issues certificates of compliance for approved designs. Any entity using a Type B package must have a quality assurance program in place.

Department of Transportation regulations relevant to radioactive waste transportation (49 C.F.R. Parts 171-180). These include standards and requirements for the packaging, transportation, and handling of radioactive material for all modes of transportation. For example, part 173 of title 49 of the *Code of Federal Regulations* includes performance requirements for Type A packages.

Council on Environmental Quality NEPA implementing regulations (40 C.F.R. Parts 1500-1508). These include requirements for environmental reviews, such as environmental assessments and environmental impact statements. For example, the NEPA implementing regulations in effect when DOE prepared the EIS stated that an EIS should devote substantial treatment to each alternative considered in detail, so that reviewers can evaluate their

²²10 C.F.R. § 61.52(a)(2).

²³10 C.F.R. § 72.3.

²⁴42 U.S.C. § 2021(b).

comparative merits and provide a clear basis for choice among alternatives by the decision maker and the public.²⁵

²⁵40 C.F.R. § 1502.14 (2019). Current NEPA regulations, published in 2020, state that agencies shall “discuss each alternative considered in detail, including the proposed action, so that reviewers may evaluate their comparative merits.” 40 C.F.R. § 1502.

Enclosure III: Certain Nuclear Waste Types

Various types of nuclear waste are often defined and managed under disparate legal and regulatory frameworks. Some types of nuclear waste may overlap. (See table 1.)

Table 1: Waste Types, by Legal and Technical Definition

Waste type	High-level, and spent nuclear fuel	Transuranic	Class A, B, or C low-level ^a	Greater-than-Class C (GTCC) low-level	GTCC-like
Defined in law or regulation	Nuclear Waste Policy Act of 1982	Atomic Energy Act of 1954, as amended (AEA) Waste Isolation Pilot Plant Land Withdrawal Act, as amended (WIPP Land Withdrawal Act)	Low-Level Radioactive Waste Policy Amendments Act 10 C.F.R. Part 61	10 C.F.R. Part 61 10 C.F.R. Part 72	Not defined in law or regulation
Origin	Defense or commercial	Defense or commercial	Commercial	Commercial	Federal government (generally non-defense)
Definition	“[H]ighly radioactive material resulting from the reprocessing of spent nuclear fuel” and “other highly radioactive material that the [NRC], consistent with existing law, determines by rule requires permanent isolation.” “[F]uel that has been withdrawn from a nuclear reactor following irradiation, the constituent elements of which have not been separated by reprocessing.”	Material contaminated with “elements that have an atomic number greater than 92 ... in concentrations greater than 100 nanocuries per gram” ^b	“Radioactive waste that is not high-level waste, spent fuel, or byproduct material”	Waste that has concentrations of certain radionuclides that exceed the Class C limits in 10 C.F.R. Part 61	Government-owned or -generated waste with similar characteristics to GTCC waste and without a disposal pathway

Waste type	High-level, and spent nuclear fuel	Transuranic	Class A, B, or C low-level ^a	Greater-than-Class C (GTCC) low-level	GTCC-like
Technical specifications	Not applicable	Material contaminated with “elements that have an atomic number greater than 92 ... in concentrations greater than 100 nanocuries per gram” ^b	Class A contains mostly relatively short-lived radionuclides that decay to background levels within a few decades. Class C contains higher concentrations of both short-lived and long-lived radionuclides.	Exceeds concentrations in Class C	Radiologically similar to GTCC
Examples	Spent nuclear fuel	Contaminated equipment (e.g., gloves)	Contaminated paper, resins and filters from nuclear power plants, and nuclear reactor components	Activated metals, sealed sources	Contaminated equipment and soil, activated metals, sealed sources
Disposal pathway under current law or regulations	Geologic repository ^c	Unspecified ^d	Near-surface ^e	Not generally acceptable for near-surface disposal	Not applicable

Source: GAO analysis of laws, regulations, and Department of Energy documents. | GAO-22-105636

^aThe federal government also generates low-level waste; however, Nuclear Regulatory Commission (NRC) regulations (and its A-C classification system) do not apply to it.

^bThe AEA defined transuranic waste as “material contaminated with elements that have an atomic number greater than 92, including neptunium, plutonium, americium, and curium, and that are in concentrations greater than 10 nanocuries per gram [nCi/g], or in such other concentrations as the [NRC] may prescribe to protect the public health and safety.” 42 U.S.C. § 2014(ee). The WIPP Land Withdrawal Act, as amended, reflects an updated concentration based on an Environmental Protection Agency revision in 1979. See Pub. L. No. 102-579, § 2(18).

^cThe Nuclear Waste Policy Act provides a pathway for high-level waste to be permanently disposed of in a deep geologic repository.

^dFederal law does not specify that transuranic waste must be disposed of in a geologic repository; however, this has been the practice since the early 1970s. Defense transuranic waste may be disposed of at the Waste Isolation Pilot Plant in New Mexico. Non-defense transuranic waste, which currently does not have a disposal pathway, is included in DOE’s estimates of GTCC and GTCC-like waste.

^oNear-surface disposal means a land disposal facility in which radioactive waste is disposed of in or within the upper 30 meters of the earth's surface. The disposal unit is usually a trench. Requirements for Class C waste specify that the waste either be disposed of (1) so that the top of the waste is a minimum of 5 meters below the top surface of the cover or (2) with intruder barriers that are designed to protect against an inadvertent intrusion for a least 500 years.

Enclosure IV: Comments from the Department of Energy



Department of Energy

Washington, DC 20585

September 14, 2022

Mr. Nathan Anderson
Director
Natural Resources and Environment
U.S. Government Accountability Office
Washington, DC 20548

Dear Mr. Anderson:

As required by 31 U.S.C. 720, this letter provides the U.S. Department of Energy (DOE) Office of Environmental Management's (EM) management decision for the recommendations to DOE contained in the U.S. Government Accountability Office's (GAO) report, *GAO-22-105636, DOE Needs to Improve Transparency in Planning for Disposal of Certain Low-Level Waste*.

Disposal of radioactive waste is a core function of the EM program. Without waste disposal capabilities, cleanup cannot proceed. EM's safety culture and well-established statutory and regulatory regime ensure waste is disposed in a manner that protects the public, workers, and the environment and is in accordance with the requirements. EM will continue to apply integrated radioactive waste disposal strategies which consider environmental justice, climate change, and site equities to maintain the current and develop additional disposal options, ensuring a sustainable cleanup mission while being fully protective. We concur with GAO's recommendations to DOE in the report. EM will coordinate with DOE's Office of National Environmental Policy Act (NEPA) Compliance to review and make appropriate updates to its guidance and procedures.

Over the next decade, EM will overcome barriers and advance development of disposal capabilities for greater-than-class C (GTCC) low-level waste (LLW). DOE has already completed important steps to develop a disposal capability, including identifying the inventory of GTCC LLW, analyzing potential disposal alternatives under NEPA, and submitting a report requested by Congress describing disposal alternatives. With action by Congress, EM will make a final decision on the best GTCC disposal alternative(s) to implement, as required by Section 631 of the Energy Policy Act of 2005 (P.L. 109-58).

The U.S. Nuclear Regulatory Commission (NRC) has initiated important steps to promulgate requirements for land disposal of GTCC LLW. DOE recognizes GAO's suggestions to Congress regarding clarifying NRC's legal authority to relinquish regulation of GTCC LLW disposal to NRC Agreement States, as well as NRC's regulatory role for any DOE facility that may accept GTCC LLW.

EM will continue to work with Congress, stakeholders, communities, Tribal Nations, and others to ensure statutory requirements are met and EM achieves its vital cleanup mission safely, compliantly, and effectively.

If you have any questions, please contact me or Mr. John A. Mullis II, Acting Associate Principal Deputy Assistant Secretary for Regulatory and Policy Affairs, at (202) 586-5042.

Sincerely,



William I. White
Senior Advisor for Environmental Management

Enclosure

Management Response to Recommendation
GAO-22-105636
GAO Report, *DOE Needs to Improve Transparency in Planning for*
Disposal of Certain Low-Level Waste

Recommendation 1: The Assistant Secretary for Environmental Management should update the guidance and associated procedures DOE and contractors use to implement NEPA reviews to include quality assurance steps on quantifying and reporting on uncertainty.

Management Response: Concur.

While the uncertainty analysis in the *Final Environmental Impact Statement for the Disposal of Greater-Than-Class C (GTCC) Low-Level Radioactive Waste and GTCC-Like Waste* (DOE/EIS-0375, published March 2016) met applicable NEPA requirements, EM recognizes opportunities for continuous improvement. EM will coordinate with DOE's Office of NEPA Compliance to review its NEPA guidance and procedures and make appropriate updates to include quality assurance steps in quantifying and reporting uncertainty.

Estimated Completion Date: December 2023.

Recommendation 2: The Assistant Secretary for Environmental Management should update the guidance and associated procedures DOE and contractors use to implement NEPA reviews to include quality assurance steps on transparency in analyses, including steps to ensure DOE's selection of its preferred alternative is transparently explained and traceable.

Management Response: Concur.

While the Final Environmental Impact Statement for the Disposal of Greater-Than-Class C (GTCC) Low-Level Radioactive Waste and GTCC-Like Waste (DOE/EIS-0375) met applicable NEPA requirements, EM recognizes opportunities for continuous improvement. EM will coordinate with DOE's Office of NEPA Policy and Compliance to review its NEPA guidance and procedures and make appropriate updates to ensure transparency and traceability in preferred alternative selection.

Estimated Completion Date: December 2023.

Accessible Text for Enclosure IV: Comments from the Department of Energy

September 14, 2022

Mr. Nathan Anderson
Director
Natural Resources and Environment
U.S. Government Accountability Office
Washington, DC 20548

Dear Mr. Anderson:

As required by 31 U.S.C. 720, this letter provides the U.S. Department of Energy (DOE) Office of Environmental Management's (EM) management decision for the recommendations to DOE contained in the U.S. Government Accountability Office's (GAO) report, GAO-22-105636, DOE Needs to Improve Transparency in Planning for Disposal of Certain Low-Level Waste.

Disposal of radioactive waste is a core function of the EM program. Without waste disposal capabilities, cleanup cannot proceed. EM's safety culture and well-established statutory and regulatory regime ensure waste is disposed in a manner that protects the public, workers, and the environment and is in accordance with the requirements. EM will continue to apply integrated radioactive waste disposal strategies which consider environmental justice, climate change, and site equities to maintain the current and develop additional disposal options, ensuring a sustainable cleanup mission while being fully protective. We concur with GAO's recommendations to DOE in the report. EM will coordinate with DOE's Office of National Environmental Policy Act (NEPA) Compliance to review and make appropriate updates to its guidance and procedures.

Over the next decade, EM will overcome barriers and advance development of disposal capabilities for greater-than-class C (GTCC) low-level waste (LLW). DOE has already completed important steps to develop a disposal capability, including identifying the inventory of GTCC LLW, analyzing potential disposal alternatives under NEPA, and submitting a report requested by Congress describing disposal alternatives. With action by Congress, EM will make a final decision on the best GTCC disposal alternative(s) to implement, as required by Section 631 of the Energy Policy Act of 2005 (P.L. 109-58).

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If you have any questions, please contact me or Mr. John A. Mullis II, Acting Associate Principal Deputy Assistant Secretary for Regulatory and Policy Affairs, at (202) 586-5042.

Sincerely,

William I. White
Senior Advisor for Environmental Management

Enclosure

ENCLOSURE 1

Management Response to Recommendation GAO-22-105636

GAO Report, DOE Needs to Improve Transparency in Planning for Disposal of Certain Low-Level Waste

Recommendation 1: The Assistant Secretary for Environmental Management should update the guidance and associated procedures DOE and contractors use to implement NEPA reviews to include quality assurance steps on quantifying and reporting on uncertainty.

Management Response: Concur.

While the uncertainty analysis in the Final Environmental Impact Statement for the Disposal of Greater-Than-Class C (GTCC) Low-Level Radioactive Waste and GTCC-Like Waste (DOE/EIS- 0375, published March 2016) met applicable NEPA requirements, EM recognizes opportunities for continuous improvement. EM will coordinate with DOE's Office of NEPA Compliance to review its NEPA guidance and procedures and make appropriate updates to include quality assurance steps in quantifying and reporting uncertainty.

Estimated Completion Date: December 2023.

Recommendation 2: The Assistant Secretary for Environmental Management should update the guidance and associated procedures DOE and contractors use to implement NEPA reviews to include quality assurance steps on transparency in analyses, including steps to ensure DOE's selection of its preferred alternative is transparently explained and traceable.

Management Response: Concur.

While the Final Environmental Impact Statement for the Disposal of Greater-Than-Class C (GTCC) Low-Level Radioactive Waste and GTCC-Like Waste (DOE/EIS-0375) met applicable NEPA requirements, EM recognizes opportunities for continuous improvement. EM will coordinate with DOE's Office of NEPA Policy and Compliance to review its NEPA guidance and procedures and make appropriate updates to ensure transparency and traceability in preferred alternative selection.

Estimated Completion Date: December 2023.

Enclosure V: Comments from the Nuclear Regulatory Commission



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

September 13, 2022

Mr. Nathan J. Anderson, Director
Natural Resources and Environment
U.S. Government Accountability Office
441 G Street NW
Washington, DC 20548

SUBJECT: U.S. NUCLEAR REGULATORY COMMISSION COMMENTS ON DRAFT
GOVERNMENT ACCOUNTABILITY OFFICE REPORT GAO-22-105636,
"NUCLEAR WASTE: DOE NEEDS TO IMPROVE TRANSPARENCY IN
PLANNING FOR DISPOSAL OF CERTAIN LOW-LEVEL WASTE"

Dear Mr. Anderson,

Thank you for the opportunity to review and comment on the United States Government Accountability Office (GAO) draft report GAO-22-105636, "Nuclear Waste: DOE Needs to Improve Transparency in Planning for Disposal of Certain Low-Level Waste," which the U.S. Nuclear Regulatory Commission (NRC) received on August 15, 2022. The NRC staff recognizes there are no recommendations for the NRC. The staff has legal and technical comments on certain statements made in the draft report. Please find enclosed the staff's comments on those statements.

If you have any questions concerning the staff's comments, please direct them to John R. Jolicoeur at 301-415-1642 or john.jolicoeur@nrc.gov.

Sincerely,

A handwritten signature in black ink, appearing to read "Dan Dorman".

Signed by Dorman, Dan
on 09/13/22

Daniel H. Dorman
Executive Director
for Operations

Enclosure:
NRC Detailed Comments on GAO
Draft Report GAO-22-105636, "Nuclear
Waste: DOE Needs to Improve
Transparency in Planning for Disposal of
Certain Low-Level Waste"

N. Anderson

2

SUBJECT: U.S. NUCLEAR REGULATORY COMMISSION COMMENTS ON DRAFT
GOVERNMENT ACCOUNTABILITY OFFICE REPORT GAO-22-105636,
"NUCLEAR WASTE: DOE NEEDS TO IMPROVE TRANSPARENCY IN
PLANNING FOR DISPOSAL OF CERTAIN LOW-LEVEL WASTE"
DATED: September 13, 2022

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Accessible Text for Enclosure V: Comments from the Nuclear Regulatory Commission

September 13, 2022

Mr. Nathan J. Anderson, Director
Natural Resources and Environment
U.S. Government Accountability Office
441 G Street NW
Washington, DC 20548

SUBJECT: U.S. NUCLEAR REGULATORY COMMISSION COMMENTS ON DRAFT GOVERNMENT ACCOUNTABILITY OFFICE REPORT GAO-22-105636, "NUCLEAR WASTE: DOE NEEDS TO IMPROVE TRANSPARENCY IN PLANNING FOR DISPOSAL OF CERTAIN LOW-LEVEL WASTE"

Dear Mr. Anderson,

Thank you for the opportunity to review and comment on the United States Government Accountability Office (GAO) draft report GAO-22-105636, "Nuclear Waste: DOE Needs to Improve Transparency in Planning for Disposal of Certain Low-Level Waste," which the U.S. Nuclear Regulatory Commission (NRC) received on August 15, 2022. The NRC staff recognizes there are no recommendations for the NRC. The staff has legal and technical comments on certain statements made in the draft report. Please find enclosed the staff's comments on those statements.

If you have any questions concerning the staff's comments, please direct them to John R. Jolicoeur at 301-415-1642 or john.jolicoeur@nrc.gov.

Sincerely,

Daniel H. Dorman
Executive Director for Operations

Enclosure:
NRC Detailed Comments on GAO
Draft Report GAO-22-105636, "Nuclear Waste: DOE Needs to Improve Transparency in Planning for Disposal of Certain Low-Level Waste"

SUBJECT: U.S. NUCLEAR REGULATORY COMMISSION COMMENTS ON DRAFT GOVERNMENT ACCOUNTABILITY OFFICE REPORT GAO-22-105636, "NUCLEAR WASTE: DOE NEEDS TO IMPROVE TRANSPARENCY IN PLANNING FOR DISPOSAL OF CERTAIN LOW-LEVEL WASTE"

DATED: September 13, 2022

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DATE	08/26/2022	08/26/2022	09/22 /2022

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Enclosure VI: GAO Contact and Staff Acknowledgments

GAO Contact

Nathan Anderson, Director, Natural Resources and Environment, (202) 512-3841 or andersonn@gao.gov.

Staff Acknowledgments

In addition to the contact named above, Amanda K. Kolling, Assistant Director; Alisa Beyninson (Analyst in Charge); Adrian Apodaca; Will Bauder; Kevin Bray; Tara Congdon; Cindy Gilbert; and Cory Ryncarz made key contributions to this report.

(105636)