

**REGULATORY AND ENVIRONMENTAL ANALYSIS OF
THE USE OF AWAY-FROM REACTOR STORAGE FACILITIES FOR
INTERIM STORAGE OF GREATER-THAN-CLASS C WASTES**

Stephen J. Krill, Jr. and Don Hammer
ICF Kaiser Consulting Group
9300 Lee Highway, Fairfax, VA, 22031-1207 (USA)

ABSTRACT

From 1988 to 1994, Federal government agencies evaluated the technical, regulatory, and legal issues of Greater-Than-Class-C (GTCC) radioactive waste storage and disposal. Although many recommendations were made regarding GTCC waste management, very few of them were ever implemented. Now, with several nuclear utilities actively involved in reactor decommissioning, the industry faces numerous restrictions on GTCC storage and disposal. These restrictions, particularly regarding storage, tend to limit the industry's ability to complete decommissioning. Recently, the industry sought regulatory relief from the U.S. Nuclear Regulatory Commission (NRC) for temporary storage of GTCC wastes. In response, the Commission embarked upon a rulemaking to clarify its existing regulations so that licensees could use of away-from reactor storage facilities (e.g., independent spent fuel storage installations and monitored retrievable storage facilities) for interim storage of GTCC wastes. This paper evaluates the regulatory and environmental impacts of interim storage of GTCC wastes in these away-from reactor storage facilities. As part of the evaluation, this paper updates the current and projected (to year 2035) volumes, component types, and activity levels for GTCC wastes. It also summarizes the current types of GTCC waste management practices, and suggests a set of performance criteria for interim storage of GTCC wastes in away-from reactor storage facilities.

INTRODUCTION

In late 1995, the Portland General Electric (PGE) Company petitioned the NRC to amend its existing radioactive waste storage requirements for licensed Independent Spent Fuel Storage Installations (ISFSIs) and Monitored Retrievable Storage (MRS) facilities, as codified in 10 CFR Part 72. Specifically, PGE requested that the scope of Part 72 be expanded to clarify the licensing process for interim storage of GTCC waste, pending transfer of such waste to a permanent disposal site.

In its rulemaking plan, the NRC indicated that its existing regulations were not clear with respect to the acceptability of storing GTCC waste at an ISFSI or MRS. The Commission believed that this lack of clarity created uncertainty on the part of decommissioning reactors and could create inefficiency and inconsistency in the way the NRC handles GTCC waste licensing matters.

Under their Part 50 licenses, nuclear utilities store their GTCC wastes either within the reactor vessel or in the spent fuel pool, pending development of a suitable disposal facility. The Low-Level Radioactive Waste Policy Amendments Act of 1985 gave the Federal government (*viz.* U.S. Department of Energy [DOE]) the primary responsibility for developing a national strategy for disposal of GTCC waste, and the Act gave the NRC licensing responsibility for a disposal facility for such waste. Based on current plans, disposal capability exclusively for GTCC wastes will not be available in the near term. Further GTCC waste is unlikely to be disposed of at a low-level waste (LLW) disposal site under the requirements of Part 61.

The licensing requirements of Part 72 only provide for storage of spent fuel in an ISFSI and storage of spent fuel and solid high-level waste in a MRS facility. Nonetheless, a reactor licensee could elect to store GTCC waste co-located at an ISFSI site under licenses issued under other NRC regulations, namely Part 30 and Part 70. (a) However, the present Part 30 and Part 70 regulations do not provide specific licensing criteria for storage of GTCC waste co-located at these types of facilities.

To resolve the issue of interim storage of GTCC waste prior to permanent disposal, ICF evaluated, on behalf of the NRC, two regulatory alternatives:

1. **No-Action.** The purpose of the alternative is to clarify that NRC's existing regulations allow for storage of GTCC waste at a licensed ISFSI under a Part 30 or Part 70 license normally conferred as part of a Part 50 license. Upon termination of a Part 50 license, however, it would be necessary to apply for a specific Part 30 or Part 70 license if GTCC waste remained at the ISFSI. This option would require no changes to existing regulations.
2. **Proposed Action.** The second alternative would modify existing regulations to allow storage of GTCC waste under Part 72, using performance criteria specified elsewhere. Storage and licensing requirements would be contained within Part 72. Since neither Part 30 or Part 70 include explicit criteria for storage of GTCC waste, and licensees would therefore need to propose criteria for review and approval by NRC.

REGULATORY DEFINITION OF GTCC WASTE

In 10 CFR Part 61.55, "Waste Classification," the NRC codifies disposal requirements for three classes of LLW, which are considered generally suitable for near-surface disposal, namely, Class A, B, and C (with Class C waste required to meet the most rigorous disposal specifications). Waste with concentrations above Class C limits for certain short- and long-lived radionuclides (i.e., GTCC) are not generally suitable for near-surface disposal, except where agreed on a case-specific basis by the NRC or an Agreement State that disposal of such waste will meet the performance objectives of Part 61. Classification of LLW is determined by evaluating two factors: (1) concentration of long-lived radionuclides and (2) concentration of short-lived radionuclides. Wastes for which the concentration of listed radionuclides exceeds the specified classification are designated as GTCC wastes. For wastes containing mixtures of the listed radionuclides, the classification is determined by summing the fractions of the concentration limits for the individual radionuclides.

Description of GTCC Wastes Generated by Nuclear Utilities

ICF, on behalf of the NRC, reviewed the available information on the volumes, waste component types, and radionuclide activities for currently stored and projected GTCC utility waste. Much of the available information on GTCC waste was obtained from a 1994 DOE report on GTCC waste characterization (1). In general, that report grouped GTCC wastes into two categories:

1. **Activated Metals.** Irradiated metal components from nuclear reactors (e.g., core shrouds, support plates, and core barrels), with activities greater than Class C limits; and
2. **Process Wastes.** Filters and resins resulting from the operation and decommissioning of reactors with activities greater than Class C limits.

GTCC wastes are generated either during operation or decommissioning of a reactor. Operations wastes are generated periodically during routine or maintenance activities. Operations wastes become available for storage or disposal at the end of each refueling cycle. Decommissioning wastes are generated when a reactor closes – a one-time event that can generate a substantial volume of GTCC waste. A large percentage of activity in GTCC decommissioning wastes comes from short-lived radionuclides which, if allowed to decay for several years, greatly reduces radiation levels, therefore making handling much easier. For this reason, industry practice generally assumes that decommissioning wastes are stored in the spent fuel pool for approximately three years after reactor closure, before being available for storage in an ISFSI or MRS, or for disposal.

Table I identifies component types associated with reactor operations and decommissioning for pressurized water reactor (PWR) and boiling water reactor (BWR) designs that may exceed Class C

limits. For each component type, a brief description of both the component and its function is provided. Also provided is the percentage of waste for each component assumed to exceed Class C limits. The NRC believes this list of GTCC component types, which was based almost exclusively on information compiled by the DOE, identifies both the currently stored and projected waste types that may exceed Class C limits.

Table I. GTCC Waste Component Types and Descriptions

Component Type	Description
BWR Core Shroud	The shroud is a large cylindrical, Type 304 stainless steel structure that surrounds the core. It provides a barrier to separate the upward flow through the core from the downward flow in the annulus. This waste is generated only during plant decommissioning and will always exceed Class C limits.
Control Rod Blades	The boron material in control rod blades (CRBs) helps control the rate of fission within the reactor by absorbing neutrons. The CRBs are distributed radially throughout the core. A mid size BWR contains up to 137 CRBs and a large BWR contains 185 CRBs. CRBs are typically discharged in batches based on boron depletion. There are two different placement configurations for CRBs, conventional mode or controlled cell. It was assumed that 10 percent of conventional mode CRBs and 25 percent of controlled cell CRBs might exceed Class C limits.
Control Rod Drive Strainers	Reactors use cartridge filters throughout primary and secondary systems to clean up contaminated liquids. Each control rod drive contains three metallic strainers. Control rod drive strainers are replaced when the drives are refurbished or replaced. About 50 percent of the strainers generated are above Class C limits.
Crud Tank Filter	Reactors use cartridge filters throughout primary and secondary systems to clean up contaminated liquids. Crud tank filters are only for Babcock & Wilcox plants. They are the highest-activity filters in all PWRs. These filters collect the media backflushed from etched disk filters. These filters always exceed Class C limits.
Fuel Pool/Vacuum Filters	Reactors use cartridge filters throughout primary and secondary systems to clean up contaminated liquids. The fuel pool filters are located upstream or down stream of fuel pool purification demineralizers and consist of cartridge-type filter elements with metal retention screens. The vacuum filter units consist of large and small micron cartridge filters with metal retention screens, and are used during vacuuming of the spent fuel pool and the reactor cavity. These filters are usually replaced during fuel outages. About 25 percent of the filters can individually exceed Class C limits.
Full System Fuel-In Resins	Resins beds are used to clean up liquids containing soluble and insoluble radioactive constituents. Decontamination resins might exceed Class C limits if the decontamination is performed with the fuel in. Class C limits might be exceeded primarily due to the transuranic content removed from fuel assemblies. It was assumed that 50 percent of the decontamination resins generated would exceed Class C limits and that one such decontamination project would occur at each plant during its operating life.
In-Core Instrument Strings	Instrument strings consist of flux monitor probes and Iconel or stainless steel flux wires. They are inserted through instrument tubes in the fuel assemblies. The common names of the instrument strings and their characteristics vary with each reactor vendor: • Thimble tubes (Westinghouse) • In-core detectors (Babcock & Wilcox) • Instrument strings (Combustion Engineering) It was assumed that 75 percent of all in-core instrument strings exceed Class C limits.
Intermediate Range Monitor (IRM)/Short Range Monitor (SRM) Dry Tubes	Each core contains eight IRM dry tubes and four SRM dry tubes. These dry tubes are made from stainless steel tubing and are replaced only when damaged or embrittled. It was assumed that the dry tubes remain intact and that all exceed Class C limits.
Local Power Range Monitor Strings	A BWR core contains 31 local power range monitor (LPRM) strings, each containing four fission chamber detectors. These stainless steel strings are routinely discharged based on fission chamber depletion or device malfunction. Generally, all LPRM strings exceed Class

Table I. GTCC Waste Component Types and Descriptions

Component Type	Description
	C limits unless they are removed early (after only one or two cycles). It was assumed that 75 percent of the LPRMs discharged would exceed Class C limits.
Lower Core Barrel	The lower core barrel is a Type 304 stainless steel cylinder that provides lateral support for the core and directs the flow of coolant water. For Combustion Engineering plants, the barrel is much larger and is referred to as the core support assembly barrel. This waste is generated only during plant decommissioning and will always exceed Class C limits.
Lower Core Support Plate	The lower core support plate is a Type 304 stainless steel cylindrical plate below the fuel that attaches to the core barrel and supports fuel assemblies laterally. In Combustion Engineering plants, this component is incorporated into the larger lower forging, but only the top cylindrical plate exceeds Class C limits. At Babcock & Wilcox plants this component is referred to as the lower grid. This waste is generated only during plant decommissioning and will always exceed Class C limits.
Primary Sources	Primary sources greatly exceed Class C limits. Usually they are used only in the first fuel cycle to start a reactor, then removed. Only a few BWR primary sources exist, which are used to start a reactor and then stored until needed to start another reactor; these sources are not considered waste. For PWRs, however, current practice is to store primary sources as waste in the spent fuel pool after they have been used to start a reactor. PWR primary strength and volume vary by reactor vendor. As stated before, all primary sources are expected to exceed Class C limits.
PWR Core Shroud (Baffle)	The baffle is a Type 304 stainless steel structure that surrounds the core. In Westinghouse plants, structures called core formers maintain the baffle's form and location and provide for limited water flow between the baffle and the core barrel for additional cooling of the barrel. This waste is generated only during plant decommissioning and will always exceed Class C limits.
PWR Miscellaneous Cartridge Filters	PWRs use cartridge filters throughout primary and secondary systems to clean up contaminated liquids. Most PWR cartridge filters are grouped into the general category of miscellaneous cartridge filters. This category includes the following type of filters: reactor coolant system filters, seal water injection filters, cavity drain filters, and fuel pool filters. It is assumed that 25 percent of these filters individually exceed Class C limits.
Thimble Plug Assemblies	These components are used to restrict water flow through fuel assemblies and are positioned in the top of selected assemblies. For Westinghouse plants, the thimble plug assemblies are stainless steel with an Iconel spring. They are discharged only when damaged. Comparable components in other plants do not typically exceed Class C limits and are not included. It was assumed that 25 percent of the thimble plug assemblies discharged exceed Class C limits.
Top Fuel Guide	The top fuel guide is a stainless steel structure that provides lateral support for the top section of the fuel assemblies. It may also be referred to as the upper core grid. This waste is generated only during plant decommissioning and will always exceed Class C limits.
Upper Core Support Plate	The upper core support plate is a Type 304 stainless steel cylindrical plate above the fuel that rests on the core barrel and supports fuel assemblies laterally. It is called the fuel assembly alignment plate in Combustion Engineering plants and the upper grid assembly and Babcock & Wilcox plants. This waste is generated only during plant decommissioning and will always exceed Class C limits.

Current GTCC Waste Management Practices

As described earlier, utilities generate GTCC waste during both reactor operations and decommissioning activities. Operational wastes from utilities may include activated metals and process wastes. Activated metals include non-fuel reactor core components such as thimbles, in-core instrumentation, fuel channels, control assemblies, and flux wires. These are composed mainly of stainless steel, Inconel, and other high-grade metals. This waste stream is likely to be GTCC mainly because of the nickel-59, nickel-63, and niobium-94 radionuclide concentrations.

The other GTCC waste stream from reactor operations includes neutron sources, fission chambers, spent ion-exchange resins, and sludges containing transuranic radionuclides from periodic reactor decontamination and fuel pool cleanup. Some decontamination wastes may contain chromium in sufficient quantities to be considered mixed waste.

Currently, there are no routine disposal options for GTCC waste, so such waste typically is either kept within the reactor vessel or removed and stored in the spent fuel pool under Part 50 licenses, pending development of a suitable disposal site. During reactor operations, generation and storage of GTCC waste are not considered problematic. According to an industry representative (2), most utilities store their GTCC waste in stainless steel containers, which are then placed into spare slots or racks in the spent fuel pool. (b) Because the amount of GTCC waste generated during reactor operations is relatively small, additional interim storage capacity is rarely needed to accommodate such waste.

When power plants are decommissioned, additional GTCC waste will be generated. Such waste is expected to include stainless steel core shrouds (sleeves separating the reactor core from the reactor vessel) in which component elements are activated (primarily from niobium-94, nickel-59, nickel-63, and carbon-14). Other GTCC wastes from decommissioning activities can include spent resins, sludges, and other materials. Because the quantity and volume of GTCC waste from decommissioning greatly exceeds that generated during reactor operations, additional storage capacity may be needed if there is insufficient space to accommodate both spent fuel and GTCC waste in the spent fuel pool. In addition, if the licensee decommissions the entire reactor building, including the spent fuel pool, it must relocate the radioactive wastes contained in the spent fuel pool to another location.

Table II presents the GTCC waste projections for nuclear utilities through the year 2035.

Table II. GTCC Waste Projections for Nuclear Utilities (to the year 2035)^a

Component	Activated Metal	Process Waste	Activity (Ci)	Volume (m ³)			Concentration (Ci/m ³)
				Unpackaged	Packaged	Potentially Co-located at ISFSIs	
PWR Decommissioning							
Core shroud (baffle)	x		24,190,000	86.4	259.1	259.1	279,977
Full system fuel-in resins		x	6,317	114.6	114.6	0	55
Lower core barrel	x		4,758,000	165	494.9	247.9	28,836
Lower core support plates	x		1,387,600	19.45	58.35	43.74	71,342
Upper core support plates	x		206,600	13.43	40.2	20.12	15,383
PWR Operations							
Crud tank filters		x	1.8	1.37	2.75	0	1
In-core instrument strings	x		529,300	15.365	76.83	9.992	34,448
Miscellaneous cartridge filters		x	1,718	58.32	116.5	0	29
Primary sources	x		1,999.8	0.0258	0.0258	0.0258	77,512
Thimble plugs or assemblies	x		40,490	2.613	52.4	0	15,496
BWR Decommissioning							
Core shroud	x		1,930,000	74.1	222	167	26,046
Top fuel guide	x		1,340,000	34	21.8	21.8	39,412
Full system fuel-in resins		x	412	7.28	34	0	57
BWR Operations							
Control rod blades	x		956,000	48.8	244	24.4	19,590
Inner and outer control rod drive strainers		x	1,872	16.38	32.8	0	114
IRM/SRM dry tubes	x		192,700	2.49	12.42	3.1	77,390
Local power range monitors (LPRMs)	x		4,370	14.08	70.4	9.15	310
Underwater vacuum filter (fuel pool vacuum)		x	575	23.46	46.8	0	25
Total Activated Metal	x		35,537,060	476	1,565	785	74,696
Total Process Waste		x	10,896	221	335	22	49
Total GTCC Waste			35,547,956	697	1,900	806	50,989

a. Numbers in this table are accurate to only two significant figures

REGULATORY ANALYSIS

ICF established as the following primary bases for the regulatory analysis of potential values (benefits) and impacts (costs):

1. GTCC wastes generated by commercial nuclear power plants do not pose the same environment, health, and safety concerns as spent fuel because unlike spent fuel, GTCC wastes resist environmental degradation, generate less heat per gram, and cannot achieve criticality under any configuration;
2. In an environmental assessment of the license application for co-located storage of spent fuel and GTCC wastes at the Trojan Nuclear Plant, the NRC found that this activity would not result in significant incremental environmental impacts on the quality of the human environment; and
3. The performance criteria specified in Part 72 provide one acceptable set of criteria for the storage of GTCC wastes either in an ISFSI or MRS.

The regulatory analysis examined both the no-action and the proposed action alternatives. It also covered the anticipated affects of both alternatives on existing NRC regulations, the roles and authorities of Agreement States, and the current and planned waste management practices for GTCC wastes by Part 50 licensees.

The no-action alternative represents a denial of the petitioner's request for changes to Part 72 to specifically provide for storage of GTCC waste at an ISFSI or MRS, pending transfer to a permanent disposal facility. The NRC is likely to believe that existing regulations under Part 30 or Part 70 (or under equivalent Agreement State Part 30 or Part 70 regulations) allow for interim storage of GTCC waste co-located at an ISFSI. Although neither Part 30 nor Part 70 includes explicit criteria for storage of GTCC waste co-located at an ISFSI or MRS, a Part 50 licensee could propose acceptance criteria for NRC's review and approval. Consequently, the petitioner's request would simply provide licensees an additional option of storing GTCC waste under a Part 72 license using the general design criteria in Subpart F.

NRC is likely to believe that the performance criteria specified in Part 72 provide one acceptable set of criteria for the storage of GTCC wastes co-located in either an ISFSI or MRS. Further, GTCC wastes generated by commercial nuclear power plants would not pose the same environment, health, and safety concerns as spent fuel because unlike spent fuel, GTCC wastes resist environmental degradation, generate less heat per gram, and cannot achieve criticality under any configuration. Consequently, the NRC is likely to believe that existing regulations related to worker health and safety and environmental protection are more than adequate for the storage of GTCC waste in either an ISFSI or MRS.

Licensees may propose criteria for interim storage of GTCC waste co-located in either an ISFSI or MRS, which the NRC will review on a case-specific basis. However, licensees that fail to demonstrate reasonable assurance of compliance for interim storage of GTCC waste co-located in either an ISFSI or MRS, must continue to store such waste according to current licensing conditions (e.g., Part 50 licensees would continue to store GTCC waste in their spent fuel pools).

In general, GTCC waste is expected to be in a solid waste form. However, other GTCC waste forms would be considered for co-located, interim storage at the ISFSI (or MRS) provided that the licensee demonstrates that such waste meets acceptable criteria. The NRC may approve other provisions for the classification and characteristics of GTCC waste not currently identified on a case-specific basis if, after an evaluation of the actual characteristics of the waste or method of interim storage, NRC finds reasonable assurance that the waste will be safely stored. Regardless, any utility that chooses to pursue co-located, interim storage of GTCC waste in either an ISFSI or MRS under a Part 30 or Part 70 license is obligated to comply with all applicable licensing requirements in those Parts, as well as other applicable requirements for LLW. In order to facilitate eventual disposal and avoid regulation of either ISFSIs or

MRS facilities by both the NRC and an Agreement State, the NRC staff intends to prohibit the commingling of GTCC waste and spent fuel stored in a single container.

The requested action represents an approval of the petitioner's request for changes to Part 72 to specifically provide for storage of GTCC waste at an ISFSI or MRS pending its transfer to a permanent disposal facility. This option would modify existing regulations to allow storage of GTCC waste under Part 72 using the performance criteria of that part. Storage and licensing requirements would be fully contained in Part 72. Storage of GTCC waste would be permitted under a Part 72 general or specific license. This option meets the request of the petitioner and provides an alternate means of implementing what is already permitted by the regulations (storage of GTCC waste at an ISFSI or MRS). That is, revising the regulations to allow storage of GTCC waste under Part 72 does not preclude storing it under Part 30 or Part 70 if a licensee so chooses.

ENVIRONMENTAL ASSESSMENT

For the No-Action Alternative, NRC's "Generic Environmental Impact Statement (GEIS) on Spent Fuel Storage" (3) found a low potential for creating an environmental hazard from spent fuel storage at an ISFSI. As discussed in the rulemaking for Part 72 (4), a license to store spent fuel in a dry storage facility will be judged on its merits and no such license will be issued unless the proposed facility is technically adequate from a safety standpoint. License conditions imposed under Part 72 for an ISFSI (or MRS) will define the limiting characteristics of the spent fuel that can be stored in the facility. This rulemaking also stated that,

"An ISFSI is not expected to store irradiated core components other than those associated with spent fuel assemblies. If such a need should arise, it could be handled by a specific application which would be evaluated on its merits as an exception under Section 72.7."

GTCC waste is less hazardous than spent fuel from a radiological, chemical, and physical standpoint. The GTCC waste is also in the form of solid waste (i.e., mostly activated metals) such as reactor internals, nozzles, and in-core instrumentation. In addition, storage of GTCC waste at an ISFSI or MRS would be in a passive mode with no human intervention needed for safe storage. Therefore, the NRC believes that GTCC waste can be stored at an ISFSI or MRS safely and without significant environmental impacts.

In August 1984, the NRC published an environmental assessment for the proposed revision to Part 72 (5), which discussed the major issues of the rule and the potential impacts on the environment. The findings of the environmental assessment were:

"(1) past experience with water pool storage of spent fuel establishes the technology for long-term storage of spent fuel without affecting the health and safety of the public, (2) the proposed rulemaking to include the criteria for 10 CFR Part 72 for storing spent nuclear fuel and high-level waste does not significantly affect the environment, (3) solid high-level waste is comparable to spent fuel in its heat generation and in its radioactive material content on a per metric ton basis, and (4) knowledge of dry storage conditions and the ability to institute repairs in a reasonable manner without endangering the health [and safety] of the public shows dry storage technology options do not significantly impact the environment."

The assessment concluded that there are no significant environmental impacts as a result of promulgation of the revisions to 10 CFR Part 72.

Based on that assessment, the NRC would conclude that interim storage of GTCC waste co-located at an ISFSI or MRS would not result in significant incremental environmental impacts on the quality of the human environment.

Potential Adverse Impacts

Although the GEIS found that an ISFSI has low potential for adversely impacting health, safety, and the environment, there are certain minor adverse impacts associated with the storage of radioactive waste in general and the storage of GTCC waste co-located at an ISFSI in particular. A presentation at the 15th Annual DOE LLW Conference detailed some of the potential hazards associated with long-term storage of LLW (6). Hazards applicable to interim storage of GTCC waste at an ISFSI were increased radiation exposure to workers and increased risk of accidents.

Storage of GTCC waste could result in exposure to workers during the packing of casks for storage, the unloading of waste for disposal, and during radiation surveys and site inspections. Although NRC has not conducted a quantitative analysis, it believes that the risk of potential releases from storage sites around the country is greater than the risk of a potential release from a disposal site. These risks, however, are associated with any storage facility for radioactive waste. Storage at an ISFSI reduces adverse impacts associated with other long-term interim storage options, such as degradation of storage containers.

The environmental assessment conducted for the Trojan ISFSI (7) predicted limited exposure to off-site populations as a result of storage of both spent fuel and GTCC waste in its proposed ISFSI, and determined that calculated exposure levels were well within Federal limits. Although occupational exposure was anticipated under normal operating conditions, working dose rates for the GTCC storage cask system were calculated to be lower than those for the fuel storage cask system. However, the assessment found that the impact of a tornado or lightning strike could result in increased exposure for workers conducting repairs to the GTCC storage casks. Such an event would result in a loss of concrete from the storage cask. While this would not result in a release of radioactive material to the environment, workers could receive a dose of radiation streaming through the damaged concrete. Because GTCC waste has higher activity than spent fuel, the dose on the exterior wall of a storage cask would increase roughly 10 times, resulting in a dose of approximately 490 millirem/hour to a worker repairing the cask. However, NRC found no significant impacts associated with the proposed ISFSI:

“The proposed action is not expected to cause any significant release of effluents, and there will be no significant increases in individual and collective radiation doses to either the public or on-site workers. Potential off-site impacts from a postulated worst-case credible accident are a small fraction of the regulatory limits of 10 CFR 72.106 and well below the U.S. Environmental Protection Agency’s Protective Action Guides.” (8)

Environmental Assessment Findings

Based on these previous analyses, the NRC is likely to determine that the adverse impacts associated with the storage of GTCC waste co-located at an ISFSI are insignificant, whereas the storage of this waste in the spent fuel pool would mean continued generation of solid and liquid LLW.

CONCLUSIONS

Based on analyses of the potential regulatory and environmental impacts of the use of ISFSIs and MRS facilities for interim storage of GTCC wastes, the authors found that:

1. In general, GTCC wastes can be grouped into two categories: activated metals – irradiated metal components from nuclear reactors (e.g., core shrouds, support plates, and core barrels) and process wastes – filters and resins resulting from the operation and decommissioning of nuclear reactors. GTCC wastes are generated during both reactor operations and decommissioning. Operations wastes include non-fuel reactor core components, such as thimbles, in-core instrumentation, fuel channels, control assemblies, and flux wires, neutron sources, fission

- chambers, spent ion-exchange resins, and sludges. Decommissioning wastes include stainless steel core shrouds, spent resins, sludges, and other materials.
2. The total projected activity, volume, and concentration for activated metal GTCC waste are 35.5 megacuries (MCi), 785 cubic meters (m³), and 74,696 Ci/m³, respectively. For process GTCC wastes, the total project activity, volume, and concentration are 10,896 Ci, 22 m³, and 49 Ci/m³, respectively.
 3. Currently, there are no routine disposal options for GTCC wastes. Nuclear utilities store their GTCC wastes under their Part 50 license, either within the reactor vessel or in the spent fuel pool, pending development of a suitable disposal facility. The NRC's existing licensing requirements of Part 72 only provide for storage of spent fuel in an ISFSI and storage of spent fuel and solid high-level waste in a MRS facility. Although a reactor licensee could elect to store GTCC waste at an away-from reactor storage facility under licenses issued by other NRC regulations, the existing requirements in Part 30 and Part 70 do not provide specific licensing criteria for interim storage of GTCC waste at these types of facilities.
 4. GTCC wastes generated by commercial nuclear power plants do not pose the same environment, health, and safety concerns as spent fuel because unlike spent fuel, GTCC wastes resist environmental degradation, generate less heat per gram, and cannot achieve criticality under any configuration. Further, in an environmental assessment of the license application for co-located storage of spent fuel and GTCC wastes at the Trojan Nuclear Plant, the NRC found that interim storage of such wastes in an ISFSI would not result in significant incremental environmental impacts on the quality of the human environment.
 5. In general, the performance criteria specified in Part 72 provide an acceptable set of criteria for the interim storage of GTCC wastes either in an ISFSI or MRS.

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FOOTNOTES

- a. In this paper, "co-located" means interim storage of GTCC waste in an approved cask and placement of that cask on the ISFSI storage pad in such a manner that the GTCC waste is

physically located outside the boundary established by spent fuel stored in that facility. Hence, the term “co-located” is used herein only when interim storage of GTCC in an ISFSI (or MRS) is licensed under regulations found in either Parts 30 and/or 70, or both.

- b. These spare slots or racks, which cannot be reached by the overhead crane, are usually found along the periphery of the spent fuel pool.