

**THE STATE OF SOUTH CAROLINA
In The Court of Appeals**

Sierra Club, Appellant,

v.

South Carolina Department of Health and Environmental
Control and Chem-Nuclear Systems, LLC, Respondents.

Appellate Case No. 2012-212791

Appeal From The Administrative Law Court
Ralph King Anderson, III, Administrative Law Judge

Opinion No. 5253
Heard February 5, 2014 – Filed July 30, 2014
Withdrawn, Substituted and Refiled August 12, 2015

AFFIRMED IN PART, REVERSED IN PART

Amy Elizabeth Armstrong and Michael Gary Corley,
S.C. Environmental Law Project, both of Pawleys Island,
and Robert Guild, of Columbia, for Appellant.

Mary Duncan Shahid and Stephen Peterson Groves, Sr.,
both of Charleston, and Sara S. Rogers, of Columbia, all
of Nexsen Pruet, LLC, for Respondent Chem-Nuclear
Systems; Claire Harley Prince and Jacquelyn Sue
Dickman, both of Columbia, for Respondent South
Carolina Department of Health & Environmental
Control.

FEW, C.J.: This is an appeal from the administrative law court (ALC), which upheld the South Carolina Department of Health and Environmental Control's (DHEC) decision to renew the license under which Chem-Nuclear Systems, LLC operates a disposal facility for low-level radioactive waste. We affirm the ALC as to all issues, except four subsections of the regulation governing DHEC's issuance and renewal of such licenses. *See* 24A S.C. Code Ann. Regs. 61-63, pt. VII (1992 & Supp. 2010).

I. Procedural History

Chem-Nuclear operates a disposal facility for low-level radioactive waste in Barnwell County (the "facility") pursuant to a license DHEC first issued in 1971. Part VII of regulation 61-63—entitled "Licensing Requirements for Land Disposal of Radioactive Wastes"—establishes "specific technical requirements" and "performance objectives" "upon which [DHEC] issues licenses for the land disposal of wastes." 24A S.C. Code Ann. Regs. 61-63 § 7.1.1, 7.1.3 (1992). Before DHEC may renew Chem-Nuclear's license to operate the facility, it must determine Chem-Nuclear designed, constructed, and operates the facility in compliance with the requirements and objectives of part VII of regulation 61-63. *See generally* § 7.1.

In 2000, Chem-Nuclear submitted an application to renew its license. After holding a public hearing and accepting comments, DHEC issued a renewal license to Chem-Nuclear in 2004. DHEC's decision to renew the license was challenged on the basis that the disposal methods at the facility do not meet certain requirements and objectives of part VII of the regulation. The ALC issued an order affirming DHEC's decision to renew the license (the "2005 order"), and found Chem-Nuclear complied with subsections 7.10.1 through 7.10.4 of South Carolina Code Regulation 61-63 (1992 & Supp. 2010) and section 7.18 of South Carolina Code Regulation 61-63 (1992). However, the ALC ordered Chem-Nuclear to conduct further studies to address concerns "related to the potential for groundwater contamination on and near the [facility]." In particular, the 2005 order stated these studies must "concern[] methods to reduce contact between radioactive waste and rainfall and other water at its facility" and ordered Chem-Nuclear to submit the results of the studies to DHEC within 180 days.

This court's opinion reviewing the findings of the 2005 order is reported at 387 S.C. 424, 693 S.E.2d 13 (Ct. App. 2010) (*Chem-Nuclear I*). We affirmed the findings related to section 7.18 and subsections 7.10.1 through 7.10.4. 387 S.C. at 438, 693 S.E.2d at 20. However, we remanded the case to the ALC to apply its

factual findings from the 2005 order to determine whether Chem-Nuclear complied with the following subsections of regulation 61-63: 7.11.1 through 7.11.12 (1992 & Supp. 2010), 7.23.6 (1992), and 7.10.5 through 7.10.10 (1992 & Supp. 2010). 387 S.C. at 435, 436, 438, 693 S.E.2d at 18-19, 20.

On remand, the ALC issued an order affirming DHEC's conclusion that Chem-Nuclear complied with these subsections (the "remand order"). In this appeal, we review the findings in the remand order. After we filed our first opinion, Op. No. 5253 (S.C. Ct. App. filed July 30, 2014) (Shearouse Adv. Sh. No. 30 at 53), DHEC and Chem-Nuclear petitioned for rehearing. We granted a stay of the relief ordered in the first opinion on August 28, 2014, and we now grant both petitions for rehearing. We withdraw our original opinion and substitute this opinion.

II. Factual Findings in the 2005 Order

Following this court's instructions, the ALC considered on remand only the findings from the 2005 order. In reviewing the remand order, therefore, we likewise consider only the findings from the 2005 order. In this section of the opinion, we recite those findings relevant to our review. Unless otherwise indicated, all quotations in this section are from the 2005 order.

A. Overview of Chem-Nuclear's Disposal Practices

Chem-Nuclear disposes of waste at the facility using "enhanced shallow land burial with engineered barriers." An engineered barrier is "a man-made structure or device that is intended to improve the land disposal facility's ability to meet the performance objectives" set out in part VII of regulation 61-63. 24A S.C. Code Ann. Regs. 61-63 § 7.2.9 (Supp. 2010). The primary engineered barriers used by Chem-Nuclear are disposal trenches, disposal vaults, and enhanced caps.

Initially, waste is shipped to the facility in a disposal container. *See* 24A S.C. Code Ann. Regs. 61-63 § 3.2.30 (Supp. 2010) ("Disposal container' means a container principally used to confine low-level radioactive waste during disposal operations at a land disposal facility . . . [and] for some shipments, the disposal container may be the transport package."). Depending on the type of waste, disposal containers are also shipped to the facility inside a container called a cask. When a shipment of waste arrives at the facility, it is directed to either the appropriate trench for disposal or the Cask Maintenance Building, where Chem-Nuclear performs quality control inspections to ensure the casks are not damaged. Following this inspection, Chem-Nuclear transports the casks to the appropriate

disposal trench where the disposal containers are loaded into reinforced concrete disposal vaults inside the trench. As disposal containers are loaded into vaults, Chem-Nuclear continues to inspect them.

Some "large components," such as steam generators and pressurizers, are considered disposal vaults themselves and can be placed directly into the trench after DHEC approves them for burial. Otherwise, all waste is contained inside a disposal container that is loaded into a vault, which is located within a trench.

Chem-Nuclear uses the term "active" to describe disposal vaults and trenches that are in the process of being filled. Thus, vaults are active until filled to capacity with disposal containers, and trenches are active until filled to capacity with vaults and large components. Once vaults and trenches become full, Chem-Nuclear refers to them as "inactive." When an individual vault becomes full, Chem-Nuclear covers the inactive vault with "general cover soils and an initial clay cap," which reduces "the infiltration of surface water into the trench." When a trench becomes full, Chem-Nuclear installs an "impermeable" multi-layer enhanced cap over the inactive trench, which consists of an initial clay cap, polyethylene and bentonite, a sand drain layer, and general soil materials.

Waste is divided into three classes—A through C—based on the concentration of "long-lived" and "shorter-lived radionuclides" in the waste. Class A is the least radioactive waste, while C is the most radioactive. *See* 24A S.C. Code Ann. Regs. 61-63 § 3.56.1.1 to .8 (Supp. 2010). Chem-Nuclear currently uses three types of disposal trenches that are designed to hold different types of waste: (1) Class A trenches, which are the largest of the three types, hold vaults containing Class A waste; (2) Class B/C trenches hold vaults containing Class B and C waste; and (3) slit trenches, which are narrow, hold irradiated hardware and large components. Chem-Nuclear uses soil to fill voids between the vaults in each type of trench, which "enhance[s] long-term stability of the entire trench system."

Each trench has a drainage system "to facilitate monitoring of water accumulation entering the trench." Chem-Nuclear also implements a "surface water management plan" to manage rainfall after it collects in trenches, which consists of pumping water into either adjacent trenches or a lined pond.

B. Tritium Contamination of Groundwater

Tritium is a radioactive isotope of hydrogen that is found in "trace amounts in groundwater throughout the world." *NRC Senior Management Review of Overall*

Regulatory Approach to Groundwater Protection (N.R.C., Rockville, M.D.), Feb. 9, 2011, at SECY-11-0019. Although tritium is naturally occurring, it is also a byproduct of the manufacture of nuclear power, and found in radioactive waste generated by nuclear power plants. *Id.*

The waste disposed of at the facility contains tritium. Rainfall "in and on the disposal trenches drives tritium into the groundwater beneath the facility." Chem-Nuclear initially discovered the presence of tritium in its disposal trenches in 1974. Chem-Nuclear determined that early disposal practices utilizing "unreliable containment and waste forms" led to this initial tritium contamination. However, these early containment methods "were acceptable at the time" under the regulations. In fact, they "were identical to practices at . . . other low-level radioactive waste disposal facilities."

Although "it is inadvisable to attempt to uncover or excavate" the old containers that caused the initial tritium release, improvements in disposal technology and changes in the operations at the facility have "enhanced site performance." In 1995, DHEC substantially revised part VII of regulation 61-63 to require engineered barriers for all waste classes disposed of at the facility. Specifically, DHEC required all waste, except large components, to be placed in vaults, and required enhanced caps to be installed on all inactive trenches. Chem-Nuclear began using vaults and enhanced caps to meet these new requirements. In addition, Chem-Nuclear began using high-integrity polyethylene disposal containers to hold certain waste forms and discontinued the disposal of unstable, liquid waste forms. All of these measures served to "reduce[] the amount of tritium migrating to groundwater."

DHEC imposes a regulatory limit on the amount of radioactive material Chem-Nuclear may release to the "general environment." *See* § 7.18. Although certain groundwater samples collected from beneath the facility show high concentrations of tritium, these samples are inappropriate for evaluating Chem-Nuclear's compliance with section 7.18. This is because DHEC regulates the release of radiation into the "general environment," § 7.18, not into the groundwater within the boundaries of the facility where there is no risk of public exposure. To determine whether Chem-Nuclear is in compliance with section 7.18, DHEC established a "compliance point"—defined as the "first point where a hypothetical member of the public might receive a dose of radiation"—at which it measures Chem-Nuclear's release of tritium into the general environment. This compliance point is located at Mary's Branch Creek, where the groundwater from beneath the facility flows into an above-ground stream. Chem-Nuclear regularly samples the

water from Mary's Branch Creek to determine whether there has been a release of tritium above the regulatory limit set by DHEC. Since 2001, tritium concentrations at the compliance point have been declining, and all measurements taken at Mary's Branch Creek have been well below the regulatory limit for exposure under section 7.18. In fact, "[t]here is no evidence of any actual release resulting in an exposure above regulatory limits to any member of the general public."

C. Actions to Prevent Tritium Exposure

Chem-Nuclear has taken steps to protect the public from exposure to radiation at the compliance point. The general public is restricted from accessing the waters of Mary's Branch Creek at the compliance point, and there are no known consumers of the water who are "located in and around the compliance point." Chem-Nuclear also erected a fence around the compliance point to prevent entry of unauthorized persons. Additionally, Chem-Nuclear has a restrictive covenant and easement on three parcels of property surrounding the compliance point. This property serves as a buffer zone by prohibiting the use of groundwater under the property, as well as surface water on the property, without written consent from DHEC. Moreover, changes in design and operations at the facility further reduce the potential for radioactive exposure to the general environment.

D. Long-Term Predictions for Compliance

As required by DHEC, Chem-Nuclear created a predictive model—the Environmental Radiological Performance Verification (ERPV)—to predict the future performance of the site for up to two thousand years. This model relies on data collected through a system of groundwater monitoring wells and thirty years of data derived from over two hundred sampling points. DHEC commissioned and funded a panel of experts—the "Blue Ribbon Panel"—to review the ERPV and determine whether Chem-Nuclear's predictions were accurate. After finding the ERPV predictions to be reliable, the Blue Ribbon Panel concluded the facility "pose[d] minimal risk to either the environment or members of the public, both today and into the long-term future." DHEC relied on the conclusions of both the ERPV and the Blue Ribbon Panel in deciding to renew the facility's license.

III. Standard of Review

In the 2005 order, the ALC conducted a de novo review of DHEC's decision to renew Chem-Nuclear's license. *See Marlboro Park Hosp. v. S.C. Dep't of Health*

& *Envtl. Control*, 358 S.C. 573, 579, 595 S.E.2d 851, 854 (Ct. App. 2004) (stating the ALC acts "as the fact-finder" in a contested case and "must make sufficiently detailed findings supporting the denial [or grant] of a permit application" (alteration in original) (citation omitted)). In *Chem-Nuclear I*, this court reviewed the ALC's findings and conclusions in the 2005 order to determine whether they were "[s]upported by substantial evidence or controlled by some error of law." *See* 387 S.C. at 430-31, 693 S.E.2d at 16 (relying on the standard of review set forth in S.C. Code Ann. § 1-23-610(B) (Supp. 2013)). Although we affirmed the ALC's determination that Chem-Nuclear complied with all sections of regulation 61-63 addressed in the 2005 order, we remanded for the ALC to apply the factual findings from the 2005 order to other, applicable sections it did not address. 387 S.C. at 439, 693 S.E.2d at 20-21. *See* 387 S.C. at 439, 693 S.E.2d at 20 (instructing the ALC "to apply its factual findings [from the 2005 order] to these sections of regulation 61-63" on remand). In the remand order, the ALC applied the factual findings from the 2005 order to determine whether Chem-Nuclear complied with these additional sections.

In this appeal from the remand order, we must accept the factual findings in the 2005 order. We review the remand order under the standard of review set forth in subsection 1-23-610(B)(d), and may reverse only if the ALC's decision was affected by an error of law. *See* § 1-23-610(B)(d) (stating an appellate court may reverse the ALC's decision when it is affected by an error of law); *S.C. Dep't of Revenue v. Blue Moon of Newberry, Inc.*, 397 S.C. 256, 260, 725 S.E.2d 480, 483 (2012) ("The construction of a regulation is a question of law to be determined by the court. We will correct the decision of the ALC if it is affected by an error of law, and questions of law are reviewed de novo." (internal quotation marks and citations omitted)).

IV. Chem-Nuclear's Compliance with Regulation 61-63

DHEC drafted part VII of regulation 61-63 to include three general categories of regulations. *See* § 7.1.3 ("This Part establishes procedural requirements[,] . . . performance objectives[,] . . . [and] specific technical requirements for near-surface disposal of radioactive waste . . ."). All three categories are applicable to the enhanced shallow land burial of low-level nuclear waste at the facility.¹ In this appeal, we address the ALC's determination that Chem-Nuclear complied with

¹ Subsection 7.1.3 provides that the "procedural requirements" and "performance objectives" apply "to any method of land disposal," and the "specific technical requirements" apply to "near-surface disposal of radioactive waste."

regulations in two of these categories—regulations imposing technical requirements and performance objectives. Generally, regulations containing technical requirements require Chem-Nuclear to take action to comply with the regulation, while regulations containing performance objectives require Chem-Nuclear to achieve certain results sought under the regulation. There is some overlap, however, between the action-based and result-based requirements of these two categories of regulations.

Some regulations imposing "technical requirements" require Chem-Nuclear to take a specific action to meet the requirement. For example, subsection 7.24.2 of South Carolina Code Regulation 61-63 (1992) requires that Chem-Nuclear place five meters of material above Class C waste when the disposal unit is full and made inactive. *See id.* (requiring Class C waste be disposed of "so that the top of the waste is a minimum of 5 meters below the top surface of the cover").² Other regulations imposing technical requirements do not list any specific action, but leave to Chem-Nuclear the choice of action to take to comply with the regulation. For example, subsection 7.11.11.7 of South Carolina Code Regulation 61-63 (Supp. 2010) requires "[t]he disposal units and the incorporated engineered barriers . . . be designed and constructed to . . . prevent[] contact between the waste and the surrounding earth."³ Chem-Nuclear's compliance with "technical requirements" regulations may be determined only by examining the specific actions taken by Chem-Nuclear. As to subsection 7.24.2 and others, the required action is specifically listed in the regulation. As to subsection 7.11.11.7 and others, Chem-Nuclear may choose what action to take to comply with the regulation. In both instances, Chem-Nuclear must take action to meet the technical requirements of the regulation.

On the other hand, compliance with a regulation imposing "performance objectives" must be determined by examining whether Chem-Nuclear obtained the results required by the regulation. An example of such a regulation is section 7.18, which requires reasonable efforts be made to maintain radioactive releases to the general public "as low as is reasonably achievable"—a concept known by the acronym "ALARA."⁴ This and other result-based "performance objective"

² Chem-Nuclear's compliance with subsection 7.24.2 is not an issue in this appeal.

³ We discuss Chem-Nuclear's compliance with subsection 7.11.11.7 in section IV.B.5 of this opinion.

⁴ Regulation 61-63 defines the "ALARA" standard as:

regulations require consideration of existing environmental conditions, such as the fact that tritium levels are declining in the groundwater below the facility and in the surface water of Mary's Branch Creek.

In *Chem-Nuclear I*, we affirmed the ALC's finding that Chem-Nuclear met the performance objectives of sections 7.18 and 7.10. 387 S.C. at 438, 693 S.E.2d at 20. Section 7.18 and the subsections of 7.10 that we addressed in *Chem-Nuclear I* relate to whether Chem-Nuclear is protecting the public from radioactive releases, and generally do not impose specific requirements as to how Chem-Nuclear must accomplish any particular result.⁵ In affirming Chem-Nuclear's compliance with section 7.18, we gave deference to the ALC's finding that "Chem-Nuclear . . . demonstrated adherence to ALARA . . . by taking appropriate measures to address tritium migration from the Barnwell facility and the potential for releases from other radionuclides." 387 S.C. at 429, 438, 693 S.E.2d at 15, 20. Showing similar deference, we affirmed the ALC's findings that Chem-Nuclear complied with four of the performance objectives in section 7.10. 387 S.C. at 438, 693 S.E.2d at 20.

[M]aking every reasonable effort to maintain exposures to radiation as far below the dose limits in this part as is practical consistent with the purpose for which the licensed activity is undertaken, taking into account the state of technology, the economics of improvements in relation to state of technology, the economics of improvements in relation to benefits to the public health and safety, and other societal and socioeconomic considerations, and in relation to utilization of nuclear energy and licensed materials in the public interest.

24A S.C. Code Ann. Regs. 61-63 § 3.2.6 (Supp. 2010).

⁵ See § 7.10.1 ("The issuance of the license will not constitute an unreasonable risk to the health and safety of the public."); § 7.10.2 ("The applicant is qualified . . . to carry out the disposal operations . . . in a manner that protects health and minimizes danger to life or property."); § 7.10.3 ("The . . . operations . . . are adequate to protect the public health and safety in that they provide reasonable assurance that the general population will be protected from releases of radioactivity . . ."); § 7.10.4 ("The . . . operations . . . are adequate to protect the public health and safety in that they will provide reasonable assurance that individual inadvertent intruders are protected . . .").

We found, however, the ALC did not address the six remaining subsections of 7.10 (7.10.5 through 7.10.10). 387 S.C. at 438-39, 693 S.E.2d at 20-21. We remanded for the ALC to determine whether Chem-Nuclear complied with those subsections. *Id.*

We also required the ALC to consider on remand Chem-Nuclear's compliance with section 7.11 and subsection 7.23.6. 387 S.C. at 435-36, 693 S.E.2d at 18-19. DHEC argued that in determining whether DHEC properly renewed the license, the ALC must consider compliance with the result-based requirements "set forth in section 7.10 . . . rather than apply criteria set forth in sections 7.11 and 7.23.6." 387 S.C. at 431, 693 S.E.2d at 16. We rejected that argument, finding "the technical requirements" of "section 7.11 impose[] additional compliance requirements for Chem-Nuclear such that the balancing test of ALARA would not be sufficient to address[] whether Chem-Nuclear is in compliance." 387 S.C. at 435, 693 S.E.2d at 18-19. Similarly, we found "the technical requirements of [sub]section 7.23.6 . . . impose[] additional compliance requirements for Chem-Nuclear." 387 S.C. at 436, 693 S.E.2d at 19. Under our holding in *Chem-Nuclear I*, therefore, the technical requirements of subsections 7.11.11 and 7.23.6 require Chem-Nuclear to take action to design and construct the disposal site, disposal units, and engineered barriers to meet the specifications in those subsections. *See* 387 S.C. at 432, 435, 436, 693 S.E.2d at 17, 19, 20. DHEC and Chem-Nuclear may not demonstrate compliance with those subsections simply by showing Chem-Nuclear met the performance objectives of other subsections. *See id.*

With these considerations in mind, we discuss the ALC's determination that DHEC properly found Chem-Nuclear complied with the applicable subsections of regulation 61-63.

A. Section 7.10⁶

The subsections of 7.10 that we review in this appeal⁷ set forth performance objectives for the issuance and renewal of Chem-Nuclear's license. The

⁶ In this section, we discuss compliance with subsections 7.10.6 and 7.10.8, and not 7.10.7, because our analysis of that subsection depends on whether Chem-Nuclear complied with the relevant subsections of 7.11.11. We later discuss subsection 7.10.7 in section IV.D. of this opinion.

⁷ Chem-Nuclear's compliance with subsections 7.10.5, 7.10.9, and 7.10.10 is not an issue in this appeal.

correctness of DHEC's and the ALC's determination of compliance with subsections 7.10.6 and 7.10.8 depends, in part, on Chem-Nuclear's progress in reducing the amount of tritium released from the facility. In reviewing the ALC's findings as to these subsections, therefore, we rely upon evidence that shows its operations are "adequate to protect the public health and safety," which includes the following result-based evidence: (1) Chem-Nuclear's disposal operations currently meet the ALARA standard; (2) "improvements in waste disposal procedures" have enhanced site performance; and (3) there is a decline in the "tritium concentration at the compliance point."

1. Subsection 7.10.6

Subsection 7.10.6 provides that before DHEC may issue a license to Chem-Nuclear, it must find:

[Chem-Nuclear]'s proposed disposal site, disposal site design, land disposal facility operations, disposal site closure, and postclosure institutional control are adequate to protect the public health and safety in that they will provide reasonable assurance that long-term stability of the disposed waste and the disposal site will be achieved and will eliminate to the extent practicable the need for ongoing active maintenance of the disposal site following closure.

This subsection focuses our analysis on Chem-Nuclear's efforts to protect the public, the environment, and inadvertent intruders from radioactive exposure by ensuring "long-term stability of the disposed waste and the disposal site." We begin our discussion with the definitions of the relevant terms used in subsection 7.10.6.

"Site closure" is defined as "those actions that are taken upon completion of operations that prepare the disposal site for custodial care [by the State of South Carolina] and that assure that the disposal site will remain stable and will not need ongoing active maintenance." 24A S.C. Code Ann. Regs. 61-63 § 7.2.19 (1992).

Once site closure is accomplished, the "institutional control" period begins, in which the State of South Carolina "assume[s] responsibility" for maintaining the facility, 24A S.C. Code Ann. Regs. 61-63 §§ 7.8.1, 7.15 (1992), and "control[s]

access to the disposal site." 24A S.C. Code Ann. Regs. 61-63 § 7.27.2 (1992). By regulation, the institutional control period is one hundred years. *Id.*

"Stability" is defined as "structural stability." 24A S.C. Code Ann. Regs. 61-63 § 7.2.20 (1992). According to Part III of regulation 61-63, structural stability results from: (1) "the waste form itself" being stable, or "processing the waste to stable form"; (2) converting waste containing liquid "into a form that contains as little free-standing and non-corrosive liquid as is reasonably achievable"; and (3) filling "[v]oid spaces within the waste and between the waste and its package." 24A S.C. Code Ann. Regs. 61-63 § 3.56.2.2.1 to .3 (Supp. 2010).

"Active maintenance" means "any significant activity needed during the period of institutional control to maintain a reasonable assurance that the performance objectives in 7.18 and 7.19 are met." 24A S.C. Code Ann. Regs. 61-63 § 7.2.1 (1992). As we previously discussed, section 7.18 regulates the concentration of radioactive material that may be released to the general environment and the public. Section 7.19 of South Carolina Code Regulation 61-63 (1992) requires that the "[d]esign, operation, and closure of the land disposal facility . . . ensure protection of any individual inadvertently intruding into the disposal site and occupying the site or contacting the waste at any time after active institutional controls over the disposal site are removed." An "inadvertent intruder" is a "person who might occupy the disposal site after closure and engage in . . . activities . . . in which an individual might be unknowingly exposed to radiation from the waste." 24A S.C. Code Ann. Regs. 61-63 § 7.2.13 (1992).

The following findings from the 2005 order support the ALC's determination that the waste and disposal site are structurally stable:

- (1) All waste is placed into reinforced concrete disposal vaults;
- (2) Void space between the vaults is filled with soil, which enhances "long-term stability of the entire trench system";
- (3) Enhanced caps are installed on all inactive trenches;
- (4) "[T]he elimination of liquid waste forms . . . have increased site performance"; and
- (5) "Improvements in waste forms . . . have succeeded in reducing the amount of tritium that is migrating to groundwater."

Additionally, the following findings support the determination that *long-term* stability of the disposed waste and disposal site will be achieved and will be

adequate to protect the general public and inadvertent intruders from radioactive exposure:

- (1) Predictions of a declining trend in radioactive releases to the general environment;
- (2) The Blue Ribbon Panel's conclusion that the facility "poses a minimal risk to either the environment or members of the public, both today and into the long-term future";
- (3) The presence of a buffer zone, which provides "long-term protection to the public from exposure to radioactive material in the surface water at the compliance point"; and
- (4) The use of concrete disposal vault lids⁸ for Class C waste, which serves as an intrusion barrier for inadvertent intruders.⁹

Based on these findings, we find the ALC did not err in concluding Chem-Nuclear is in compliance with subsection 7.10.6.

2. Subsection 7.10.8

Subsection 7.10.8 requires Chem-Nuclear to provide a "proposal for institutional control" that gives "reasonable assurance that such control will be provided for the length of time found necessary to ensure the findings in 7.10.3 through 7.10.6 and that the institutional control meets the requirements of 7.27." On appeal, Chem-Nuclear's compliance with this subsection is challenged on the ground that it violated subsection 7.10.6.¹⁰ As previously discussed, subsection 7.10.6 requires the design and operations of the facility to provide "long-term stability of the

⁸ We are uncertain of the nature and purpose of disposal vault lids. Neither the regulations nor the 2005 order defines "disposal vault lid," and the 2005 order references disposal lids only twice and in two limited contexts: (1) "the lids of the vaults are not grouted or otherwise sealed to prevent water from entering the vault"; and (2) "[t]he disposal vault lids serve as an intrusion barrier for Class C waste."

⁹ Subsection 3.56.1.2.3 requires Class C waste to be disposed of in a manner that "protect[s] against inadvertent intrusion."

¹⁰ We previously affirmed Chem-Nuclear's compliance with subsections 7.10.3 and 7.10.4. *Chem-Nuclear I*, 387 S.C. at 438, 693 S.E.2d at 20. Chem-Nuclear's compliance with subsection 7.10.5 is not an issue on appeal.

disposed waste." When considered in the context of subsection 7.10.6, subsection 7.10.8 requires Chem-Nuclear to provide reasonable assurances the waste will be stable after the facility is closed. Based on our ruling regarding subsection 7.10.6, we find the ALC correctly determined Chem-Nuclear is in compliance with subsection 7.10.8.

B. Subsection 7.11.11

Subsection 7.11.11 provides, in relevant part,

The disposal units and the incorporated engineered barriers shall be designed and constructed to meet the following objectives:

7.11.11.1 to minimize the migration of water onto the disposal units.

7.11.11.2 to minimize the migration of waste or waste contaminated water out of the disposal units.

7.11.11.4 temporary collection and retention of water and other liquids for a time sufficient to allow for the detection and removal or other remedial measures without the contamination of groundwater or the surrounding soil.

7.11.11.6 reasonable assurance that the waste will be isolated for at least the institutional control period.

7.11.11.7 prevention of contact between the waste and the surrounding earth, except for earthen materials which may be used for backfilling within the disposal units.

DHEC and Chem-Nuclear continue to assert that in reviewing the ALC's findings as to subsection 7.11.11, we may rely on result-based evidence—(1) its operations meet the ALARA standard, (2) "improvements in waste disposal procedures" have enhanced site performance, and (3) there is a decline in the "tritium concentration at the compliance point." As we previously acknowledged, evidence of improvements in disposal practices and a decline in tritium concentrations is certainly relevant to our analysis of compliance with the regulations containing

performance objectives. However, that evidence does not directly relate to, and cannot alone show compliance with, the technical requirements imposed by subsection 7.11.11. *See* 387 S.C. at 435, 693 S.E.2d at 18-19 (holding "the [specific] technical requirements" of "section 7.11 impose[] additional compliance requirements for Chem-Nuclear such that the balancing test of ALARA would not be sufficient to address[] whether Chem-Nuclear is in compliance"). For these subsections of the regulation, compliance may not be measured solely by results. Instead, we must consider whether Chem-Nuclear took any actions to meet the technical requirements imposed by these subsections, and if so, the sufficiency of Chem-Nuclear's actions.

1. Subsection 7.11.11.1

Subsection 7.11.11.1 requires that Chem-Nuclear design and construct its disposal units and engineered barriers "to minimize the migration of water onto the disposal units."

The regulations define "disposal unit" to include "a vault or a trench," 24A S.C. Code Ann. Regs. 61-63 § 7.2.8 (Supp. 2010), and "engineered barrier" to include "vaults or equivalent structures," § 7.2.9. The regulations, however, do not define the phrase "migration of water." DHEC concedes the phrase encompasses not only the flow of surface water, but also rainfall. We need not rely on DHEC's concession, however, because we find the subsection clearly applies to rainfall. Thus, for DHEC to have correctly determined Chem-Nuclear complied with this subsection, DHEC must have found Chem-Nuclear took action that reduced rainfall and the flow of surface water onto the vaults and trenches. Chem-Nuclear's compliance concerning the migration of rainfall onto disposal units is particularly important, given the following findings from the 2005 order: (1) "[t]ritium is driven into the groundwater through rainfall in and on the disposal trenches," and (2) tritium concentrations in the groundwater seem to "vary[] with the amount of rainfall." Referring to these and other findings, the ALC called this "the undeniable 'rainfall problem.'"

We first examine whether the ALC correctly determined Chem-Nuclear complied with subsection 7.11.11.1 in regard to rainfall migrating onto active disposal units—vaults and trenches that are in the process of being filled. The 2005 order provides that while Chem-Nuclear is filling individual vaults with disposal containers, it employs "no cover or roof, so rain can fall directly into the vault during the loading period." The 2005 order also indicates Chem-Nuclear provides no cover for active trenches, which leaves these trenches and the vaults contained

within them exposed to rainfall until the trenches become full. Vaults contained within an active trench remain exposed to rainfall for up to two years while Chem-Nuclear fills the trench. The 2005 order further states rainfall enters vaults because they "are not sealed against water intrusion," and the "lids of the vaults are not . . . sealed to prevent water from entering" them.

DHEC interprets subsection 7.11.11.1 as requiring Chem-Nuclear to "minimize the migration of water onto the disposal units" during the period in which the trenches are active. This interpretation required DHEC to consider what action Chem-Nuclear took to reduce the amount of rain falling onto open vaults while they are being filled, and onto closed vaults in active trenches. However, neither the 2005 order, the remand order, nor any other portion of the record or the briefs contain any evidence that Chem-Nuclear has taken a single action to stop a single raindrop from falling onto active vaults or trenches.

Although the ALC determined Chem-Nuclear complied with this subsection, none of the evidence it relied upon addresses the rainfall issue. Specifically, the ALC listed the following factual findings from the 2005 order to support DHEC's determination of compliance as to active and inactive disposal units:

- (1) The Class A trench has a sloped floor and a drainage system that facilitates monitoring of water that enters the trench;
- (2) The Class B/C trench contains a French drain and sump system that allows monitoring of water accumulation in the trench;
- (3) The slit trench has a sloped floor that is filled with "coarse drain sand" and contains "standpipes" that monitor water accumulation;
- (4) Chem-Nuclear implements a surface water management plan to pump water out of trenches.

We find none of these findings support the ALC's determination that Chem-Nuclear complied with this subsection as to rain falling on disposal units—active or inactive. These findings relate to remedial measures to monitor, drain, and manage water that has already migrated onto disposal units. The plain language of this subsection, however, requires Chem-Nuclear to do more than monitor, drain, or otherwise manage water once it enters the vaults and trenches.¹¹ These

¹¹ Other subsections of regulation 61-63 deal with accumulation of water within disposal units once it migrates there. *See, e.g.*, § 7.23.6 (requiring the disposal site to be designed in a way that "minimize[s] . . . the contact of *standing water* with

measures listed by the ALC have no effect on the initial migration of rainfall and thus, do not relate to compliance with subsection 7.11.11.1. Furthermore, the record is devoid of any evidence to support the ALC's conclusion that Chem-Nuclear has done *anything* to reduce rainfall onto active disposal units. When pressed at oral argument to list what Chem-Nuclear has done to reduce rainfall onto active disposal units, neither Chem-Nuclear nor DHEC could name one action Chem-Nuclear took, except to construct berms along the edges of trenches.¹²

The ALC also listed the following two factual findings, in addition to the four discussed above, to affirm DHEC's determination of compliance with this subsection as to rainfall on inactive disposal units only:

- (5) Backfilling methods that fill voids between vaults are implemented for all trenches; and
- (6) Initial clay caps placed on inactive vaults and enhanced caps installed over inactive trenches minimize the infiltration of surface water into the trench.

We find neither of these findings support—and only one actually addresses—the ALC's determination that Chem-Nuclear complied with this subsection as to inactive disposal units. Regarding finding (5), "backfilling methods" involve placing soil in open spaces between the vaults, which has nothing to do with reducing the migration of water onto disposal units. Finding (6), however, is relevant to Chem-Nuclear's compliance with subsection 7.11.11.1 as to inactive disposal units. The installation of the initial clay cap on inactive vaults and the enhanced cap on inactive trenches reduces the migration of water onto these disposal units. Although these measures *reduce* the migration of water, subsection 7.11.11.1 requires Chem-Nuclear to "minimize" this occurrence. Thus, whether finding (6) supports Chem-Nuclear's compliance with this subsection requires us to consider the meaning of "minimize."

waste during disposal, and the contact of *percolating* or *standing water* with wastes after disposal" (emphasis added)).

¹² While berms may keep surface water from migrating onto the disposal units, they do nothing to minimize direct rainfall onto active trenches and vaults. Additionally, the ALC made no findings as to whether Chem-Nuclear ever constructed a berm, or if so, whether the berms reduce the migration of surface water onto the disposal units.

Regulation 61-63 does not define minimize. Chem-Nuclear and DHEC filed a joint brief with this court in which they set forth the following definition of minimize: "to reduce to the smallest possible amount, extent, size, or degree."¹³ Applying this definition to the requirements of subsection 7.11.11.1, we must consider two sub-issues in analyzing compliance: (1) whether there is evidence to support a finding that Chem-Nuclear has reduced the migration of water onto disposal units, and (2) whether the extent of this reduction is adequate to meet DHEC's definition of minimize. Thus, we cannot find the ALC correctly determined Chem-Nuclear complied with this subsection simply because Chem-Nuclear "reduced" the migration of water onto disposal units.

As to the first sub-issue, we agree with the ALC that installation of initial clay caps and enhanced caps reduce the migration of surface water and rainfall onto inactive vaults and trenches. However, the ALC did not address the second sub-issue—whether initial clay caps and enhanced caps "reduce to the smallest possible amount" the migration of water onto inactive disposal units. Both DHEC and Chem-Nuclear represented to this court in their brief that Chem-Nuclear must have taken action to "reduce [the migration of water onto inactive trenches] to the smallest possible amount." Yet, neither DHEC nor the ALC made any finding as to whether Chem-Nuclear did so. The determination of this issue is crucial to the question of whether Chem-Nuclear complied with subsection 7.11.11.1.

In considering whether Chem-Nuclear's disposal units and engineered barriers adequately reduce—"minimize"—the migration of water, we acknowledge it is the duty of DHEC, not this court, to enforce regulation 61-63. Similarly, it is the duty of Chem-Nuclear, not DHEC, to take the necessary action to comply with the

¹³ While this definition sets a strict standard for compliance, we find this is supported by the way in which this regulation, and others, are written. For example, subsection 7.23.6 requires Chem-Nuclear to "minimize to the extent practicable" the contact of water with waste at different stages of the disposal process. We interpret subsection 7.23.6 as imposing a less stringent standard for compliance than subsection 7.11.11.1 because the term "minimize" is followed by language prompting DHEC to consider the reasonableness of Chem-Nuclear's efforts to comply. The lack of similar language in subsection 7.11.11.1 suggests there is no inherent reasonableness or practicability consideration involved in analyzing Chem-Nuclear's compliance. The definition of "minimize" provided by Chem-Nuclear and DHEC accords with this interpretation. Thus, we rely on their definition of minimize—"to reduce to the smallest possible amount, extent, size, or degree"—in analyzing DHEC's and the ALC's determinations of compliance.

regulations. Nevertheless, we find support in the 2005 order that implementing "relatively simple measures" could further reduce the migration of water onto both active and inactive disposal units. These measures include "shelter[ing] the disposal trenches from rainfall" while they are being filled and "sealing and grouting the concrete disposal vaults to prevent the intrusion of water."

In 2001, DHEC directed Chem-Nuclear to consider implementing such measures. According to the 2005 order, "during the review of the re-issuance of the Chem-Nuclear license, DHEC . . . advis[ed] Chem-Nuclear to review and revise all trench construction details, plans, specifications, and procedures." "In particular, [DHEC] informed Chem-Nuclear that consideration should be given to protection of the open trenches from direct rainfall and runoff such as temporary covers." In response to this directive, Chem-Nuclear considered "several conceptual trench designs," including designs for "temporary roofs to keep water out of the trenches and vaults." Although Chem-Nuclear informed DHEC in 2001 it would take "up to two years to evaluate [these] designs," the ALC found in the 2005 order "Chem-Nuclear ha[d] not completed its evaluation and ha[d] not submitted final designs to DHEC for review and approval."

The ALC found it significant that Chem-Nuclear had not yet completed and submitted these final designs to DHEC, given the "undeniable 'rainfall problem.'" Specifically, the 2005 order stated, "Chem-Nuclear has already considered conceptual designs to keep rainfall out of the trenches, . . . [but] it failed to complete a report on its research and has not submitted such a report to DHEC, despite its request." Additionally, the ALC found further studies "were needed to evaluate the . . . feasibility of employing or implementing designs" that would: (1) "shelter disposal trenches from rainfall and prevent rainfall from entering the trenches," and (2) "provide for sealing and grouting the concrete disposal vaults to prevent the intrusion of water to the maximum extent feasible." The order explained these additional studies were necessary because "no evidence was presented . . . that the Blue Ribbon Panel considered any of these particular issues." The ALC ordered that "Chem-Nuclear shall conduct the[se] studies . . . and submit the results to DHEC within 180 days."

These findings and directives from the 2005 order support the importance of implementing measures to address concerns related to rainfall on the disposal units. Both DHEC and the ALC ordered Chem-Nuclear to consider such measures. However, none are currently in place, a fact directly relevant to Chem-Nuclear's ability to reduce water migration onto the disposal units "to the smallest possible amount."

In conclusion, we find the record in this case conclusively demonstrates Chem-Nuclear has taken no action whatsoever to prevent even one raindrop from migrating onto one active vault or trench.¹⁴ Additionally, while initial clay caps and enhanced caps reduce the migration of water onto inactive disposal units, there is no evidence and no finding by the ALC that DHEC has required, or that Chem-Nuclear has taken, any action that would reduce this migration to the smallest possible amount. In light of these facts, we hold the ALC erred in affirming DHEC's conclusion that Chem-Nuclear complied with subsection 7.11.11.1.

2. Subsection 7.11.11.2

Subsection 7.11.11.2 requires that Chem-Nuclear design and construct its disposal units and engineered barriers "to minimize the migration of waste or waste[-] contaminated water out of the disposal units." DHEC and Chem-Nuclear contend the same definition of minimize used in the previous section applies to the analysis of this subsection.

Based on the plain language of subsection 7.11.11.2, Chem-Nuclear must minimize the migration of two types of wastes: (1) the radioactive waste-form contained within the disposal containers, and (2) water that has been contaminated by radioactive waste. As to the first, we agree with the ALC's determination that Chem-Nuclear's disposal units and engineered barriers minimize the migration of radioactive waste-forms out of disposal units. The record establishes that Chem-Nuclear uses disposal containers and reinforced concrete vaults, which prevent the migration of these waste-forms out of disposal units. Thus, we affirm the ALC's

¹⁴ DHEC argues in its petition for rehearing that we "misapprehended the requirement of subsection 7.11.11.1" because "[t]he regulation does not require a design that prevents rainfall onto the disposal units." We do not believe our opinion can be fairly read to require Chem-Nuclear to prevent all rainfall onto the disposal units. Rather, the opinion is written to the requirement in subsection 7.11.11.1 that Chem-Nuclear "minimize" rainfall. *See* § 7.11.11.1 (requiring that Chem-Nuclear design and construct its disposal units and engineered barriers "to *minimize* the migration of water onto the disposal units" (emphasis added)). We chose the phrase "prevent even one raindrop from migrating onto one active vault or trench" in contemplation of the reality that to minimize rainfall onto disposal units, Chem-Nuclear must start by taking some action in an attempt to stop one drop of rain. We are struck by the lack of any evidence that Chem-Nuclear has taken any action to stop any rainfall onto the disposal units.

ruling that DHEC correctly determined Chem-Nuclear is in compliance with this subsection as to the migration of the waste itself out of the disposal units.

We next address whether Chem-Nuclear is in compliance as to the migration of waste-contaminated water out of the disposal units. According to the 2005 order, the vaults contain holes that allow water to drain from them and into the trenches. As for the trenches, they are lined with partially impermeable materials so that liquids may drain to the soil below the trench. Thus, "rainfall that accumulates in the trenches eventually percolates into the soil" and groundwater beneath the trenches. Also, the water table may rise during "wet periods," causing groundwater to "rise up into the [vaults]."

The ALC relied on its previous findings related to subsection 7.11.11.1 to hold Chem-Nuclear complied with this subsection because the methods "designed to minimize the infiltration of water into the vaults" serve to "minimize[] the migration of . . . waste-contaminated water out of them." We agree evidence of compliance with subsection 7.11.11.1 is relevant to our determination of compliance with this subsection. This is because reducing the initial migration of water onto disposal units has a reciprocal effect upon reducing the migration of waste-contaminated water out of disposal units. Therefore, our holding that Chem-Nuclear failed to comply with subsection 7.11.11.1 relates to whether it complied with subsection 7.11.11.2 as to waste-contaminated water.¹⁵

Relying on the two-part definition of minimize discussed in the previous section, we must first analyze whether there is evidence that Chem-Nuclear reduced the migration of waste-contaminated water out of disposal units. The ALC found Chem-Nuclear's use of disposal containers prevents waste from coming into direct contact with water that enters vaults, which reduces the potential for water to become contaminated. This, in turn, reduces the migration of waste-contaminated water out of vaults. Second, the ALC found that although the drainage holes in the vaults allow "water to rise up into the containers" and drain into the trenches below, they also allow water to drain away from the waste. This decreases the

¹⁵ Noncompliance with subsection 7.11.11.1 would not conclusively establish non-compliance with this subsection. Subsection 7.11.11.1 regulates the migration of "water," while subsection 7.11.11.2 regulates the migration of "waste[-] contaminated water." Thus, the fact that water migrates onto and, subsequently, out of disposal units does not itself violate this subsection. A violation occurs only when water is allowed to come in contact with waste and waste-contaminated water then migrates out of disposal units.

likelihood that water entering the vaults will become contaminated. We agree the ALC's findings support the conclusion that Chem-Nuclear has taken *some* action to reduce the migration of waste-contaminated water from the disposal units.

However, the ALC did not address the second part of the analysis—whether these measures are sufficient to meet DHEC's definition of minimize. As we previously stated regarding subsection 7.11.11.1, compliance with subsection 7.11.11.2 depends on whether there is evidence to support a finding that Chem-Nuclear's actions "reduce to the smallest amount possible" the migration of waste-contaminated water out of disposal units.

On this point, the 2005 order stated "trench water . . . becomes contaminated by the fact that there is some residual tritium on . . . vaults and waste packages that have . . . water on them as a result of rain." Based on this fact, the following findings in the 2005 order demonstrate the vaults and trenches allow water that has come into contact with residual tritium on the disposal containers to migrate out of them:

- (1) The "floors of the vaults have holes to allow water to drain from the vaults";
- (2) These drainage holes "can also allow water to rise up into the containers";
- (3) "[N]one of the trenches . . . have an impermeable liner";
- (4) "The bottoms of the trenches" are not designed to "prevent the migration of liquids out of the bottom of trenches" and, in fact, are "designed to be partially impermeable and . . . allow liquids to infiltrate the soil below the trenches"; and
- (5) "Precipitation in and on the disposal trenches drives tritium into the groundwater beneath the [facility]."

As we acknowledged above, the holes in the vaults allow water to drain away from the waste, which decreases the likelihood that water entering the vaults will become contaminated. Nevertheless, these holes permit water that has come in contact with residual tritium to drain into the trenches, which, in turn, allow the water to percolate into the soil and groundwater beneath the facility. This supports that Chem-Nuclear has not taken action to reduce to the smallest possible amount the migration of waste-contaminated water out of its vaults and trenches.

Moreover, the fact that Chem-Nuclear has failed to minimize the migration of water onto vaults under subsection 7.11.11.1 weighs in favor of non-compliance with subsection 7.11.11.2.

In affirming DHEC's conclusion that Chem-Nuclear complied with this subsection, the ALC recognized that trench bottoms "are designed to be partially impermeable and allow liquids to infiltrate the soil below" them. However, the ALC noted the 2005 order contained "no finding that Chem-Nuclear's waste disposal design is faulty or fails to minimize the migration of . . . waste-contaminated water out of disposal units." We find the ALC erred in relying on the absence of such a finding in the 2005 order.

In *Chem-Nuclear I*, we held "section 7.11 imposes additional compliance requirements" not addressed by the 2005 order. 387 S.C. at 435, 693 S.E.2d at 19. We remanded for the ALC "to apply its factual findings [in the 2005 order] to the technical requirements" of section 7.11—including subsection 7.11.11.2. 387 S.C. at 435, 693 S.E.2d at 18-19. Thus, the ALC could not rely on the fact that the 2005 order did not contain the conclusion we ordered the ALC to make on remand—whether, based on the factual findings in the 2005 order, the disposal units minimized the migration of waste-contaminated water out of them. The lack of such a conclusion in the 2005 order was the very reason we remanded for the ALC to make this determination.

We also find the ALC erred in relying on evidence that "improvements in waste disposal procedures" have reduced the "tritium concentration at the compliance point." As acknowledged by the ALC in the remand order, this evidence "does not get to the heart of the technical requirements" established by the subsection. This is because subsection 7.11.11.2 imposes technical requirements, and we find the evidence does not relate to the requirement that the disposal units be designed to minimize the migration of waste-contaminated water out of them. Instead, this evidence relates to Chem-Nuclear's compliance with the result-based performance objectives contained in section 7.18—that Chem-Nuclear keep radioactive releases to the general environment "as low as is reasonably achievable." Subsection 7.11.11.2 required DHEC and the ALC to analyze the sufficiency of Chem-Nuclear's actions to comply with the plain language of this subsection. Thus, we cannot base our decision on the fact that Chem-Nuclear has reduced the overall tritium concentration at the compliance point.

We conclude the record demonstrates Chem-Nuclear has taken measures to reduce the migration of waste-contaminated water out of disposal units. However, the record does not support a finding that Chem-Nuclear complied with subsection 7.11.11.2. We base our holding on (1) Chem-Nuclear's failure to comply with subsection 7.11.11.1, and (2) there being no evidence, and no finding, that Chem-

Nuclear has taken action to "minimize"—reduce to the smallest amount possible—the migration of waste-contaminated water out of disposal units. We hold the ALC erred in affirming DHEC's conclusion that Chem-Nuclear complied with subsection 7.11.11.2.

3. Subsection 7.11.11.4

Subsection 7.11.11.4 requires Chem-Nuclear to design and construct its disposal units and engineered barriers in a way that allows for "temporary collection and retention of water and other liquids for a time sufficient to allow for the detection and removal or other remedial measures without the contamination of groundwater or the surrounding soil." The plain language of this subsection imposes multiple requirements on Chem-Nuclear: (1) collect and retain water that migrates onto the disposal units, (2) test this water for radioactive waste material, (3) if such waste material is discovered, engage in removal or remedial measures, and (4) accomplish this without contaminating the groundwater or surrounding soil.

The ALC relied on the following findings in the 2005 order to support its conclusion that Chem-Nuclear complied with this subsection:

- (1) Chem-Nuclear implements a surface water management plan to manage precipitation that collects in trenches, which involves pumping water into adjacent trenches or a lined pond; and
- (2) The trenches are designed to prevent the flow of surface water from coming into contact with waste.

We find neither finding supports—and only one addresses—the ALC's determination that DHEC correctly concluded Chem-Nuclear complied with this subsection. Finding (1)—regarding Chem-Nuclear's surface water management plan—is relevant to the first requirement of subsection 7.11.11.4, "temporary collection and retention of water." However, there is no evidence that Chem-Nuclear tests the water pumped from the trenches for radioactive waste material. The subsection requires Chem-Nuclear to do more than collect and retain the water. Finding (2)—that trenches are designed to prevent surface water from coming into contact with waste—is irrelevant to Chem-Nuclear's compliance with this subsection. It has nothing to do with collecting, testing, or removing contaminated water from the disposal units. Because the ALC cited no additional evidence of Chem-Nuclear's compliance with this subsection, we hold the ALC erred in affirming DHEC's determination that Chem-Nuclear complied with subsection 7.11.11.4.

Upon our review of the 2005 order, we find no evidence of compliance with this subsection.¹⁶ In fact, the evidence in the record demonstrates Chem-Nuclear is not in compliance. First, the vaults and trenches are designed to allow water that enters them to drain into the soil and groundwater below. That water is not tested before it enters the ground. Second, the only other evidence relevant to this subsection is the finding in the 2005 order that states, "None of the trenches at the [facility] have . . . a leachate collection system." Leachate is defined as "any liquid, including any suspended or dissolved components in the liquid, that has percolated through or drained from the [radioactive] material." 10 C.F.R. § 40 app. A (2011). Although the regulation does not define "leachate collection system," in common industry usage, it is "a system or device . . . that is designed, constructed, maintained, and operated to collect and remove leachate" for proper disposal. 40 C.F.R. § 503.21(i) (2011); *see also* 40 C.F.R. § 264.301(a)(2) (2011).¹⁷ Such a system would allow Chem-Nuclear to satisfy the four requirements of subsection 7.11.11.4—(1) collect water migrating onto the disposal units, (2) test this water, (3) remove waste-contaminated water, and (4) do this without contaminating the groundwater because the system would collect the leachate for alternate disposal. Thus, the ALC's finding regarding the non-existence of a leachate collection system undermines its conclusion that Chem-Nuclear complied with this subsection and supports our determination that the ALC erred in reaching that conclusion.

¹⁶ This regulation imposes requirements for the design and construction of "disposal units" and "engineered barriers." While Chem-Nuclear has monitoring wells to test the groundwater for contamination and a system to monitor water accumulation in trenches, neither of these qualifies as a disposal unit. *See* § 7.2.8 (defining "disposal unit" as "a discrete portion of the disposal site into which waste is placed for disposal"). To the extent they are considered engineered barriers—"a man-made *structure or device* that is intended to improve the land disposal facility's ability to meet the performance objectives in this part," § 7.2.9 (emphasis added)—there is no evidence these monitoring "devices" allow Chem-Nuclear to collect and test this water "without the contamination of the groundwater." § 7.11.11.4.

¹⁷ These regulations provide the Environmental Protection Agency's definition of "leachate collection system" as stated in the regulations for "surface disposal" of "sewage sludge," 40 C.F.R. § 503.20(a) (2011), and "dispos[al] of hazardous waste in landfills," 40 C.F.R. § 264.300 (2011).

DHEC and Chem-Nuclear argue Chem-Nuclear is justified in not having a leachate collection system due to "concerns regarding the radioactive exposure to workers handling and processing the leachate." We find the argument contrary to the purpose and intent of the regulation. We fail to see how the danger of radioactive contamination to workers actually *justifies* releasing it into the groundwater without testing and remediation. Rather, it seems the danger to health and safety *requires* testing and remediation. We believe the drafters of these regulations imposed such a requirement for just that purpose. Subsection 7.11.11.4 contains no language excusing Chem-Nuclear's duty to comply with its regulatory requirements, which is especially important when the excuse for not taking a particular action is the very reason for the regulation—health and safety. Instead, the focus of compliance is on what action Chem-Nuclear did take—whether it designed and constructed its engineered barriers in a manner that allows it to collect, test, and remove contamination before it percolates into the soil and groundwater.¹⁸

We find no evidence to support a finding that Chem-Nuclear meets the requirements imposed by this subsection. We hold the ALC erred in affirming DHEC's conclusion that Chem-Nuclear complied with subsection 7.11.11.4.

4. Subsection 7.11.11.6

Subsection 7.11.11.6 requires Chem-Nuclear to design and construct its disposal units and engineered barriers in a way that provides "reasonable assurance that the waste will be isolated for at least the institutional control period."

We hold the ALC did not err in affirming DHEC's determination that Chem-Nuclear's current disposal units and engineered barriers—including the disposal containers, concrete disposal vaults, disposal vault lids, disposal trenches, and

¹⁸ In deciding whether Chem-Nuclear's operations met the ALARA standard, the 2005 order appropriately weighed Chem-Nuclear's concerns regarding exposure to workers because an ALARA analysis involves balancing the benefit to the general public with the risk associated with worker exposure. *See* 24A S.C. Code Ann. Regs. 61-63 § 7.20 (1992) ("Operations at the land disposal facility shall be conducted in compliance with the standards for radiation protection . . . [and] governed by 7.18."). In determining compliance with the technical requirements of subsection 7.11.11.4, however, we consider the actions taken by Chem-Nuclear to comply, not the reasons why it decided not to implement a certain measure based on its own ALARA analysis.

enhanced caps on inactive trenches—comply with subsection 7.11.11.6. Waste is put into a disposal container, which is then placed into a reinforced concrete vault that is covered with an initial clay cap and buried in a disposal trench. Once the trench is full, Chem-Nuclear installs an enhanced cap over the trench. The following findings from the 2005 order demonstrate that the use of these disposal units and engineered barriers provide reasonable assurance the waste will be isolated from the general environment and inadvertent intruders "for at least the institutional control period": (1) the predictions of a "continually declining trend in radioactive releases to the general environment"; and (2) the Blue Ribbon Panel's conclusion that the facility's disposal practices "pose a minimal risk to either the environment or members of the public, both today and *in the long-term future*." (emphasis added).

5. Subsection 7.11.11.7

Subsection 7.11.11.7 requires Chem-Nuclear to design and construct its disposal units and engineered barriers in a way that "prevent[s] contact between the waste and the surrounding earth, except for earthen materials which may be used for backfilling within the disposal units." We interpret the plain language of this subsection as seeking to prevent waste, and not waste-contaminated water, from coming in contact with soil. Otherwise, the regulatory effect of subsections 7.11.11.1 and 7.11.11.2 becomes obsolete.¹⁹ Under this interpretation, we hold the ALC did not err in affirming DHEC's determination that Chem-Nuclear complied with this subsection because the "placement of waste in a waste container and a reinforced concrete vault" prevents the waste from coming into direct contact with the soil.

C. Subsection 7.23.6

¹⁹ Subsections 7.11.11.1 and 7.11.11.2 explicitly regulate the migration of *water* onto disposal units and the migration of *waste* and *waste-contaminated water* out of disposal units. This distinction between "water," "waste," and "waste-contaminated water" in these subsections supports a conclusion that these regulations seek to prevent waste and waste-contaminated water from infiltrating the soil and groundwater beneath disposal units. Thus, we narrowly construe subsection 7.11.11.7 as applying to only the prevention of waste, and not waste-contaminated water, from coming in contact with the soil. To the extent the ALC relied on evidence related to subsections 7.11.11.1 and 7.11.11.2, we hold the ALC erred in that regard.

Subsection 7.23.6 requires Chem-Nuclear to design the disposal site in a way that "minimize[s] to the extent practicable the contact of water with waste during storage, the contact of standing water with waste during disposal, and the contact of percolating or standing water with wastes after disposal."²⁰

As we previously discussed, subsection 7.23.6 imposes technical requirements that require Chem-Nuclear to take action to design and construct the disposal site to meet the specifications of this subsection. Thus, DHEC and Chem-Nuclear cannot demonstrate compliance with subsection 7.23.6 simply by showing Chem-Nuclear met the performance objectives of other subsections. *Chem-Nuclear I*, 387 S.C. at 436, 693 S.E.2d at 19. Instead, we must consider whether Chem-Nuclear took any actions to meet the technical requirements of this subsection, and if so, the sufficiency of Chem-Nuclear's actions.

This subsection distinguishes between "water," "standing water," and "percolating water" and between the three different phases of operations at the facility—storage, disposal, and after disposal. This subsection requires Chem-Nuclear to implement practices that drain or remove water from active vaults and trenches, as well as minimize to the extent practicable the entry of water into inactive vaults and trenches. Although the failure to minimize the migration of water onto active vaults and trenches under subsection 7.11.11.1 contributes to the accumulation of standing water, the regulatory effect of this subsection, when narrowly construed, requires Chem-Nuclear to implement methods to minimize to the extent practicable standing water that has already migrated into the disposal units.

As to the requirement that Chem-Nuclear design the disposal site in a way that minimizes to the extent practicable the contact of water with waste *during storage*, the ALC found that "[a]ny 'storage' of waste is temporary" because "there is available disposal capacity at the [facility]." The ALC stated that when a shipment of waste is received, it is taken either to the appropriate trench for disposal or to the Cask Maintenance Building, where Chem-Nuclear inspects the casks and prepares them for off-loading. The ALC found that "[b]ased on the practice of inspecting and preparing waste for disposal within the [Cask Maintenance Building], Chem-Nuclear minimizes the contact of water with waste prior to off-loading the waste into the trench." We affirm because this evidence relied on by the ALC supports compliance with this particular requirement of subsection 7.23.6.

²⁰ "Disposal site" is defined as "that portion of a land disposal facility which is used for disposal of waste" and "consists of disposal units and a buffer zone." 24A S.C. Code Ann. Regs. 61-63 § 7.2.7 (1992).

As to whether Chem-Nuclear designed the disposal site to minimize to the extent practicable the contact of standing water with waste *during disposal*, we interpret this requirement as applying to Chem-Nuclear's active vaults and trenches. We hold the ALC did not err in affirming DHEC's conclusion that Chem-Nuclear complied with this requirement of subsection 7.23.6 because the following findings from the 2005 order support this conclusion:

- (1) The vaults and trenches are designed to allow water to flow out of them;
- (2) Trenches are sloped and contain other design features that prevent "water from coming in contact with waste";
- (3) Each trench has a drainage system that allows Chem-Nuclear to monitor any water that accumulates in the trench; and
- (4) Chem-Nuclear implements a surface water management plan to manage rainwater that collects in the open trenches.

Turning to the requirement regarding minimizing to the extent practicable the contact of percolating or standing water with wastes *after disposal*, we interpret this as applying to Chem-Nuclear's inactive vaults and trenches. We hold the following findings relied on by the ALC support DHEC's determination of compliance:

- (1) When vaults become full, Chem-Nuclear places an initial clay cap over inactive vaults;
- (2) When trenches become full, Chem-Nuclear installs an impermeable enhanced cap on inactive trenches; and
- (3) Employees fill void spaces between the vaults with backfill, which "minimizes the potential for subsidence of the enhanced caps."

Based on the above discussion, we hold the ALC did not err in finding DHEC correctly determined Chem-Nuclear is in compliance with subsection 7.23.6.

D. Subsection 7.10.7

Subsection 7.10.7 requires DHEC to find Chem-Nuclear "provides reasonable assurance that the applicable technical requirements of [part VII] will be met." The technical requirements relevant to this appeal include those set forth in subsections 7.11.11 and 7.23.6. Based on Chem-Nuclear's noncompliance with subsections 7.11.11.1, 7.11.11.2, and 7.11.11.4—particularly the absence of evidence that Chem-Nuclear took *any* action to comply with the technical

requirements of subsections 7.11.11.1 and 7.11.11.4—we do not understand how DHEC could make, nor how the ALC could affirm, a finding that Chem-Nuclear provided assurance it would meet the applicable technical requirements.

DHEC argues, however, Chem-Nuclear is in compliance with these subsections because "tritium concentrations began to decline at the compliance point" after "the incorporation of new disposal techniques." While this may have been a reasonable position for DHEC to take prior to our opinion in *Chem-Nuclear I*, the argument ignores our holding in that case—that the "specific technical requirements" of 7.11.11 cannot be met by satisfying the "performance objectives" of 7.10. As we found in *Chem-Nuclear I*, "section 7.11 imposes additional compliance requirements for Chem-Nuclear such that the balancing test of ALARA would not be sufficient to address[] whether Chem-Nuclear is in compliance with section 7.11." 387 S.C. at 435, 693 S.E.2d at 19.

DHEC nevertheless continues to argue the "technical requirements are written to meet the performance objectives," and Chem-Nuclear may comply with them without taking any action—as long as it meets the performance objectives. In its petition for rehearing, DHEC states "the Court overlooks and misapprehends the crucial interplay of the performance objectives and [technical] requirements," and argues "evidence that the performance objectives have been met is appropriate to demonstrate compliance with other requirements of the regulation." We disagree with DHEC's interpretation of the regulations. The "interplay" between the performance objectives and the technical requirements of the regulations was squarely raised in *Chem-Nuclear I*. In that case, DHEC specifically "argue[d] the [court] . . . must apply the [performance objectives] criteria set forth in section 7.10 . . . rather than apply [technical requirements] criteria set forth in sections 7.11 and 7.23.6." 387 S.C. at 431, 693 S.E.2d at 16. We specifically rejected the argument and held the technical requirements of the regulation must also be met—they cannot be satisfied simply by meeting performance objectives. 387 S.C. at 435-36, 693 S.E.2d at 18-19.

There can be no doubt that the technical requirements are designed to bring about compliance with the performance criteria. As DHEC points out, "The overarching purpose of the Part VII requirements is to ensure that the performance objectives of subsection 7.18 (ALARA) through 7.21 are met." However, DHEC's argument renders the technical requirements optional, and thus essentially writes them out of the regulations. To illustrate this point, we consider how DHEC's argument would affect Chem-Nuclear's duty to comply with subsection 7.24.2. DHEC acknowledges in its petition for rehearing that subsection 7.24.2 "contain[s]

requirements for specific action[]" by Chem-Nuclear. Under the subsection, Chem-Nuclear must place five meters of material above the top of the waste after the storage unit becomes inactive. We also consider subsection 7.11.11.7, which requires Chem-Nuclear to "prevent[] . . . contact between the waste and the surrounding earth." Under DHEC's theory that it may demonstrate compliance with the technical requirements of these subsections simply by meeting the performance objectives in other subsections, Chem-Nuclear is not actually required to place five meters of fill on top of the waste, or prevent contact between the waste and the earth. Rather, DHEC's argument allows Chem-Nuclear to ignore the specific, clear, and unambiguous requirements of these subsections by demonstrating compliance with performance objectives—despite the fact that the technical requirements subsections do not provide such an exception. We fully understand the technical requirements are interconnected with the performance objectives and are designed primarily to ensure the performance objectives are achieved. We do not agree, however, that the technical requirements may be ignored as long as the performance objectives are met.

In light of our holding in *Chem-Nuclear I*, however, it is no longer reasonable for DHEC to argue Chem-Nuclear complied with subsection 7.10.7 without considering what action Chem-Nuclear took to comply with the technical requirements of 7.11.11. This is particularly true given that Chem-Nuclear failed to take *any* action to comply with the requirements of subsections 7.11.11.1 and 7.11.11.4. And yet, DHEC continues to assert Chem-Nuclear "provide[d] reasonable assurance that the applicable technical requirements of [its own regulations] will be met." Considering, for example, the technical requirement in subsection 7.11.11.1—that Chem-Nuclear "minimize the migration of [rainfall] onto the disposal units"—DHEC could not identify one action Chem-Nuclear took to meet this requirement. Nevertheless, DHEC determined Chem-Nuclear complied with subsection 7.10.7 by providing reasonable assurance that this technical requirement of 7.11.11.1 would be met.

To determine whether DHEC complied with subsection 7.10.7 in light of these facts, we consider DHEC's role in the disposal of low-level radioactive waste. In 1967, our General Assembly enacted the Atomic Energy and Radiation Control Act. *See* Act No. 223, 1967 S.C. Acts 305 (*codified at* S.C. Code Ann. §§ 13-7-10 to -100 (1977 & Supp. 2013)). Noting "that remarkable scientific developments have occurred in the field[] of atomic energy," and "plans for further developments . . . are creating broad opportunities and also responsibilities for the states," *id.* at 305, the General Assembly found "[i]t is prudent and wise that the State [give] . . . full consideration of the health and safety requirements of its people." *Id.* at 305-

06. Based on these findings, the General Assembly required DHEC to "formulate, adopt, [and] promulgate . . . regulations relating to the control of ionizing and nonionizing radiation." S.C. Code Ann. § 13-7-40(F)(3) (Supp. 2013). Pursuant to this mandate, DHEC promulgated Part VII of regulation 61-63. Under the authority of the Act, the regulations are the law of South Carolina,²¹ and DHEC is required by law to enforce them. *See* S.C. Code Ann. § 13-7-40(A) (Supp. 2013) (providing DHEC "is designated as the agency of the State which is responsible for the control and regulation of radiation sources"); § 13-7-40(F)(9) (stating DHEC "shall . . . provide by regulation for the licensing . . . of radiation sources").

The United States Nuclear Regulatory Commission (NRC), through its federal enforcement policy, has emphasized the importance of regulatory enforcement when nuclear disposal facilities do not conduct their operations with "the necessary meticulous attention to detail" and in accordance with "the high standard of compliance" imposed by the applicable regulations. General Statement of Policy and Procedure for NRC Enforcement Actions, 10 C.F.R. Pt. 2, app. C (1995). Thus, while it is important for private companies such as Chem-Nuclear to comply with applicable regulations, it is equally important, if not more so, that the administrative agency mandated by law to enforce the regulations require adherence to its own standard for compliance. To allow otherwise would impede the purpose for which DHEC was created—to act in the public interest—and risk the health and safety of our citizens. *See* S.C. Code Ann. § 48-1-20 (2008) ("It is declared to be the public policy of the State to maintain reasonable standards of purity of the air and water resources of the State, consistent with the public health, safety and welfare of its citizens, . . . [and] that to secure these purposes and the enforcement of the provisions of this chapter, [DHEC] shall have authority to abate, control and prevent pollution.").

DHEC promulgated regulation 61-63 under statutory mandate for the obvious reason that nuclear waste can adversely affect the health and welfare of our citizens if not disposed of properly. In doing so, DHEC required Chem-Nuclear to comply with the "technical requirements" and "performance objectives" that DHEC chose to put in the regulations. It is important that DHEC enforce its own regulations and require Chem-Nuclear to take action to comply with the technical requirements. This importance derives not simply from the need to avoid the serious consequences of non-compliance; it is important because it is the law. We

²¹ *See S.C. Coastal Conservation League v. S.C. Dep't of Health & Envtl. Control*, 390 S.C. 418, 429, 702 S.E.2d 246, 252 (2010) (noting "a regulation has the force of law").

are concerned that DHEC did not follow the law in failing to require Chem-Nuclear to comply with all of the technical requirements of subsection 7.11.11.

We are also concerned by DHEC's decision not to amend the requirements for issuance of the license after the ALC instructed Chem-Nuclear in its 2005 order to submit a report to DHEC regarding the feasibility of covering trenches and sealing vaults. The propriety of DHEC's decision to "concur[]" with the report's evaluation of the issues" is not before this court, and we do not base our holding on the merits of that decision.²² However, the fact that DHEC did not require Chem-Nuclear to take *any* action or make *any* changes to its disposal practices casts doubt upon DHEC's decision to renew the license.

Regardless of our affirmance of Chem-Nuclear's compliance with the remaining subsections of 7.11.11, we hold the ALC erred in affirming DHEC's determination that Chem-Nuclear complied with subsection 7.10.7.

V. Remedy

As to four separate subsections of regulation 61-63, DHEC failed to enforce the law of South Carolina. As to each, the ALC erred in finding Chem-Nuclear in compliance. Under the law, Chem-Nuclear's license to operate the facility is invalid. However, the appellant informed the court at oral argument it does not seek revocation of the license; it asks simply that DHEC enforce its regulations, and that Chem-Nuclear comply. In light of this request, we decline to rule the permit is invalid. Rather, we remand to DHEC for further proceedings.

DHEC and Chem-Nuclear argue on rehearing that this court's requirement in *Chem-Nuclear I* that all remand proceedings be based only on the factual findings

²² A footnote in the ALC's order states Chem-Nuclear conducted these studies and DHEC "concurred with the report's evaluation of the issues." The record does not contain the results of these studies or the reasons DHEC chose not to amend the license requirements as a result of the report. The basis of DHEC's decision not to amend the license or impose additional requirements for operating the facility is not before this court. While DHEC must enforce—and Chem-Nuclear must comply with—the regulations, it is not our place to disagree with DHEC as to how it should enforce its own regulations, or mandate how Chem-Nuclear should comply with these regulations. We merely review the ALC's and DHEC's determinations of compliance without passing judgment upon the technical aspects of how this compliance is accomplished.

of the 2005 order has hampered both DHEC and Chem-Nuclear's efforts to demonstrate to this court compliance with subsections 7.11.11.1 and 7.11.11.2 and others. We understand the problem. On remand, DHEC shall consider all available information as to whether Chem-Nuclear has complied with the regulations. On appeal to the ALC, it may conduct its proceedings with no limitations from this court on the evidence it may consider.

VI. Conclusion

We affirm the ALC as to all issues presented to this court, except Chem-Nuclear's compliance with subsections 7.11.11.1, 7.11.11.2, 7.11.11.4, and 7.10.7. As to those four subsections, we hold the ALC erred in affirming DHEC's conclusion that Chem-Nuclear was in compliance.

HUFF and THOMAS, JJ., concur.