BEDL-17-017

FY 2017/2018
LEAST COST OPERATING PLAN
BARNWELL DISPOSAL FACILITY

BARNWELL DISPOSAL FACILITY
740 OSBORN ROAD
BARNWELL, SOUTH CAROLINA 29812

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1.0 INTRODUCTION

Chem-Nuclear Systems, LLC (CNS), an Energy*Solutions* (ES) Company, operates a low-level radioactive waste (LLRW) disposal facility located approximately five miles west of the city of Barnwell, in Barnwell County, South Carolina. The disposal site comprises approximately 235 acres of property owned by the State and leased by CNS from the South Carolina Department of Administration.

LLRW arrives at the disposal site by truck or heavy-haul transporter. Waste packages may arrive in shielded "casks" (containers of various sizes constructed of steel and lead), in shielded or unshielded vans or on flatbed trailers. Each shipment is inspected at the site and released for disposal. Disposal generally involves removing the waste package from its transportation vehicle and placing the package in a concrete disposal vault in an engineered trench. The filled vaults are covered with soils and the completed trenches are covered with multi-layer engineered earthen caps.

1.1 PURPOSE

CNS submits this Least Cost Operating Plan (LCOP) to the South Carolina Public Service Commission (Commission) as required by the S.C. Code Ann. 1976 Section 48-46-40 (B)(6)(supp. 2008). This LCOP is the seventeenth annual update.

1.2 SCOPE

The LCOP provides a summary of and financial projections for anticipated operations over the next ten years at the Barnwell Disposal Facility (BDF).

1.3 APPENDICES

The appendices to this document provide historical background for the facility and its operation; a general description of the regulatory requirements under which the facility is operated; a description of the disposal facility; and a more detailed description of disposal facility operations.

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2.0 LEAST COST OPERATING PLAN

In this section, CNS describes the anticipated operating plan for the next 10 years (FY 2017/2018 to FY 2026/2027) of in-region only operations at the BDF and provides summary financial estimates.

2.1 OPERATING APPROACH

BDF operational requirements, which are not expected to change during the next ten-year plan period, are described in Appendix D. Maintenance, monitoring and support of closed site areas are managed as institutional activities. As agreed in the Memorandum of Understanding (MOU) between CNS and the SC B&CB, and approved by the SC B&CB on June 30, 2009, these institutional activities costs are paid from the Decommissioning Trust Fund or the Extended Care Maintenance Fund, as appropriate.

Under current law, CNS assumes, for the purpose of projection and planning, that the disposal facility lifetime includes:

(1) An in-region operations period during which the site will support the disposal needs of the Atlantic Compact.
(2) One year of final site closure and five years of final post-closure observation as described in the CNS 2016 Closure Plan, and then,
(3) One hundred years of institutional control, during which a site custodian will maintain and monitor the site.

Table 2.1-1 shows projected waste volumes for the next ten years along with actual waste volumes in past years. As of FY 2008/2009, waste receipts have been limited to the Atlantic Compact states (SC, CT and NJ). The routine operational waste volume projections are based on information developed in discussions with Atlantic Compact utility generators and the South Carolina Energy Office staff.

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Slit trench shipments are listed separately in Table 2.1-1 because they require additional labor and resources to prepare and offload.

TABLE 2.1-1
ACTUAL AND PROJECTED RADIOACTIVE WASTE VOLUMES (FT^3)

FISCAL YEAR	MAXIMUM ALLOWED VOLUMES BY STATUTE [3]	ACTUAL/PROJECTED WASTE VOLUME [1]	NUMBER OF SLIT TRENCH SHIPMENTS
2000/2001	160,000	125,989	43
2001/2002	80,000	57,763	11
2002/2003	70,000	65,660	14
2003/2004	60,000	59,515	23
2004/2005	50,000	43,260	23
2005/2006	45,000	44,988	18
2006/2007	40,000	37,606	37
2007/2008	35,000	32,954	75
2008/2009	NA	12,314	3
2009/2010 [2]	NA	34,626	0
2010/2011	NA	10,424	0
2011/2012	NA	9,494	3
2012/2013	NA	8,753	0
2013/2014	NA	8,494	2
2014/2015	NA	9,564	0
2015/2016	NA	8,304	2
2016/2017 [4]	NA	10,318	0
2017/2018	NA	7,000	1
2018/2019	NA	7,000	0
2019/2020	NA	7,000	1
2020/2021	NA	7,000	0
2021/2022	NA	7,000	1
2022/2023	NA	7,000	0
2023/2024	NA	7,000	1
2024/2025	NA	7,000	0
2025/2026	NA	7,000	1
2026/2027	NA	7,000	0

[1] Volumes through FY 2016/2017 are actual volumes. Volumes after FY 2016/2017 are projected annual routine operational waste volumes only (not including large components or decommissioning waste).
[2] Additional volume was received during FY 2009/2010 due to disposal of four Salem Steam Generators.
[3] As of FY 2008/2009, waste receipts are limited to Atlantic Compact states. There is no limit on volume received from Atlantic Compact states.
[4] One reactor head was received during FY 2016/2017.

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2.1.1 IN-REGION OPERATIONS

During the next ten years of in-region operations, CNS anticipates routine operational waste volumes at about 7,000 ft^3 per year with one slit trench shipment of irradiated hardware on average about every other year. Additional waste volume (such as the large component disposal in FY 2009/2010 and 2016/2017) may occur in some years based on the operational needs of the Atlantic Compact nuclear utilities. Disposal of large components and irradiated hardware may require additional personnel resources for limited duration.

The least cost projections provided in this plan were developed to be consistent with anticipated operational practice during the ten-year period. CNS has estimated variable and irregular costs based on waste volume projections with some allowance for irregular projects and trench construction, while fixed costs are generally independent of waste receipts. Operating cost projections also assume payment of institutional costs from the Decommissioning Trust Fund or the Extended Care Maintenance Fund, as appropriate.

The revenue projections provided are based on expected agreements with the Atlantic Compact generators as well as the anticipated types and volumes of waste received in future years and pricing increases tied to the Producer Price Index.

During in-region operations, CNS uses the Class B/C type trench configuration for disposal of all waste types and classes, except for (1) irradiated hardware, which are disposed in the slit trench configuration, and (2) large components, which normally require special accommodation.

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2.1.2 SITE DECOMMISSIONING

CNS started Phase I Decommissioning in 2008 and completed the final submittals in June, 2013. Detailed information on Phase I and future decommissioning plans is provided in the 2016 Closure Plan. It also describes post-closure observation, site transfer, and institutional control activities. The costs of these activities are funded through either the Decommissioning Trust Fund or the Extended Care Maintenance Fund, as appropriate.

2.1.3 INSTITUTIONAL CONTROL PERIOD

The Institutional Control Period begins following the final (Phase II) closure and post-closure periods. At that point, a State custodial agency (SC ORS) will assume responsibility for the property and all buried materials including site maintenance and monitoring. Costs during the Institutional Control Period are to be paid from the Extended Care Maintenance Fund.

2.2 LEAST COST FINANCIAL EVALUATION

The LCOP financial evaluation is divided into two parts: (1) past years of operation including Fiscal Year 2016/2017, and (2) the next ten years of operations. Table 2.2-1 provides cost and revenue information from fiscal year 2000/2001 to present.

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TABLE 2.2-1
REVENUE/COST SUMMARY

FISCAL YEAR	ACTUAL VOLUME	GROSS REVENUE[1] (IN $M)	COSTS (IN $M)				NET REVENUE (IN $M)[5]
			ALLOWABLE OPERATING COST	OPERATING MARGIN[2]	SURCHARGES, TAXES, AND FEES[3]	TOTAL OPERATING COST[4]	
2000 / 2001	125,989	69.29	9.41	2.55	2.94	14.90	54.38
2001 / 2002	57,763	33.19	9.72	2.64	2.17	14.54	18.66
2002 / 2003	65,660	37.73	9.68	2.60	2.11	14.39	23.34
2003 / 2004	59,515	39.17	9.82	2.63	2.09	14.54	24.62
2004 / 2005	43,260	29.69	10.85	2.81	2.35	16.01	13.68
2005 / 2006	44,988	28.96	10.44	2.81	2.35	15.59	13.37
2006 / 2007	37,606	36.66	10.10	2.70	2.36	15.16	21.50
2007 / 2008	32,954	54.59	11.27	2.93	2.14	16.34	38.25
2008 / 2009	12,314	5.03	3.85	1.10	0.94	5.90	-0.87
2009 / 2010	34,626	6.48	4.28	1.18	1.25	6.71	-0.23
2010 / 2011	10,424	6.09	3.44	0.96	0.98	5.38	0.71
2011 / 2012	9,494	6.42	3.80	1.09	0.98	5.87	0.55
2012 / 2013	8,753	5.81	3.72	1.07	0.94	5.73	0.08
2013 / 2014	8,494	5.97	4.00	1.16	1.01	6.17	-0.20
2014 / 2015	9,564	5.80	4.50	1.30	1.10	6.90	-1.10
2015 / 2016	8,304	7.71	4.31	1.30	1.02	6.63	1.08
2016 / 2017[6]	10,318	6.58	4.48	1.3	1.00	6.78	-0.20

(1) Gross revenue (billed activity) is the total of all income for waste received for disposal.
(2) Operating margin of 29% is not applied to all allowable costs.
(3) Surcharges (for ORS, PSC, etc.), taxes, and license fees related to disposal operations are allowable costs distributed from gross revenue.
(4) Actual costs are based on PSC orders when available.
(5) Positive net revenue amounts may not match actual payments to the State because of cash collection and other adjustments. Negative net revenue is paid for by roll-over cash and retention amounts from previous years.
(6) Based on financials as of 7-17-2017.

Starting in 2007, CNS, the Atlantic Compact utilities, the Atlantic Compact Commission, and the SC Energy Office staff met in a series of meetings to discuss disposal site operating costs, in-region operations, and funding mechanisms to ensure economic viability of the BDF as a small volume disposal site operation. These meetings and discussions resulted in agreement in 2009 on several key points: all parties agreed to a commitment to maintain the economic viability and continued operation of the BDF; the larger in-region generators

agreed to an alternative funding mechanism for allocating operating costs and disposal volume among the utilities in the Atlantic Compact; and the State of South Carolina agreed to disposal rates that would yield no net revenue to the State. An alternative rate schedule was first established for fiscal year 2009/2010 (effective July 1, 2009) incorporating a quarterly access fee concept for the larger volume in-region generators.

Table 2.2-2 provides cost estimates for the plan period using the most recent alternative rate schedule and waste volume information obtained through discussions with the SC Energy Office staff and the Atlantic Compact utilities. The estimated costs included in this table are based on recent actual costs and are consistent with orders issued by the SC Public Service Commission in prior determinations of allowable costs. Costs and revenue indicated in Table 2.2-2 include inflationary factors (3% per annum), but do not include costs or revenue for disposal of slit trench shipments or large components.

Based on a Memorandum of Understanding (MOU) approved by the SC Budget and Control Board on June 30, 2009 and included in agreements with Atlantic Compact utilities, CNS anticipates operations on a "break even" basis with respect to net revenue during the plan period. The MOU identified Institutional costs of up to $2.3 million annually (adjusted each year since the June 30, 2009, MOU in accordance with the Producer Price Index) to be paid from either the Decommissioning Trust Fund or Extended Care Maintenance Fund, as appropriate. Because they are not categorized as operational, Institutional costs are not included in Table 2.2-2.

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TABLE 2.2-2
ANTICIPATED REVENUE / COST SUMMARY

FISCAL YEAR	PROJECTED VOLUME	GROSS REVENUE[1] (IN $M)	COSTS (IN $M)				NET REVENUE[4] (IN $M)
			ALLOWABLE OPERATING COST[2]	OPERATING MARGIN	SURCHARGES, TAXES, AND FEES[3]	TOTAL OPERATING COST	
2017 / 2018	7,000	$6.78	$4.61	$1.34	$1.03	$6.98	0
2018 / 2019	7,000	$6.98	$4.75	$1.38	$1.06	$7.19	0
2019 / 2020	7,000	$7.19	$4.90	$1.42	$1.09	$7.41	0
2020 / 2021	7,000	$7.41	$5.04	$1.46	$1.13	$7.63	0
2021 / 2022	7,000	$7.63	$5.19	$1.51	$1.16	$7.86	0
2022 / 2023	7,000	$7.86	$5.35	$1.55	$1.19	$8.10	0
2023 / 2024	7,000	$8.09	$5.51	$1.60	$1.23	$8.34	0
2024 / 2025	7,000	$8.34	$5.68	$1.65	$1.27	$8.59	0
2025 / 2026	7,000	$8.59	$5.85	$1.70	$1.30	$8.85	0
2026 / 2027	7,000	$8.84	$6.02	$1.75	$1.34	$9.11	0

(1) Gross revenue is the estimated billed activity for disposal operations.
(2) Allowable operating cost is the cost of disposal operations for which CNS receives 29% operating margin. Also included in this category are costs identified as allowable by the PSC upon which no 29% margin is allowed.
(3) Surcharges (for SC ORS, PSC, etc.), taxes, and license fees related to disposal operations are allowable costs distributed from gross revenue.
(4) CNS operates on a "break even" basis with respect to net revenue.

On July 1, 2008, CNS began accepting waste from only the Atlantic Compact states (South Carolina, Connecticut and New Jersey). The subsequent two years constituted a period of transition during which CNS performed the majority of Phase I Decommissioning, reduced manpower to current levels, and began institutional activities for closed site areas. Since 2008, volumes have ranged from a high of 34,626 ft^3 in FY 2009/2010 to a low of 8,304 ft^3 in FY 2015/2016.

Based on on-going dialog with the Atlantic Compact utility generators and SC ORS, CNS assumes future annual volumes of about 7,000 cubic feet (with one slit trench offload about every other year). Projected costs are based on past year costs, escalated for inflation. Allowable costs for operating the site are well established through Office of Regulatory Staff (ORS) audit and Public Service Commission (PSC) rulings.

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2.3 SUMMARY AND CONCLUSIONS

The costs of disposal site operations have been assessed based on updated operational costs, disposal rates, and waste volume projection information. The projections of waste types and volumes are based on information from dialog with the Atlantic Compact utility generators and the SC Energy Office Staff. Table 2.2-2 shows estimated operating costs versus projected revenue generated for each fiscal year of the next ten-year period. Costs for in-region disposal operations have been reduced to the extent practicable.

If the current agreements with Atlantic Compact utility generators continue into the future, revenue will continue to be sufficient to cover the cost of operations. Institutional Costs will be paid from either the Decommissioning Trust Fund or the Extended Care Maintenance Fund, as appropriate. In-region operations will take place in the remaining available areas of the site as needed to ensure safety, ALARA, and efficient accommodation of incoming waste.

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APPENDIX A

HISTORICAL BACKGROUND

This section provides a brief history of regulatory and legislative actions, and associated changes to the licensed disposal area, trench construction and maintenance, waste characterization and packaging.

REGULATORY DOCUMENTS

Three major documents govern the BDF, its operation and disposition. These documents are the Lease Agreement and its amendments, South Carolina Radioactive Material License 097 (License 097) and the Decommissioning Trust Agreement of 1981.

Lease Agreement and Amendments: Chem-Nuclear Systems entered into a 99-year lease agreement with the SC B&CB on April 21, 1971, to lease 17.2 acres of land, previously deeded to the State by Chem-Nuclear Systems, for the purpose of burial of radioactive waste. Under this agreement, Chem-Nuclear Systems agreed to operate in accordance with its license application, the conditions of License 097 and the requirements of the U.S. Atomic Energy Commission. The agreement also established a requirement for payments to an Extended Care Maintenance Fund for the long-term care of the site. Under §48-46-40(B)(6) of the S.C. Code (as amended), the Extended Care Maintenance Fund provides funding for long-term care as well as closure activities and post closure maintenance and monitoring after the Decommissioning Trust Fund is exhausted.

In the original agreement, Chem-Nuclear Systems agreed to pay eight cents into the Extended Care Maintenance Fund for every cubic foot of waste received for burial. The Lease Agreement was amended on April 6, 1976, replacing the previous agreement and expanding the lease area to its present 235 acres. At the same time, the fund payment was increased to sixteen cents per cubic foot. The agreement included a formula for increasing the rate of payment based on the Consumer Price Index. Since 1985, the

payment to the Extended Care Maintenance Fund has been set at $2.80 per cubic foot of waste. Other conditions of the lease have remained essentially the same since inception.

As of June 30, 2017, there is $149,022,364.25 in the Extended Care Maintenance Fund.

South Carolina Radioactive Material License 097: License 097 governs operations and closure of the BDF. It was issued in 1969 by the South Carolina Department of Health and Environmental Control (DHEC) to authorize receipt and storage of LLRW. Following extensive geohydrological investigations the license was amended in 1971 to authorize disposal of LLRW by shallow land burial. State and federal agency involvement and DHEC approval preceded authorization for burial.

License 097 specifies requirements by which CNS operates the disposal site. Waste acceptance criteria are described as well as specific documentation that must accompany each shipment from the generator. Waste shipments and vehicles must comply with United States Department of Transportation (DOT) regulations for transport and receipt at the site and even more stringent license conditions for acceptance, burial and vehicle release. The license also describes trench construction specifications, backfilling and capping requirements and required trench markings.

License 097 has been amended sixty times since it was issued in 1969. Amendments cover a range of changes, from modifying a single license condition to a complete rewrite consolidating several previous amendments into a single document. The amendments have resulted in positive changes and improvements to the burial site and its long-term integrity. An application to renew the license was submitted to DHEC in April 2000, again in December 2008, and, most recently, in March 2014. Currently, site activities continue with the license in timely renewal status.

Decommissioning Trust Agreement of 1981: On March 24, 1981, Chem-Nuclear Systems entered into a Trust Agreement with the State of South Carolina to provide monies for establishment of a Decommissioning Trust Fund. In 1981, at the time Chem-Nuclear

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Systems entered into the Trust Agreement, Chem-Nuclear Systems contributed a lump sum of approximately $1.7 million to the decommissioning fund. No additional contributions were made until April 1, 1993, when a rate of $4.11 per cubic foot of waste received for disposal at the BDF was contributed to the fund. This contribution rate lasted for three months. Soon thereafter, contributions were set at $12.60 per cubic foot effective January 1, 1994, to cover costs of enhanced capping at the BDF. On July 1, 1995, the contribution rate was reduced to the current $4.20 per cubic foot.

In January 2008, the SC B&CB authorized expenditures for Phase I Decommissioning and Institutional maintenance and monitoring activities. The primary activities of Phase I Decommissioning began in 2008 and were completed by December 31, 2009. License 097 performance objective reporting, as required by the Phase I Decommissioning Plan, was completed by June, 2013. Further information on Phase I Decommissioning is provided in the 2016 Closure Plan.

On June 30, 2009, the SC B&CB approved a Memorandum of Understanding (MOU) that included (1) recognition that large portions of the BDF were permanently closed and decommissioned and (2) agreement that the SC B&CB will, consistent with all laws, regulations and procedures, approve disbursals from the Decommissioning Trust Fund and/or the Barnwell Extended Care Maintenance Fund to cover institutional maintenance and monitoring costs for the disposal facility. As described in the MOU, institutional costs include:

a. The costs for monitoring and custodial care of those portions of the disposal facility that have been designated by DHEC as closed areas.
b. The costs of monitoring areas adjacent to the BDF property to assess compliance with regulatory standards.
c. A portion of the total costs for monitoring, security, custodial care, and other shared costs of common areas of the disposal site property, in accordance with an apportionment schedule that is consistent with any determinations by the PSC regarding allowable costs of operation.

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In 2016, an updated Closure Plan was developed to describe decommissioning work completed to date, provide plans for future decommissioning, post-closure, and institutional activities, and to assess adequacy of both the Decommissioning Trust and Extended Care Maintenance Funds.

In 2000, with passage of the Atlantic Compact Act, the Decommissioning Trust Fund was allowed to be expended for both Decommissioning and Institutional costs and for the Extended Care Maintenance Fund to fund these activities after depletion of the Decommissioning Trust Fund. As of June 30, 2016, the Decommissioning Trust Fund balance is approximately $0, therefore, future institutional and decommissioning costs will come mostly from the Extended Care Maintenance Fund.

REGULATORY/POLITICAL HISTORY

During the early 1970's, the Barnwell site was one of six commercially operated LLRW disposal sites. By 1979, three of the commercial sites (in Illinois, Kentucky and New York) had closed, and the Barnwell site was receiving more than three-fourths of the nation's waste.

The increased rate of waste receipt led to South Carolina establishing limits on the annual volume of waste allowed to be received at the site. The volume restriction program gradually reduced allowable volume by one-half over a two-year period (1979-1981) to 1.2 million cubic feet per year. This restriction remained in effect until the enactment of the Atlantic Compact Act in 2000, which established the current framework.

During 1979, South Carolina developed and promulgated Regulation Number 61-83, "Transportation of Radioactive Materials Into and Through the State of South Carolina." This regulation established a permit system for waste generators shipping LLRW in the State and a prior notification system to provide DHEC and Chem-Nuclear Systems advance notification of shipments passing through the State and arriving at the site. In order for the waste generator to obtain a radioactive waste transport permit, the generator must pay a permit fee and provide

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DHEC evidence of financial ability to protect the State and the public from possible radiological injury or damage due to packaging, transportation, disposal, storage or delivery of radioactive waste. Evidence of financial ability can be established through a liability insurance certificate, bond, letter of credit, etc. The system requires that shippers certify shipments have been inspected and meet the requirements of appropriate regulations and license conditions.

In 1980, the U.S. Congress passed the Low-Level Radioactive Waste Policy Act. The Act established three major policies. First, each state is responsible for the low-level waste generated within its boundaries. Second, states may form compacts (or groups of states) to facilitate managing low-level waste generated within the boundaries of the compact states, including the right to deny disposal of out-of-compact wastes at compact disposal facilities. The Act also established the policy that these compacts could not refuse waste from other states until the U.S. Congress had ratified the compact. The Southeast Compact, consisting of eight southeastern states (Alabama, Florida, Georgia, Mississippi, North Carolina, South Carolina, Tennessee and Virginia) was formed, with the BDF designated the regional facility.

In December 1982, NRC promulgated 10 CFR Part 61, "Licensing Requirements for Land Disposal of Radioactive Wastes," which became effective in December 1983. This regulation specifies technical requirements applicable to the different life cycle phases of a disposal facility: licensing, operations, closure, post-closure surveillance and institutional control. As a matter of Agreement State compatibility, DHEC adopted regulations equivalent to 10 CFR Part 61.

On January 1, 1986, the Low-Level Radioactive Waste Policy Amendments Act was signed into law, making a generator's continued access to the three operating disposal sites contingent on its compact meeting specified milestones for new site development. The amended Act clarified Congress' intent to require compacts (or individual states not within a compact) to provide disposal capacity for LLRW generated within their boundaries by January 1, 1993. The legislation also defined the LLRW for which states are responsible. It also mandated Federal responsibility for all wastes for which states are not responsible (e.g. wastes classified as above NRC 10 CFR Part 61 Class C limits). The amended Act established conditions for access to operating disposal sites during the interim period, allowed the partial rebate of surcharges to

states and compacts which meet statutory milestones, and established penalties for states that fail to meet the mandated site development goals. A US Supreme Court decision in 1992 struck down the penalty portion of the amended Act.

The South Carolina General Assembly (SCGA), in its 1992 session, enacted legislation to allow the site to continue as the regional facility until December 31, 1995 subject to several conditions. One condition required states outside the Southeast Compact to demonstrate progress in developing their own regional disposal sites in order to retain access to the Barnwell facility. Another condition stipulated that after June 30, 1994, the site would accept waste from Southeast Compact generators only.

By 1995, continued delays in building a new regional disposal site led South Carolina's governor to propose legislation to withdraw the state from the Southeast Compact. In June of 1995, the SCGA enacted the legislation, South Carolina withdrew from the Southeast Compact, and the site began accepting waste from generators in all states except North Carolina and the Northwest Compact. North Carolina was restricted from site use due to its failure to develop the next disposal facility, and the Northwest Compact states already disposed of their LLRW at a facility in Washington. South Carolina also imposed a $235 per cubic foot tax on all waste received for disposal at the Barnwell facility. Proceeds from this tax went to the State's Children's Education Endowment Fund, which was used for educational scholarships and school construction.

On July 1, 2000, the Atlantic Compact Act became effective, enabling South Carolina to join the Atlantic Compact (formerly the Northeast Compact). Provisions in the legislation placed limits on yearly waste volumes for the period of 2000 to 2008, repealed the $235 tax, and, as of July 1, 2008, restricted acceptance of waste to the three states of the Atlantic Compact: South Carolina, Connecticut and New Jersey.

LICENSED DISPOSAL AREA

At site inception, the licensed area consisted of approximately 17.2 acres leased from the State for disposal operations. This tract of land was part of a larger property evaluated and found

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suitable for use as a disposal site during the site's licensing phase (1969 to 1971). The Lease Agreement was amended in 1976, enlarging the licensed disposal area to the current 235 acres.

TRENCH CONSTRUCTION

Waste burial operations in Barnwell began upon issuance of Amendment 3 to License 097 in April 1971. Since that time, trench design and construction practices have changed in response to regulatory input, license changes, and Chem-Nuclear Systems technical evaluations.

As specified in Amendment 3, the first trenches were shallow earthen excavations. The waste was placed into these excavations, surrounded and covered with backfill material, and then capped with clay. The clay cap was covered with a sheet of 10-mil plastic, over which additional protective soil was placed. Trench excavations were required to be located above the water table.

In April, 1973, Amendment 5 established several new trench design requirements and standardized trench dimensions. This amendment also required that a gravel-filled drain (French drain) be placed in the bottom center of each new trench, running the length of the trench. Monitoring pipes located at specific intervals were placed in the French drain. Also incorporated into the trench design was trench floor sand surrounding and covering the French drain. The trench cover no longer included 10-mil plastic.

Amendment 6 (1973) required DHEC inspection and approval of newly excavated trenches prior to commercial waste disposal.

Amendment 12 (December 1975) established design criteria for the slit trench. The new slit trench was similar to other trenches with the exception of width, which was greatly reduced. The trench was designed to provide a disposal method for higher activity waste such as irradiated reactor hardware. In regard to the standard trench, Amendment 12 required placing the French

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drain and monitoring standpipes along the sidewall of the trenches to reduce the possibility of pipe damage during waste placement.

Amendment 15 (July, 1977) allowed larger trenches to be constructed. The larger trench size allowed Chem-Nuclear Systems to arrange waste more efficiently, to make better use of trench space, and to reduce personnel exposure by using low-activity waste as shielding. This amendment also changed cover design, requiring a minimum thickness of clay and general earth cover.

At the end of 1982, NRC promulgated Regulation 10 CFR 61, which became effective in December 1983. Amendment 36 (November 1983) facilitated the implementation of 10 CFR 61 by requiring segregation of wastes according to waste class. Waste segregation was implemented through the use of three separate trench designs: Class A, Class B/C and slit (C-type) trench.

Amendment 36 also established the practice of installing intrusion barriers on trenches with Class C waste. In response to this change, Chem-Nuclear Systems installed intrusion barriers on existing slit trenches. The slit trench design was also changed to incorporate a keyway, a notch at the top of the trench designed to allow offload operations below grade. This below-grade arrangement provided additional shielding, thereby reducing worker and fenceline exposures.

In 1988, Chem-Nuclear Systems improved the design of the trench floor French drain system based on an evaluation of existing trench drainage properties. Chem-Nuclear Systems changed trench standpipes and screens from polyvinyl chloride (PVC) to stainless steel, and the French drain gravel materials to a coarse sand. The benefits were (1) the steel standpipes provide greater resistance to collapse and bending during trench disposal and backfilling operations, and (2) coarse sand minimizes the infiltration of fines into the French drain.

Amendment 45 (January, 1990) required that Chem-Nuclear Systems place polyethylene high integrity containers (HICs) containing Class B or C wastes in concrete vaults. This change was made to resolve concerns regarding the long-term stability of the polyethylene HICs.

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During 1993, Chem-Nuclear Systems began placing slit trench wastes in concrete vaults, eliminating the need for a separate concrete intrusion barrier on subsequent slit trenches.

Amendment 46 (August 1995) instituted several substantial changes to trench design and construction. These changes included placing all waste in concrete vaults (unless otherwise approved) and covering all future trenches with enhanced multi-layer earthen cap.

In 2003, Chem-Nuclear Systems received DHEC approval to place all waste classes within the Class B/C type trench, with Class A Unstable waste to be segregated from other waste by using separate disposal vaults. To accommodate large components and highly radioactive waste, slit trenches or other custom trench designs may be built, as appropriate.

In 2004, Chem-Nuclear Systems changed trench backfill material type and installation methods to minimize settlement and subsidence on trench covers.

WASTE FORM/PACKAGING REQUIREMENTS HISTORY

Since the beginning of site operations there have been many changes affecting the acceptability of wastes, waste packaging, and methods for disposal. This section describes the history of waste types received and disposal methods.

Waste types disposed in the first years of operations included utility wastes consisting of dewatered resins, absorbed liquids and Dry Active Waste (DAW). Chem-Nuclear Systems also received institutional and industrial wastes in the form of biological materials, absorbed liquids, liquid scintillation vials surrounded with absorbent material (e.g., vermiculite), general laboratory trash, DAW, and source and special nuclear materials (SNM: LLRW contaminated with small amounts of plutonium and certain isotopes of uranium). These wastes were generally packaged in metal drums, wooden or metal boxes and steel liners. A considerable amount of biological waste containing mostly tritium and carbon-14 radioisotopes was packaged in paper or cardboard containers.

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In April 1974, DHEC prohibited the receipt of utility-generated liquids processed in absorbent materials. Instead these liquids had to be processed by cement solidification. The license was amended again in July 1977 to broaden the list of acceptable solidification media. In May 1979, scintillation liquids were prohibited from site disposal, and institutional liquids were required to be solidified.

A change to the license in July 1981 required all ion-exchange resin and filter media bearing isotopes with half-lives greater than five years and combined activity of one microcurie per cubic centimeter, to be solidified or placed in a DHEC-approved HIC. Biological wastes were required to be double-packaged in metal containers with absorbent material and lime added to the waste and the interstitial space between containers filled with absorbent materials. These requirements continue to the present.

The operational requirements of 10 CFR Part 61 were implemented at the site during 1983. These requirements directed certain waste, based on specific radionuclides and concentrations, to be processed/packaged in a more stable form. Since most of these wastes were already packaged in HICs, the biggest effect was the requirement to segregate waste into separate trenches based on waste classification.

In 1989, NRC concluded that the current design of polyethylene HICs did not meet long-term stability requirements. A concrete vault was approved by DHEC to allow continued disposal of Class B and C waste in the polyethylene HICs.

Since 1996, Chem-Nuclear Systems has buried all waste in DHEC-approved vaults. These vaults are designed to improve long-term trench stability and also provide structural stability to waste packages. With DHEC's prior approval, large components such as steam generators, pressure vessels or reactor coolant pumps are qualified for disposal based on filling the shipping container with cement grout or demonstrating that the component exterior shell is comparable to a vault in its disposal location.

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In 2003, DHEC authorized placement of different waste classifications in a single trench provided "stable" and "unstable" wastes remained segregated by vaults.

Wastes received for disposal are documented on shipment/disposal manifests. The manifest has evolved during the site's history to meet regulatory requirements and site reporting needs. During the early years of disposal, the manifest did not require specific radionuclide information. Often, only the single most abundant radionuclide or a small percentage of the nuclides were listed. During the late 1970's and early 1980's, radionuclide reporting improved as a result of regulatory reporting changes. Isotopes such as carbon-14, tritium, etc., (usually shipped by private industries and universities) were specifically listed on the manifests enabling their existence and quantities to be traced back to their origin. However, in the case of power plant generated wastes, nuclide reporting was still limited mainly to the more abundant nuclides such as easily identified gamma emitters.

In 1983, with the advent of 10 CFR Part 61 waste stabilization and classification requirements, radionuclide reporting vastly improved. Specific waste stream samples from power plants were analyzed by independent laboratories for hard-to-identify radionuclides. Scaling factors were also developed to better estimate radionuclides in waste streams.

WASTE VOLUME HISTORY

Table A-1 lists the total waste volume received each year. After 2000, burial volumes are totaled over the State's fiscal year, which extends from July 1 to June 30. The site's annual disposal volume has varied significantly over the years, from approximately 50,000 ft^3 in 1971 to approximately 2,445,000 ft^3 in 1980 and more recently 10,318 ft^3 in FY 2016/2017.

TABLE A-1
BARNWELL DISPOSAL VOLUMES

YEAR	VOLUME (CUBIC FEET)
1971	50,219.34
1972	159,933.47
1973	599,886.28
1974	624,759.55
1975	643,564.44
1976	1,393,587.55
1977	1,636,425.12
1978	2,220,519.72
1979	2,238,322.13
1980	2,444,810.72
1981	1,543,278.67
1982	1,228,200.83
1983	1,240,668.21
1984	1,231,715.28
1985	1,214,422.99
1986	1,053,791.68
1987	958,275.82
1988	931,974.01
1989	1,103,299.56
1990	788,031.90
1991	789,681.85
1992	828,727.84
1993	605,443.07
1994	733,896.31

YEAR	VOLUME (CUBIC FEET)
1995	484,890.82
1996	325,815.32
1997	222,269.48
1998	195,684.08
1999	166,435.79
2000 (Jan-June)	69,197.42
FY 2000/2001	125,988.99
FY 2001/2002	57,763.15
FY 2002/2003	65,660.02
FY 2003/2004	59,515.00
FY 2004/2005	43,260.45
FY 2005/2006	44,988.48
FY 2006/2007	37,606.47
FY 2007/2008	32,954.23
FY 2008/2009	12,314.07
FY 2009/2010	34,626.38
FY 2010/2011	10,423.75
FY 2011/2012	9,494.35
FY 2012/2013	8,753.04
FY 2013/2014	8,494.00
FY 2014/2015	9,564.21
FY 2015/2016	8,304.27
FY 2016/2017	10,317.76
TOTAL	**28,307,757.87**

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APPENDIX B

REGULATORY REQUIREMENTS

Chem-Nuclear Systems operates the Barnwell site in accordance with the following regulatory requirements.

DISPOSAL FACILITY SC RADIOACTIVE MATERIAL LICENSE NUMBER 097

CNS is authorized to receive, store and dispose of radioactive material as LLRW in accordance with the conditions found in License 097. The license conditions are subdivided into the categories described below.

The General Conditions specify the location of the disposal facility, regulatory requirements, personnel training requirements, authorized users, record retention, site operation inspections and operating parameters.

The Receipt, Acceptance and Inspection Conditions specify shipment and disposal documentation required for receipt and disposal of low-level radioactive waste, reporting criteria, shipment inspection criteria and unusual hazard notifications.

The Waste Characteristics and Waste Form Conditions specify waste classification requirements, acceptable waste forms, documentation for particular waste forms, packaging criteria for particular waste forms, package activity limits for particular waste forms and prohibited waste.

The Contamination Limit Conditions specify contamination limits for incoming shipments of radioactive waste and incoming vehicles. These conditions also specify the release criteria for vehicles.

The General Packaging Conditions specify the minimum requirements for disposal packages and lifting attachments.

The Site Design, Construction and Maintenance Conditions specify disposal trench design, construction, approvals and maintenance. These conditions also specify the backfilling of trenches, erosion control, trench inspection procedures, trench closure, unauthorized entry, and trench marker requirements.

The Burial Operation Conditions specify methods for waste emplacement, vault design and construction, radiation and contamination controls and waste storage limits.

The Environmental Surveillance Conditions specify the environmental monitoring programs, surveillance reporting criteria, license transfer requirements, and site closure and stabilization plan criteria.

REGULATIONS

CNS operates the disposal site in accordance with all applicable state and federal regulations. The following sections identify and briefly describe key regulations.

South Carolina Regulation 61-63 specifies the requirements for the possession, use and disposal of radioactive material. The requirements include general provisions as well as provisions covering licensing, radiation protection, notices and reports, and land disposal of low-level radioactive waste.

South Carolina Regulation 61-83 specifies the requirements for reporting of shipper violations, for verifying generators and shippers have valid transportation permits, and for notifying shippers of any special requirements for delivery to the BDF.

10 CFR 71.12(b) requires the operator of any NRC approved package (transport cask) to maintain an approved QA program in accordance with 10 CFR 71 Subpart H and to have each package registered with the NRC. CNS operates in accordance with its Quality Assurance Program under NRC Approval No. 0935.

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South Carolina Regulation 61-9 specifies that certain industrial facilities possess a National Pollution Discharge Elimination System (NPDES) permit for storm water discharge. CNS operates under a general permit in accordance with a Storm Water Pollution Prevention Plan.

CNS disposal operations must also comply, as applicable, with the following regulatory requirements:

- Code of Federal Regulations, Title 29, Chapter XVII – Occupational Safety and Health Administration
- South Carolina State Primary Drinking Water Regulation 61-58
- South Carolina Hazardous Waste Management Regulation 61-79
- South Carolina Air Pollution Control Regulations and Standards, Regulation 61-62

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APPENDIX C

FACILITY DESCRIPTION

LICENSED DISPOSAL AREA

The 235 acre licensed disposal area is divided into the different use categories shown on Table C-1 below. The area used for disposal consists of the total area of enhanced cap (119.5 acres) plus the approximate trench area used (2.1 acres) as of June 30, 2017, in non-capped Trenches 91, 98, 99 and Slit Trenches 37 and 38. Future trench area is the total of remaining site surface area available for disposal and unused area in approved trenches.

TABLE C-1
BARNWELL SITE LAND DESIGNATIONS

DESIGNATION	APPROX. ACREAGE
Area Used for Disposal Since 1971	121.5
Future Trench Area	17.5
Remaining Licensed Area (including buffer zone, water management, and ancillary operational areas currently unavailable for disposal)	96
Total Licensed Disposal Area	**235**

DISPOSAL TRENCHES

Barnwell site trench design and construction practices are governed by DHEC-approved trench construction procedures and trench construction detail drawings. License 097 requires that changes to these documents be approved by DHEC prior to implementation. Trench areas are qualified for use and approved by DHEC prior to trench construction.

The two standard trench designs currently in use are the Class B/C type trench for all routine operational waste and the slit trench for irradiated hardware shipments. Special trenches may be built, when needed, to accommodate large components.

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Prior to establishment in 2003 of the Class B/C type trench for disposal of all waste classes, the most recent significant change to trench operating practice came into effect in January 1996 to comply with changes incorporated in Amendment 46 of License 097. Changes included requiring that all waste be placed in concrete disposal vaults and all trenches be covered with engineered enhanced cap.

With the transition to in-region operations, all waste other than slit trench waste and large components is disposed in the Class B/C type trench. Class A unstable waste is segregated from other waste in the Class B/C type trench by using separate disposal vaults. Disposal vault concrete lids serve as intrusion barriers for Class C wastes. A French drain and sump system allows monitoring of water accumulation in the trench. Voids around disposal vaults are filled with free-flowing sandy materials, and vaults are then covered with an initial clay cap. At a later date, enhanced cap is installed over contiguous areas of filled trenches.

The slit trench is used for disposal of irradiated hardware and large-quantity sealed sources. Trenches are narrow to facilitate remote offload, shielding and rapid covering of waste. The typical size allows a two-high stack of slit trench concrete disposal vaults. The concrete disposal vault lids serve as intrusion barriers. The entire trench floor is filled with coarse drain sand and sloped to one end. Standpipes to monitor water accumulation are installed periodically along the length of trench. Disposal vaults in the slit trench are backfilled with free-flowing material and then covered with clay-rich soils. Enhanced cap is installed above backfill materials.

Special trench configurations are constructed, as required, for disposal of large components or other unusual waste packages.

For all trench types, CNS has developed and documented, through its procedures, backfilling methods to maximize filling of voids around vaults and to enhance long-term stability of the entire trench system.

A multi-layer enhanced cap is installed following completion of disposal in a trench or a group of adjacent trenches. The enhanced cap consists of the initial clay cap overlain by polyethylene

and bentonite mat materials, a sand drain layer and general soil materials (for vegetation growth). The topmost layer is covered with topsoil and seeded with grass. The final task is to install trench standpipe and wellhead protective pads, and trench corner and identification markers.

SITE SUPPORT FACILITIES

CNS maintains several facilities on and adjacent to the licensed disposal area, some directly supporting site operations and others related to other business lines. Table C-2 lists existing facilities related to disposal operations. Disposal operations support facilities are described further below.

TABLE C-2
BARNWELL ANCILLARY FACILITIES

NAME
Receiving Warehouse No. 2
Administration Building
Environmental & Dosimetry Laboratory
Site Building
Cask Maintenance Building
Instrument Calibration Shop
Slit Trench Equipment Storage Building

Receiving Warehouse No. 2 is the point of receipt and inspection for shipments of equipment and supplies to the disposal site and other facilities in the Barnwell Complex. Goods are inventoried and stored here until needed and certain routine supplies are stored for disposition when needed.

The Administration Building houses most of the disposal site administrative staff including Site Management, Security, Personnel, Finance and Regulatory Affairs. The main access gate is adjacent to the building and controlled by Security whose office overlooks the gate.

The Environmental and Dosimetry Laboratory (BEDL) contains facilities and equipment for radiological analysis of air, water, and soil samples collected as part of the Barnwell

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Complex environmental monitoring program. The laboratory also provides company-wide radiological personnel monitoring services, such as whole body counting, bioassay, and dosimetry services. The laboratory's professional technical staff performs disposal site engineering design, environmental characterization, and site performance studies. SC Radioactive Material License 287-03 authorizes possession and use of radioactive material in the analytical laboratory.

Immediately adjacent to the BEDL is a storage building for storage of environmental monitoring supplies, archived samples and geologic cores.

The Site Building is the personnel access and egress point for the disposal site restricted area. Security controls are in place to manage vehicle and personnel access to the restricted area. Monitoring equipment is maintained at this location for routine self-monitoring to detect personnel contamination upon exiting the restricted area of the site. The Site Building also includes site employee lockers, a break room, radiation safety work and office space to support the performance of radiological surveys, and an office for the DHEC on-site inspector. The building also houses contamination smear counting equipment and meters used for radiation surveys as well as parts and supplies in support of environmental sampling and drilling operations at the disposal site.

The Cask Maintenance Building (CMB) is used to prepare casks for offloading (removing rain covers, loosening lid bolts, etc.), decreasing radiation exposure and improving efficiency and safety during offloading. Routine maintenance of casks is also performed in this building.

The Instrument Calibration Shop provides space for calibration and maintenance of radiation safety equipment in support of the disposal site radiation protection program. SC Radioactive Material License 287-01 authorizes possession and use of radioactive material in the calibration source area.

The Slit Trench Equipment Storage Building provides covered space for storage of slit trench off-loading equipment.

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ENVIRONMENTAL MONITORING FACILITIES

CNS maintains significant facilities, instrumentation and equipment for environmental monitoring of the Barnwell site. The program infrastructure is based in the BEDL, where CNS performs radiological analyses of environmental media. Non-radiological and certain radiological analyses are performed by vendor laboratories. CNS regularly collects water, air, soil and vegetation samples from monitoring well, trench monitor pipe, air sampling and boundary station locations. The BEDL also implements comprehensive monitoring of direct radiation along the facility's fenceline and at other appropriate locations using thermoluminescent dosimeters (TLDs).

CNS monitors a network of approximately 188[1] groundwater monitoring wells and 164 trench standpipes designed and located to monitor for the migration of radioactive and hazardous materials. Wells are categorized by type as on-site, boundary, or off-site. Wells located near trenches and within the restricted area are designated as on-site wells. Wells positioned within the restricted area around the boundary of the disposal site are referred to as boundary wells. Wells located off restricted property are off-site wells. Monitor wells are positioned to collect groundwater upgradient as well as downgradient of the site burial area. Trench standpipes monitor for water accumulation in closed trenches.

BEDL disposal site support also involves site characterization, groundwater and contaminant transport modeling and site performance evaluation. A full complement of equipment is maintained and routinely used to gather data for site performance evaluation as well as for routine geotechnical investigation related to qualifications for new trenches. This equipment includes a drill rig for geologic/geotechnical sample collection and monitoring well installation, and assorted drilling support equipment such as pumps, air compressors and cement mixing apparatus.

[1] Includes potable wells, wells used to only measure water levels, and Barnwell Processing Facility wells.

SITE EQUIPMENT

In addition to equipment associated with specific facilities described above, CNS operates and maintains a variety of equipment and vehicles associated with disposal operations at the site. Equipment includes mobile cranes, earth moving and grading equipment, mowers, electrical generators and forklifts. Vehicles include yard tractors, stake bed trucks, light trucks and trailers.

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APPENDIX D

DISPOSAL FACILITY OPERATIONS

This section presents the scope of disposal operations, describing in detail the elements required to successfully and safely operate a disposal site. In addition to basic disposal operations functions such as waste receipt and burial, site maintenance and trench construction, this section describes critical compliance functions embodied in CNS' comprehensive environmental monitoring, health and safety and radiation protection programs. These programs have enabled the disposal site to set a high standard in safety and environmental compliance. The activities described in this section form the basis for the allowable costs identified and described in Section 2.0. A significant portion of the environmental monitoring and site maintenance activities described in this section are institutional activities paid from the Decommissioning Trust Fund and/or Extended Care Maintenance Fund.

DISPOSAL TRENCH DESIGN AND CONSTRUCTION

Trench areas are qualified for use prior to trench construction. A geotechnical and hydrological trench qualification investigation is performed in the proposed trench area to demonstrate satisfactory soil and water table conditions. Site conditions (surface drainage, access, etc.) and information from existing boreholes are evaluated as the initial phase of field investigation. Additional exploratory boreholes are drilled if available information is insufficient to characterize the geology of the proposed trench area.

Nearby water table wells are used to determine maximum historic water levels. These data are used to establish the maximum trench depth.

CNS combines trench data and evaluations along with the proposed trench design drawings into a trench qualification report, which is submitted to DHEC for review and approval. Construction may begin following DHEC approval.

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Disposal trenches are constructed in accordance with DHEC-approved procedures, trench construction detail drawings, and a trench-specific design drawing. These drawings must be approved by DHEC prior to use. CNS and DHEC verify conformance to design by inspections at designated hold-points defined in the trench construction procedure.

To minimize open time, the Class B/C type trench is typically constructed in short sections (100 – 150 feet in length) based on expected waste receipts. This approach limits trench exposure to rainfall, runoff, and other forms of weathering and minimizes the potential for storm water accumulation in a trench. The Class B/C type trenches are constructed using a combination of hydraulic excavators, dump trucks, motor graders and bulldozers. During construction, temporary trench ramps provide access to the excavation area. Personnel access into trench excavation is restricted during construction and operations.

Due to their narrow and steep-walled design, slit trenches are excavated entirely from the top. CNS allows no personnel entry into the slit trench excavation during construction or trench operations. CNS excavates slit trenches using a hydraulic excavator and dump trucks, often in sections of limited length. CNS then extends the slit trench, as needed, based on waste receipt projections, thereby minimizing trench exposure to rainfall, runoff, and other forms of weathering.

As excavation proceeds in all trench types, a registered land surveyor (RLS) monitors elevations and sloping and establishes trench bottom elevations. CNS conducts formal and informal inspections throughout the construction process, and DHEC performs several formal inspections as outlined in construction procedures. Formal DHEC inspections occur after (1) trench excavation, (2) drain system construction, and (3) final floor sand installation. After trench approval, CNS may begin waste disposal operations within the trench.

WASTE DISPOSAL OPERATIONS

Certain prerequisites must be satisfied prior to the acceptance of waste for disposal, including:

- prior notification of waste shipments by shippers,

- review of shipment documentation upon arrival of the shipment at the disposal facility,
- inspection of the shipment for compliance with U.S. DOT regulations,
- radiological survey of the vehicle and accessible packages and
- verification of waste class and waste form.

At least 72 hours prior to releasing a shipment for delivery to the disposal site, the shipper must notify the CNS Licensing Department with information concerning the shipment. This information includes name of shipper, anticipated arrival date and detailed information on the waste.

CNS reviews the information and verifies that the shipper has a valid permit to transport waste into or within the state of South Carolina. The detailed waste information is entered into an electronic database (the Waste Manifest Data Management System) and then the shipper is issued a shipment identification number.

When waste shipments arrive at the disposal site, the Licensing Department reviews the paperwork to verify compliance with U.S. DOT regulations, Barnwell Site Criteria, and the 097 License. This paperwork includes:

- The Barnwell Waste Management Facility Uniform Low-Level Waste Manifest,
- S.C. DHEC Radioactive Waste Shipment Prior Notification and Manifest Form (DHEC 802 Form),
- S.C. DHEC Radioactive Waste Shipment Certification Form (DHEC 803 Form),
- Complete isotopic analysis printout or equivalent for aqueous filter media, filters and resins,
- Documentation of waste classification methods and approval required for Class "C" waste shipment,
- Written statement of any unusual hazards and/or precautions that must be taken,
- High Integrity Container Certification, if applicable, and

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- A DOE/NRC Form 741 for Special Nuclear Material (SNM) when required.

If a discrepancy is noted during the receipt inspection of the waste shipment or its paperwork, the CNS Licensing Department is notified. The CNS Licensing Department notifies the shipper and the DHEC on-site inspector of the discrepancy. A Condition Report is generated and the shipment may not be accepted for disposal until appropriate corrective actions are taken and approval is granted.

Data from the appropriate documents are entered into the Waste Manifest Data Management System. Calculated package volumes, activities and weights are verified with the reported values from the manifest for consistency. The waste generator and/or shipper is responsible for properly classifying the waste and documenting it on the manifest. Using the information provided in the shipping documentation, CNS verifies the waste classification. When the documentation is found to be acceptable, a "traveler" form is generated that accompanies the shipment through the remaining inspections and offload.

Once the paperwork has been accepted, the Radiation Safety Department performs a visual and radiological inspection of the shipment. The visual inspection includes checking that the packages are:

- properly braced and blocked,
- properly labeled and marked,
- not damaged, and
- properly palletized, if appropriate.

The transport vehicle is also inspected to verify that it is properly placarded. Direct radiation and surface contamination surveys of the vehicle and packages are performed to verify compliance with U.S. DOT radiological limits.

When all incoming inspections are satisfactorily completed, CNS provides the shipment paperwork to the on-site DHEC inspector for review. When the DHEC inspection is complete, CNS proceeds with offload of the shipment.

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Depending on the type of shipment and waste type, the transport vehicle will be directed to either the Cask Maintenance Building (CMB) or other appropriate location within the restricted area.

Cask shipments are directed to the CMB where they are prepared for offloading and inspected. Inspections include checking the integrity of cask chains and cables, hold-down assembly, rain cover, and cask bolts and ratchets. Radiation Safety personnel perform additional radiological surveys on the cask to assist in preparing for offloading. Offload preparations include removal of the rain cover or impact limiter, loosening ratchet binder assemblies, and removal of lid hold-down bolts.

Once all inspections and offload preparations are complete, casks are then directed to the trench for offloading waste containers into concrete disposal vaults.

Closed vans, when received, are directed to the CMB to complete arrival radiation surveys. Following these surveys the van is moved to the trench. Containers are unloaded using the appropriate equipment into either a rectangular or cylindrical disposal vault.

CNS continues inspecting containers as they are unloaded and placed in the disposal vaults. The CNS Licensing Department is notified if any container is damaged or is improperly marked or labeled.

Waste containers are selected according to CNS procedure or at DHEC request for verification of the absence of freestanding liquid. Liners may be placed in a test stand and punctured using hydraulic rams and special punches. Low dose drums and boxes may be placed in an appropriately controlled area and punctured using hand tools. Liquids found are collected and measured. If the amount of measured liquid exceeds established criteria, the on-site DHEC inspector and the generator are notified and proper disposition of the container is determined.

Waste containers are unloaded from vans and casks and placed inside disposal vaults. Three types of reinforced concrete vaults are normally used: slit trench, rectangular and cylindrical

vaults. In some cases, oversized waste containers may require a custom-size vault that will require additional DHEC approval. The position of each vault is recorded in the Waste Manifest Data Management System.

Large components, which must be qualified as equivalent to disposal vaults, can be placed directly in the trench. A trench placement plan must be approved by DHEC prior to acceptance of any large component for disposal.

Detailed records of waste receipt and burial are maintained by CNS, with disposal volume reports prepared and submitted to DHEC monthly.

TRENCH BACKFILL AND ENHANCED CAP

When vaults are filled and closed, CNS places free flowing backfill material in the void space between the vaults. Filling void space minimizes the potential for subsidence of the enhanced cap.

Following backfill, vaults are covered with additional soil material and initial clay cap. CNS installs the initial clay cap to minimize the infiltration of surface water into the trench. Grass may be planted on the initial cap to control erosion. CNS installs the final multi-layer enhanced cap after completion of waste disposal in a trench.

Enhanced caps are installed above the initial clay cap of completed trenches. Caps consist of a combination of materials designed to minimize infiltration into the underlying trench waste zone and to promote drainage to the cap perimeter. These materials are arranged in a multi-layered system of structural fill (1 foot minimum), compacted low permeability soil (1 foot), composite geomembrane and geosynthetic clay liner barrier materials, sand drain (1 foot), and vegetative cover (2 feet) for a total thickness of at least five feet. The uppermost part of the vegetative cover layer consists of approximately 3-6 inches of topsoil, which is seeded with hardy grass species.

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SITE MAINTENANCE

As required by License 097, CNS implements a comprehensive site inspection and maintenance program to ensure on-going compliance with key site maintenance objectives such as trench cap integrity and proper surface water drainage. Trench inspections occur monthly and after substantial rainfall, and general disposal site inspections occur weekly. The inspections identify concerns such as erosion, settlement and water ponding on or around trench areas and ensure timely repair.

CNS maintains records of inspections and maintenance actions. These records document disposal area performance and provide data for estimating future trench maintenance requirements.

CNS also performs operational maintenance activities. The areas around the active trenches are graded to ensure proper drainage of precipitation away from the open portions of the trenches. On-site parking areas, trench work areas, and access roads to the active trenches are graded and maintained.

CNS manages surface water in accordance with the requirements of License 097 and State NPDES regulations. The primary License 097 requirements related to surface water concern elimination of surface water run-in into open trenches, to efficiently drain rainwater off of closed trench caps, and to contour trench covers to minimize erosion. These considerations are addressed in the facility's trench construction procedure and by final cover design, both of which are approved by DHEC before implementation. NPDES requirements are implemented through a Storm Water Pollution Prevention Plan (SWPPP). The purpose of the SWPPP is to establish measures to minimize the release of pollutants (including sediment) from the disposal site in storm water.

RADIATION PROTECTION PROGRAM

An integral part of the overall Health and Safety Program is the radiation protection program. This program is designed to ensure site workers, other CNS employees, visitors and members of

the general public are not exposed to ionizing radiation in excess of the limits established by DHEC. CNS manages this program with the philosophy that exposures to ionizing radiation should be maintained As Low As Reasonably Achievable (ALARA). CNS maintains an ALARA subcommittee to help achieve this philosophy and draws on expertise throughout the company to provide expert reviews and advice for the radiation protection of workers. Routine and special meetings are held to discuss dose goals and engineering controls to further reduce employee exposure.

The radiation protection program controls exposures to ionizing radiation in accordance with DHEC requirements. Exposures are measured using personnel monitoring and other appropriate dosimetry. Radiation work permits are generated as a controlling device for certain work activities with potential radiation exposure. The permits detail the personnel protective equipment required for the activity and any other special considerations needed to safely perform and control the work.

CNS controls exposure to internal sources of radiation to limits substantially below DHEC requirements. CNS uses bioassay samples and whole body radiation scans to monitor internal radiation exposures. If it is determined that an internal exposure has occurred, an internal dose assessment will be performed as part of the total effective dose equivalent record. Controlling internal exposure is done through the respiratory protection program and in accordance with criteria specified in specific radiation work permits.

A key element in the management of radiation program controls is the establishment of areas of different degrees of hazard or potential hazard. Clean areas, which are considered free of radioactive material hazard, are routinely monitored to ensure these areas remain clean, whereas restricted areas, which may pose a greater potential hazard, require additional monitoring or a higher level of control. Special control areas (such as radiation, airborne radioactivity, controlled surface contamination and radioactive material storage areas) are designated in accordance with regulations to manage radiation risk. Additional training requirements have been established for personnel entering these areas.

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The radiation protection program establishes radiological controls to manage external exposure to alpha, beta and gamma radiation. These controls also are used to minimize the inhalation and ingestion of radiological materials. Through radiological dose rate and contamination surveys, the proper controls can be determined. Adequate personnel contamination monitoring is provided through these surveys and radiological airborne contamination monitoring.

To properly administer the program, radiation safety technicians must undergo rigorous training in areas such as regulatory requirements, radiation protection implementation, radiation safety principles and practices, proper documentation through surveys, radiation work permits, sample logs and airborne monitoring.

To ensure proper radiation monitoring, CNS personnel maintain, repair and calibrate instrumentation. Equipment calibration standards are traceable to the National Institute of Standards and Technology. The program also controls the calibration and check source inventory.

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ENVIRONMENTAL MONITORING

As required by License 097, CNS maintains both radiological and non-radiological comprehensive environmental monitoring programs for the disposal site. These programs are designed to assure that any releases of waste materials can be readily detected during operation of the site or following closure. The monitoring programs are designed to protect workers, the public, and the environment from harmful levels of radioactivity and other regulated chemicals. The monitoring programs include constant surveillance of pathways for transport of radioactive and other regulated chemicals through the environment. Non-radiological program requirements are based on 40 CFR 122, Appendix D, Tables II and III. The radiological monitoring program objectives incorporate International Commission on Radiological Protection (ICRP) guidelines.

The radiological environmental monitoring program for the disposal site is multifaceted, involving a wide range of techniques and sample points. CNS monitors the atmosphere, soil, vegetation, surface water, sediment and groundwater. In addition, thermoluminescent dosimeters (TLDs) are carefully located to check direct radiation from the site. The sample collection schedules for the on- and off-site areas including number of each sample type, frequency of sampling and analyses performed are shown in Table D-1. Monitoring results are submitted to DHEC on a quarterly basis in the form of two reports, the CNS Site Operational Monitoring Report and the CNS Environmental Monitoring Report. Components of the monitoring program are discussed briefly in the sections that follow.

Atmospheric Monitoring

CNS implements atmospheric monitoring around the perimeter of the disposal facility as well as around active disposal areas.

Continuous air samples are taken at permanently located stations around the perimeter of the site. The disposal site's boundary stations are distributed around the site to enable CNS to distinguish between radioactive materials potentially released by adjacent facilities and that which is attributable to the Barnwell site. This approach ensures that

all sectors around the disposal site are adequately monitored. Air particulates are collected by drawing air through glass-fiber filters, which are exchanged bi-weekly for analysis.

Soil and Vegetation

Surface soil samples and samples of vegetation are collected periodically and analyzed for radioactivity.

Surface Water and Sediments

Surface water and sediments are collected at the disposal site with particular attention given to surface waters outside the site boundary that could be used as drinking water by the public or animals. Downgradient of the disposal site, CNS monitors the location where shallow groundwater flowing under the site first emerges in surface streams. Water and sediments are monitored at this location as well as at other nearby stream locations.

Groundwater

CNS routinely monitors an extensive network of both on- and off-site wells for radioactive materials. On-site wells monitor groundwater near trench locations and at the site boundary. Off-site wells are located both upgradient and downgradient from the site.

Thermoluminescent Dosimeters

Each environmental station is equipped with a set of thermoluminescent dosimeters (TLDs) to measure external exposure from penetrating gamma radiation. TLDs are also located at intervals along the perimeter fence of the site. CNS makes extensive use of TLDs as a relatively inexpensive, yet highly reliable means for demonstrating compliance with radiological standards.

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TABLE D-1
BARNWELL SITE MONITORING PROGRAM SAMPLE COLLECTION SCHEDULE

SAMPLE DESCRIPTION	# OF LOC[1]	TYPE	MEDIA	FREQUENCY	ANALYSIS
On-Site Locations:					
Monitor Wells[2,4]	79	Grab	Water	Quarterly	Gross Alpha/Beta, Gamma Isotopic, Tritium, C-14, pH, Conductivity, Temperature
Observation Sumps	155	Grab	Water	Annually	Gamma Isotopic, Tritium
Observation Sumps	9	Grab	Water	Quarterly[10]	Gamma Isotopic, Tritium
External Gamma	31	Continuous	TLD	Quarterly	Exposure
Site Boundary Locations:					
Wells[2,5]	19	Grab	Water	Quarterly	Gross Alpha/Beta, Gamma Isotopic, Tritium, C-14, pH, Conductivity, Temperature
Stormwater Surface Soil	3	Grab	Soil	Quarterly	Gamma Isotopic, Tritium
Soil	11	Grab	Soil	Annually	Gamma Isotopic, Tritium
Vegetation	11	Grab	Vegetation	Annually	Gamma Isotopic, Tritium
Atmospheric[11]	8	Continuous	Particulate Filter	Bi-Weekly	Gross Alpha/Beta, Gamma Isotopic
External Gamma	43	Continuous	TLD	Quarterly	Exposure
Off-Site Locations:					
Potable Wells[3]	14	Grab	Water	Quarterly	Gross Alpha/Beta, Gamma Isotopic, Tritium, pH, Conductivity, Temperature
Monitor Wells[2,3,12,13]	51	Grab	Water	Quarterly	Gross Alpha/Beta, Gamma Isotopic, Tritium, C-14, pH, Conductivity, Temperature
Surface Water[8,3]	7	Grab	Water	Quarterly	Gross Alpha/Beta, Gamma Isotopic, Tritium, C-14, pH, Conductivity, Temperature
Soil[8,9]	5	Grab	Soil	Annually	Gamma Isotopic, Tritium
Vegetation[7,8,9]	5	Grab	Vegetation	Annually	Gamma Isotopic, Tritium
Sediment[8]	4	Grab	Sediment	Annually	Gamma Isotopic, Tritium
Atmospheric[9]	1	Continuous	Particulate Filter	Bi-Weekly	Gross Alpha/Beta, Gamma Isotopic
External Gamma	10	Continuous	TLD	Quarterly	Background Exposure

[1] As of June 30, 2017.
[2] Water levels measured quarterly. Only includes monitoring wells on the sampling program.
[3] Nine (9) wells are sampled annually.
[4] At 13 wells annually analyzed for C-14 if average gross beta is high.
[5] At 4 wells annually analyzed for C-14 if average gross beta is high.
[6] At 8 wells annually analyzed for C-14 if average gross beta is high.
[7] At 2 locations annually analyzed for C-14 if average gross beta is high.
[8] Off-Site Springs and Creeks.
[9] Barnwell County Airport.
[10] Nine (9) sumps monitored quarterly per BEDL-11-024 approval letter.
[11] Includes a station located south of the Barnwell Site.
[12] Selected locations are sampled for gamma once a year. Selected locations are sampled for gamma every five (5) years.
[13] Includes wells at Barnwell Processing Facility.

Nonradiological Monitoring

The nonradiological monitoring program is designed to characterize and monitor nonradiological constituents in the groundwater at the disposal site. Samples are

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collected by CNS and provided to an independent laboratory for analysis. Upon receipt of the laboratory results, CNS performs a review of the data and forwards the results to DHEC. A summary of the sample schedule is provided in Table D-2.

The nonradiological groundwater monitoring program consists of fourteen on-site wells, two boundary wells, ten off-site wells and two creek sample points. On a quarterly basis, sixteen of these twenty-eight sample locations are sampled and analyzed for pH, conductivity and volatile organics. The remaining twelve locations are sampled and analyzed for pH, conductivity and chloroform.

Annually, eighteen sample locations are sampled and analyzed for carbon-14, mercury and volatile organics. The remaining ten wells are sampled and analyzed for carbon-14 and volatile organics.

Additionally, once every five years, eighteen sample points are sampled for a complete list of EPA Priority Pollutants. These priority analytes include acids, base/neutrals, pesticides/PCB's, total phenols and total cyanide.

TABLE D-2
BARNWELL SITE NON-RADIOLOGICAL GROUNDWATER SAMPLE SCHEDULE

SAMPLE DESCRIPTION	# OF LOCATIONS	TYPE	MEDIA	COLLECTION FREQUENCY	ANALYSIS
Wells	14	Grab	Groundwater	Quarterly	pH, Conductivity, Volatile Organics, Library Search
	12	Grab	Groundwater	Quarterly	pH, Conductivity, Chloroform
	10	Grab	Groundwater	Annually	pH, Conductivity, Volatile Organics, Library Search, Carbon-14
	16	Grab	Groundwater	Annually	pH, Conductivity, Volatile Organics, Library Search, Carbon-14, Mercury
				Five Years	pH, Conductivity, Volatile Organics, Library Search, Acids, Base/Neutrals, Pesticides/PCB's, Cyanide, Phenols, Carbon-14, Metals
Stream	2	Grab	Surface Water	Quarterly	pH, Conductivity, Volatile Organics, Library Search
				Annually	pH, Conductivity, Volatile Organics, Library Search, Carbon-14, Mercury
				Five Years	pH, Conductivity, Volatile Organics, Library Search, Acids, Base/Neutrals, Pesticides/PCB's, Cyanide, Phenols, Carbon-14, Metals

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QUALITY ASSURANCE PROGRAM

CNS operates in accordance with its Quality Assurance (QA) Program, comprised of planned and systematic actions designed to ensure that CNS disposal and disposal-related activities are conducted in a satisfactory and compliant manner. The controls of the CNS QA Program address disposal and disposal-related activities that are considered "Important to Safety." "Important to Safety" items and activities are those necessary to assure that radioactive waste is received, handled, packaged, stored, processed or disposed without undue risk to the health and safety of the public or the environment. The CNS QA Program is based on the nuclear industry standards and regulations required by our customers, the NRC and DHEC.

The CNS QA Program is implemented through a series of procedures, instructions and drawings that are prepared, reviewed and approved by appropriately qualified personnel. Adherence to the CNS QA Program and implementing procedures, instructions and drawings is mandatory for all CNS employees and subcontractors. Key elements of the CNS QA Program include, but are not limited to:

- Training and qualification of personnel
- Controls for purchased materials, items and services
- Document control
- Inspections
- Audits
- Record keeping

The CNS QA Program requires CNS personnel that perform "Important to Safety" activities to receive training on the purpose, scope and implementation of procedures and instructions. The personnel also receive training in the principles and techniques of the activity being performed. The CNS QA Program requires that this training be documented.

An important element of the CNS QA Program is the Safety Review Board (SRB). The Safety Review Board is responsible for review and oversight of the conduct of CNS business where

matters of safety are involved and to assure compliance with applicable regulatory requirements, procedures, policy, licenses, permits and certificates. SRB members are selected based on their experience and level of responsibility within the company. The SRB normally meets quarterly and conducts additional SRB meetings as required for review and approval of new procedures. The SRB is supported by four subcommittees that report to the SRB on matters related to ALARA, brokering, emergency response, and environmental compliance. The Complex also maintains a Safety Committee that meets monthly.

The documents that are used to implement the CNS QA Program are controlled by the company's document control center. These documents are controlled and distributed using a controlled distribution list. Procedures require that personnel remove any obsolete documents from the workplace. The document control system ensures that personnel have available the appropriate and most current version of procedures, instructions, or drawings.

Materials, items, and services purchased for the disposal site are controlled through a number of CNS QA Program procedures. First, vendors who supply the disposal site with "Important to Safety" material, items and services must be evaluated and approved by CNS Quality Assurance. Secondly, the material and items are receipt-inspected by a qualified CNS Quality Control Inspector prior to being placed in service. These actions ensure that materials, items, and services comply with the applicable design, quality, and regulatory requirements.

The CNS Quality Assurance/Quality Control department is responsible for verifying compliance to the CNS QA Program and company procedures. The verification activities include a series of inspections, surveillances, and audits of the activities performed at the disposal site. Formal internal audits of all of the functional areas covered by the CNS QA Program are conducted at least once per year. The results of these inspections, surveillances, and audits are reported to senior management for evaluation and development of corrective action, if required.

Any deficiencies identified are entered into the CNS Corrective Action Program. This program requires that each deficiency is evaluated for cause and appropriate corrective actions are developed to fix and prevent recurrence of the deficiency. Corrective action plans are reviewed

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and approved by the CNS Quality Assurance department. Further, the CNS Quality Assurance department verifies effective completion of corrective actions prior to closing the issue.

The records system maintained by CNS includes the retention of those records essential to demonstrate quality and compliance to requirements. Records are prepared, reviewed, approved and maintained in accordance with established procedures and are readily retrievable. The records are retained in a secure and controlled environment.

TRAINING AND EMERGENCY RESPONSE PROGRAM

CNS provides training to its employees and contract personnel to effectively and safely perform the duties of their position.

All personnel are required to complete the General Employee Training (GET). The GET is designed to provide employees and contract personnel with the fundamentals of safety, security, quality, and radiation protection. This fundamental information is necessary to better understand the requirements of the individual's job, safety requirements, and the various regulations under which CNS operates.

In addition to GET, individualized training is provided to each employee and contract personnel based on their job responsibilities. The individual's supervisor is responsible for identifying training requirements. The individualized training may include the following topics:

- Radiation Worker Training
- Radiation Safety Technician Training
- Transportation Training
- Heavy Equipment Operator Training
- Hazardous Materials Training
- Emergency Response Training

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The Emergency Response Program provides the guidelines for emergency preparedness to ensure that the:

- disposal site is operated to limit radiation exposure and the release of radioactive materials in an emergency;
- capability exists for measuring and assessing the significance of an accidental release of radioactive materials;
- capability exists for responding to nonradiological emergencies (e.g., fires and chemical spills);
- appropriate emergency equipment, procedures and training are provided;
- notifications are promptly made to appropriate state and local agencies; and
- necessary recovery actions are taken to return the disposal site to a safe condition after an emergency.

A facility Emergency Response Team is comprised of individuals with experience and training in responding to radiological incidents, non-radiological incidents and medical emergencies. These individuals undergo initial and annual training. CNS also routinely interfaces with and provides and receives training from local fire, medical, and law enforcement personnel. Local emergency response personnel become familiar with the facility through tours of the facility and identification of areas of special precautions.

Emergency response exercises are conducted to maintain readiness. The exercises are critiqued and corrective actions are taken to improve the program.

ENVIRONMENT, HEALTH AND SAFETY

The Safety Program defines the environmental, health and safety requirements and designated protocols to be followed by CNS employees at the disposal site. The CNS health and safety program is established through a series of safety procedures which include the applicable requirements of the Occupational Safety and Health Administration (OSHA) regulations. The program applies to all CNS employees as well as CNS subcontractors and visitors to the site. The program provides guidance for field monitoring, sample collection and data analysis, and

engineering and administrative controls. As part of this program, CNS personnel monitor and plan for chemical and biological hazards, physical hazards (such as confined spaces), vibration and noise hazards and other environmental hazards.

Safety personnel also evaluate effectiveness of the CNS personnel protective equipment program, administer the industrial hygiene air monitoring program, and provide oversight for environmental compliance in the area of hazardous and non-hazardous waste management.

PHYSICAL SECURITY

CNS has and will continue to enhance its security program as necessary to meet potential threats of theft and sabotage of nuclear materials. DHEC, through radioactive material license 097 and Regulation 61-63, provide facility security requirements. Since 2008, CNS has implemented improved electronic surveillance and monitoring systems, physical security inspections, and security training for employees and contractors.

Objectives of the security program include, but are not limited to the following:

- Constant surveillance of personnel access and egress points
- Electronic monitoring of specific areas of concern
- Facility and equipment protection
- Unauthorized entry detection
- Unauthorized entry response plans
- Employee, contractor, and visitor positive identification
- Verification and validation of employee and contractor trustworthiness and reliability
- Emergency response support

The Restricted and Controlled Areas of the BDF are protected by industrial style fencing and lighting. Access points to these areas are controlled by Security personnel and are under

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surveillance. The boundaries of these areas are posted with appropriate security and safety signage and radiological postings as necessary.

Through routine security inspections and surveillance of the facility, Security personnel ensure that the objectives of the security program are met. Security personnel provide written and verbal reports of all security infractions or violations to management in accordance with CNS policy and procedures.

Since 2008, the CNS Security program has reduced staffing to reflect the slower pace of disposal operations and has implemented engineered enhancements to improve compliance with program objectives. On-going operational security tasks include checking in waste shipments into the facility, checking out shipments exiting the site, and managing access/egress controls for the facility.

COMMUNITY EDUCATION AND COMMUNICATION

Since the beginning of site operations 45 years ago, CNS has maintained an "open door" policy with respect to the community and visitors to the disposal site as well as open and active lines of communication with community leaders, residents, and organizations. These lines of communication serve to support education of the public in matters related to LLRW disposal and have kept information about the disposal site and its operation accessible to the public. Continuation of an open, public LLRW disposal process, maintenance of effective lines of communication and education of the public will remain integral elements in the future successful operation of the disposal site.

ORGANIZATION STRUCTURE

The mission and focus of the CNS organization is operation of the regional LLRW disposal site located in Barnwell County, SC. This section defines key elements of the BDF organizational structure. A basic organization/function chart for BDF is provided as Figure D-1. Functional teams are described in the following sections.

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The site operations and construction team includes personnel and costs directly involved in waste handling operations and site construction/earthworks activities at the disposal site. Included in this team are the Disposal Site Manager, Radwaste Technicians, Cask Operating Technicians, Crane Operators, Equipment Operators, Maintenance Mechanics, Radiation Safety Technicians, and Waste Tracking Database staff.

The administrative team includes management, supervision, training and engineering support for the disposal site. It also includes finance, accounting, billing and accounts payable support for waste disposal operations.

The licensing team includes costs associated with pre-approval of waste shipments through the Prior Notification Process; review of shipping paperwork to verify compliance with US DOT regulations, Barnwell Site Criteria and License 097; review and renewal of the disposal site license and disposal related permits; and document control. Included here are Licensing and Regulatory Affairs management and Barnwell licensing support.

The health and safety team includes the Radiation Safety Officer, Radiation Safety Supervisor and Radiation Safety Technicians required to support waste receipt and disposal operations, and instrument calibration. The Radiation Safety Supervisor function is also included in this unit.

The quality assurance team provides quality assurance program support and direct quality control support required for disposal operations.

Environmental programs are primarily implemented through the Barnwell Environmental and Dosimetry Lab (BEDL). Labor, material and other costs are captured in this unit or charged to appropriate projects. The BEDL conducts environmental monitoring, characterization and groundwater modeling studies for the disposal facility. Records of environmental and regulatory compliance are maintained by the BEDL in electronic databases. The BEDL also maintains dosimetry records for the disposal site, field services and other business unit personnel. The cost

for dosimetry records, data processing and reports for other units are transferred to those units through a project number.

The liaison team includes personnel and costs associated with required interfaces with the SC Public Service Commission, the SC Office of Regulatory Staff, and the Atlantic Compact Commission. It also includes liaison and interaction with the Atlantic Compact generators. Activities associated with education of members of the public on matters relative to LLRW disposal and liaison with local elected officials relative to disposal site operations are also included here.

Disposal operations also receive various kinds of administrative support from parent company business units. This support typically includes services such as general ledger maintenance, fixed asset depreciation accounting, purchasing and receiving warehouse support, accounts receivable collections, legal counsel support, Environmental, Health and Safety support and quality assurance oversight. Costs for these services and support are collected in appropriate "pools" and allocated to lines of business throughout the company using appropriate allocation methods.

Some personnel assigned to the BDF organizational structure may occasionally charge labor costs to other projects or business units within the parent company organization. These costs are charged based on the employee's hourly rate plus fringe.

Barnwell facility costs such as utilities, janitorial services, telefax, postage, and trash pick-up and county landfill charges are allocated as direct costs to the company business units with significant activities located in the Barnwell area. This allocation is divided between disposal and other company business units based on approximate head counts.

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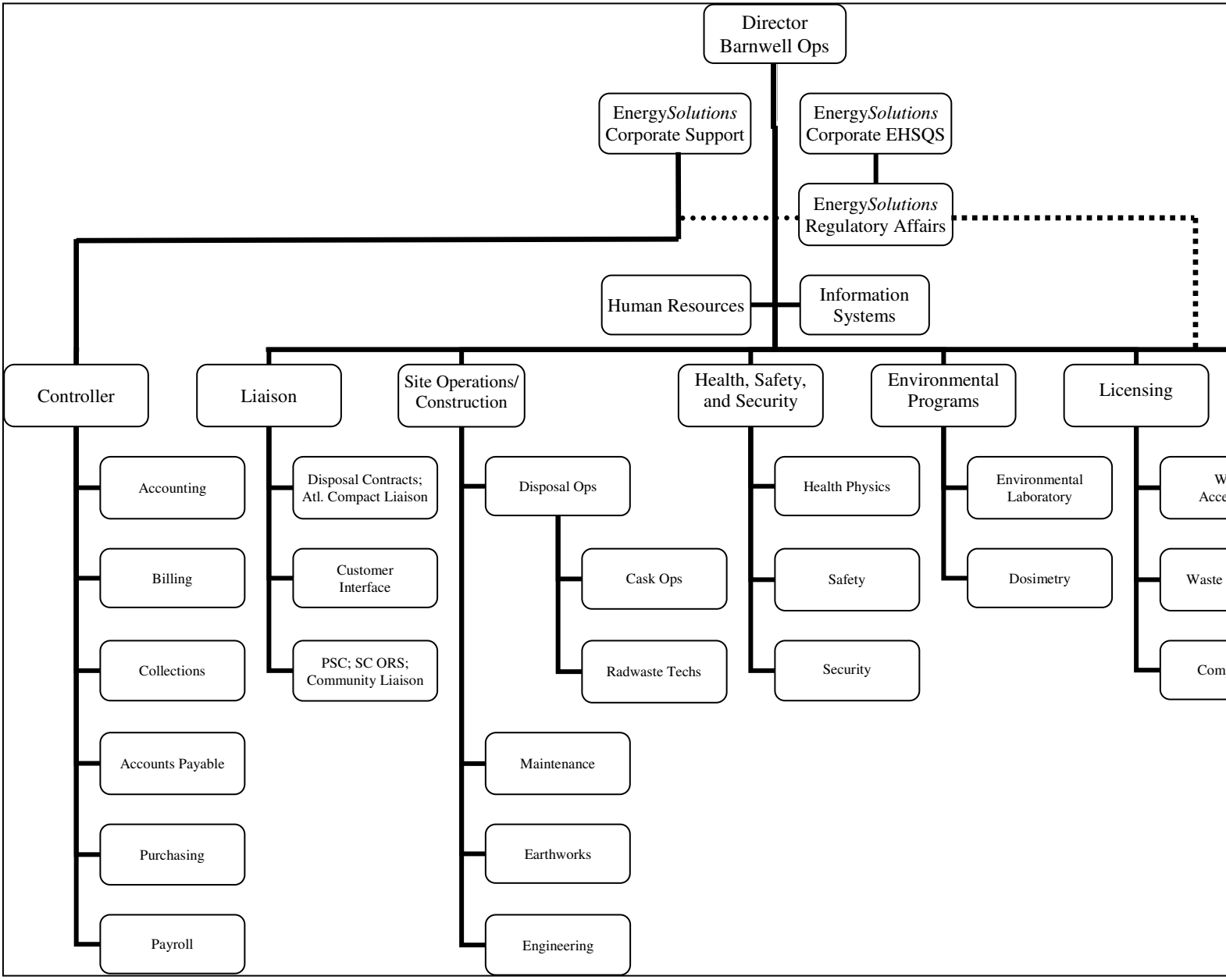
FIGURE D-1
DISPOSAL OPERATIONS FUNCTIONAL ORGANIZATIONAL CHART



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COLLABORATIVE REVIEW

In 2002, Chem-Nuclear Systems retained Project Time & Cost, Inc. (PT&C) to develop an independent Operations and Efficiency Plan (O&E Plan) for the CNS Barnwell Disposal Facility. CNS provided the plan to the South Carolina Public Service Commission on June 26, 2002. On April 14, 2003, the Commission issued Order No. 2003-188. This Order directed CNS to file a statement regarding a collaborative review of the O&E Plan. In response to the order, participants from the following organizations met several times:

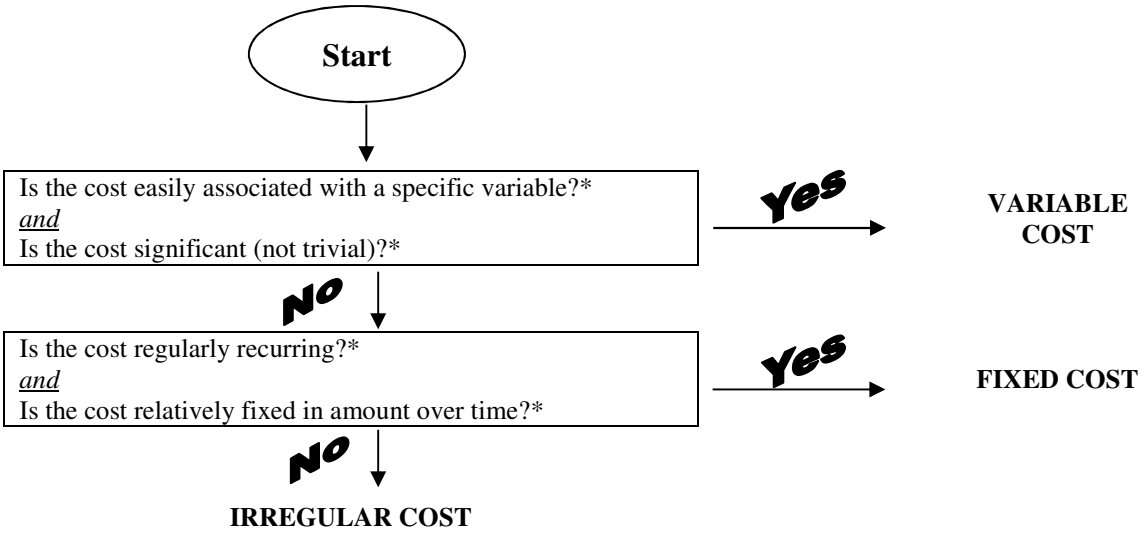
SC Public Service Commission
SC Department of Health & Environmental Control
SC Budget & Control Board
Atlantic Compact Commission
SC Consumer Advocate
Chem-Nuclear Systems

The parties, after completing a collaborative review of the O&E Plan, reached consensus that the information provided in the O&E Plan was a valid representation of disposal site operations and that the plan could be used as a baseline for establishing a method for determining allowable costs in future Commission proceedings. The parties identified three cost categories (variable costs, fixed costs, and irregular costs) for operating the Barnwell site. The parties also reached consensus on recommendations provided for the Commission's consideration.

The O&E Plan identified seven cost types, some of which are facility-specific and some could be seen as overlapping from one category to another. Through the collaborative review discussions, the participants determined that three generic cost types represent all the work breakdown structure (WBS) elements. A working definition illustrated in Figure D-2 was developed and used to classify each of the costs as variable, fixed, or irregular. Fixed costs are regularly recurring and relatively constant over time. Variable costs are readily associated with a specific variable and change as the variable changes. Irregular costs occur on an intermittent basis and cannot be easily associated with a specific variable. Subsequent audits by the Office of

Regulatory Staff have helped clarify placement of specific costs or cost elements in each of these cost types.

FIGURE D-2
WORKING DEFINITIONS FOR PURPOSES OF COST CLASSIFICATION



* The two questions in each box establish qualitative tests and should be considered together. For example, if the cost is obviously and directly associated with an easily measurable variable (Box 1, Q1), then the magnitude of the cost (Q2) is less important in determining whether it is a variable cost. Similarly, if the cost is significant (Q2), then it can still be a variable cost even though its association with a measurable variable is not as obvious and direct as some others (Q1).

The majority of the costs of Barnwell operations are fixed costs. Elements such as health and safety, security, licensing, environmental monitoring, training, administration, QA/QC, finance/ accounting and human resources, continue independent of the amount of waste arriving at the site. Fixed costs may change over time due to pay raises or supplier increases which are beyond control of the site operator.

The variable costs include certain materials and labor costs directly associated with the receipt and disposal of waste. The parties agreed that the costs identified as variable costs will likely decrease as the amount of waste received each year decreases in accordance with current statutes. The parties agreed that the methods already established by the Commission staff for determining the variable material cost rates (i.e., costs for concrete disposal vault purchases) are reasonable and appropriate and should remain in effect. As a result of the collaborative review process, the parties established variable waste dependent labor costs using information from the O&E Plan.

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Variable Material (Vault) Costs

Variable material costs for vaults may be affected each year by such factors as the cost of each type of vault, the number of each type of vault used, the size, shape and type of waste containers received and the number of vaults used in each trench. The method established for determining variable costs rates for vaults involves examination of the volume of waste received by waste classification (Class A, Class B, Class C and slit trench volume) and the volume of each waste classification disposed of in each respective trench. The total cost for vaults used in a trench divided by the total waste volume disposed in each trench provides a variable cost rate by trench type. A cumulative rate by waste classification can then be used to develop one indicator of vault costs.

Variable Waste Dependent Labor Costs

Variable waste dependent labor costs are included in the activities directly associated with waste acceptance, inspection, and disposal. While the volume of waste in various classifications has been useful in establishing variable cost rates for the material costs associated with vaults, variable labor rates can be more appropriately developed for specific work activities based on the following independent variables related to the amount of waste received for disposal:

- number of vaults used for disposal of waste
- number/type of shipments (vans, vertical casks, horizontal/slit trench casks)
- number of waste containers received

The labor costs associated with certain activities defined in various WBS elements described in the O&E Plan are directly related to the amount of waste received as measured or indicated by one of these independent variables. The parties further agreed that the labor rates for a specific WBS activity or a group of WBS elements should be based on different independent variables.

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Other Variable Costs

The O&E Plan describes other reimbursable costs (such as Atlantic Compact Commission surcharges and payments to the Decommissioning Trust Fund and the Extended Care Maintenance Fund). These costs are established on a per-cubic-foot basis and are included in the statutory requirements for operating the disposal site.

Through collaborative review, the parties identified some costs that tend to be irregular. Examples of ongoing irregular costs include trench construction, license renewal, and large component disposal. Irregular costs can be tracked and controlled separately and are easily audited by the Commission staff in their annual audit. The site operator will request reimbursement with the allowed operating margin for irregular costs in the appropriate application to the Commission.

The O&E Plan provided a structure for managing, analyzing, and communicating information about costs associated with operating the Barnwell Disposal Facility. The WBS section with its hierarchical structure and cost detail provided a framework to align the Company's accounting system to collect annual costs at a level of detail to allow better analysis. The Company's accounting system has been aligned to accumulate costs in categories of fixed, variable, and irregular costs consistent with agreements reached during the collaborative review and during subsequent ORS financial audits.

The Report of the Collaborative Review concludes that the method described for determining waste-dependent labor rates is a good approach.

Through the collaborative review process and use of the O&E Plan, the parties identified and developed four recommendations for the Commission's consideration. These recommendations are summarized below.

The parties established that the costs identified as "fixed costs" are valid costs of operating the Barnwell site. The parties recommended that the Commission allow the operating company to be reimbursed for actual dollars spent plus, where applicable, the statutory operating margin for each of these identified fixed costs.

The costs identified as "variable costs" will vary with the amount of waste, type of shipments, and number of containers received at the Barnwell site. Variable costs include waste dependent labor and materials. The parties recommended that the Commission continue to use the previously accepted method of establishing material rates by waste classification for vault purchases. The parties also recommended that the Commission establish waste dependent labor rates associated with each vault, van waste shipment, cask waste shipment, slit trench waste shipment, total shipments and total containers received for disposal.

The costs identified as "irregular costs" are likely to be different each year. The parties recommended that the Commission allow the operating company to be reimbursed for actual dollars spent plus, where applicable, the statutory operating margin for each of these identified irregular costs.

The parties agreed that operating efficiencies are important to cost reduction efforts and that CNS should continue efforts to improve efficiencies in all aspects of operations.

Subsequent to the Collaborative Review of the OEP, accounting audits conducted by the SC Office of Regulatory Staff (ORS) suggested refinement of the classification of certain specific costs as fixed or irregular.

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