Union of Concerned Scientists
Citizens and Scientists for Environmental Solutions

July 10, 2012

R. William Borchardt, Executive Director
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

SUBJECT: PETITION TO REDRESS TECHNICAL SPECIFICATION DEFICIENCIES REGARDING IRRADIATED FUEL AT THE BRUNSWICK STEAM ELECTRIC PLANT (DOCKET NOS. 050-325 AND 050-324)

Dear Mr. Borchardt:

On behalf of the North Carolina Waste Awareness & Reduction Network (NC WARN), the Nuclear Information and Resource Service (NIRS), and the Union of Concerned Scientists (UCS), I submit this petition pursuant to 10 C.F.R. § 2.206 requesting that the Nuclear Regulatory Commission (NRC) take enforcement action in the form of an order either modifying the subject operating licenses or requiring the licensee to submit amendment requests for these licenses to address the technical specifications changes detailed in the Specific Actions Requested section.

Statement of Interest

Based in Durham, North Carolina, NC WARN is a member-based nonprofit tackling the accelerating crisis posed by climate change – along with the various risks of nuclear power – by watch-dogging utility practices and working for a swift North Carolina transition to energy efficiency and clean power generation. In partnership with other citizen groups, NC WARN uses sound scientific research to inform and involve the public in key decisions regarding their wellbeing. Founded in the late 1980s, NC WARN has more than 1,000 members, mostly in North Carolina.

The Nuclear Information and Resource Service (NIRS) was founded more than 30 years ago to be the national information and networking center for citizens and environmental activists concerned about nuclear power, radioactive waste, radiation, and sustainable energy issues. NIRS still fulfills that core function, but has expanded both programmatically and geographically. NIRS initiates large-scale organizing and public education campaigns on specific issues, such as preventing construction of new reactors, radioactive waste transportation, deregulation of radioactive materials, and more.

UCS is a national non-profit membership organization headquartered in Cambridge, MA and with offices in Washington, DC, Berkeley, CA, and Chicago, IL. UCS is a leading science-based nonprofit working for a healthy environment and a safer world. UCS combines independent scientific research and citizen action to develop innovative, practical solutions and to secure responsible changes in government policy, corporate practices, and consumer choices. What began as collaboration between students and faculty at the Massachusetts Institute of Technology in 1969 is now an alliance of more than 250,000 citizens and scientists. UCS members are people from all walks of life: parents and business people, biologists and physicists, teachers and students. Nuclear power plant safety has been one of UCS's focus areas for decades.

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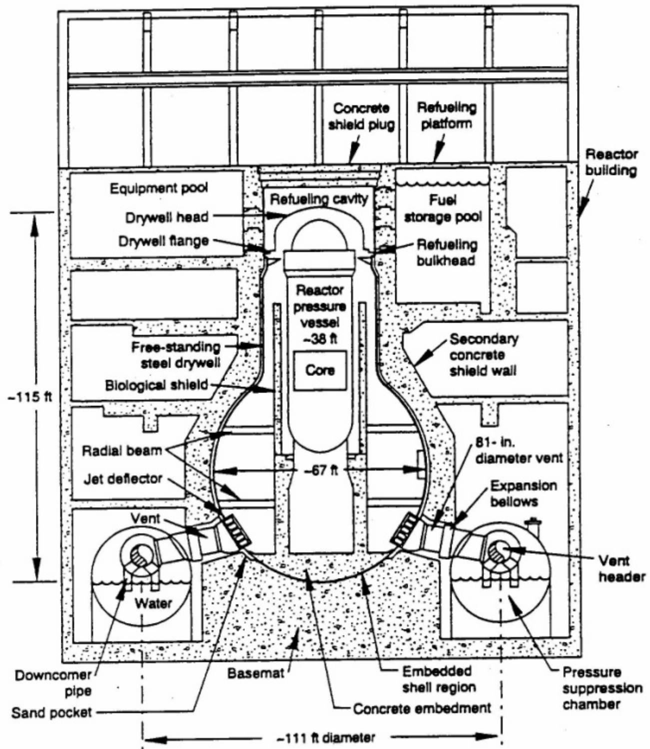
Background



The Brunswick Steam Electric Plant has two operating boiling water reactors (BWRs) with Mark I containment designs. Each reactor has its own spent fuel pool located within the secondary containment as shown in the figure.

The NRC issued operating licenses to Carolina Power & Light, now doing business as Progress Energy, for the two reactors at Brunswick. The operating licenses included technical specifications that establish minimally acceptable conditions for reactor operation and define actions to be taken – up to and including reactor shut down – when those minimally acceptable conditions are not met.

The NRC originally licensed each Brunswick unit to store up to 720 fuel bundles inside its individual spent fuel pool (Ref. 12). In August 1977, the NRC approved amendments to the Unit 1 and Unit 2 operating licenses that allowed the pools to be re-racked with racks capable of storing up to 616 pressurized water reactor (PWR) spent fuel assemblies (from the company's HB Robinson nuclear plant) or 1,386 boiling water reactor (BWR) spent fuel assemblies. The NRC approved amendments to the operating licenses in December 1983 allowing each spent fuel pool to store up to 160 PWR and 1,803 BWR fuel assemblies in the Unit 1 spent fuel pool and up to 144 PWR and 1,839 BWR fuel assemblies in the Unit 2 spent fuel pool (Ref. 13), their currently licensed storage capacities.

Each Brunswick reactor core holds 560 fuel assemblies. Thus, each Brunswick spent fuel pool is licensed to hold more than three reactor core's worth of irradiated fuel. The technical specifications issued by the NRC with the operating licenses contain many provisions to protect the irradiated fuel in the reactor core from damage and to protect workers and the public from radioactivity released from irradiated fuel in the reactor core should it become damaged despite these extensive precautionary measures. The technical specifications fail to provide adequate protection when irradiated fuel is in the spent fuel pools as shown in the following table:

Brunswick Unit Technical Specification (Reference 1)	Refueling outage and all but one irradiated fuel assembly offloaded to spent fuel pool	Refueling outage and all irradiated fuel offloaded to spent fuel pool with one irradiated fuel assembly being moved inside pool	Refueling outage and all irradiated fuel offloaded to spent fuel pool with no irradiated fuel assemblies being moved inside pool
2.1 on minimum water level in spent fuel pool	No	No	No
Table 3.3.6.2-1 on Reactor Building Exhaust Radiation – High secondary containment isolation	No	Maybe	No
Table 3.3.7.1-1 on Control Building Air Intake Radiation – High control room emergency ventilation system isolation	No	Maybe	No
3.6.4.1 on secondary containment operability	No	Maybe	No
3.6.4.2 on secondary containment isolation damper operability	No	Maybe	No
3.6.4.3 on standby gas treatment system operability	No	Maybe	No
3.7.3 on control room emergency ventilation system operability	No	Maybe	No
3.7.4 on control room air conditioning system operability	No	Maybe	No
3.7.7 on spent fuel pool water level	No	Yes	No
3.8.2 on AC power supplies with the reactor shut down	Yes	Yes	No
3.8.5 on DC power supplies with the reactor shut down	Yes	Yes	No
3.8.8 on electrical distribution systems with the reactor shut down	Yes	Yes	No
3.9.7 on residual heat removal system operability during refueling	Yes	No	No
3.9.8 on residual heat removal system operability during refueling	Yes	No	No

Several of the technical specifications may be applicable when the entire reactor core has been offloaded into the spent fuel pool and an irradiated fuel assembly is being moved inside the pool. These technical specifications only apply if the fuel assembly being moved has been inside a critical reactor core within the past 24 hours. Otherwise, the technical specification is not required/applicable.

Other than limiting the total number of fuel assemblies that can be stored in the spent fuel pool and the minimum level that the spent fuel pool water level can be inadvertently drained to, the Unit 1 technical specifications provide no protection against or mitigation of damage to irradiated fuel assemblies in the spent fuel pool from overheating.

With the spent fuel pool entirely filled with more than three reactor core's worth of irradiated fuel, including one freshly offloaded reactor core, the current technical specifications do not require water to be in the pool, secondary containment around the pool to be available, or the normal or backup cooling systems to be functional. That's clearly inadequate. Earlier this year, the NRC issued orders to Brunswick's owner requiring that reliable instrumentation be installed to monitor parameters like water level and water temperature. Because the existing technical specifications do not require water level to be maintained in the spent fuel pool except when certain irradiated fuel is being moved within it, the NRC-mandated spent fuel pool water level instrumentation could be disabled for months; after all, since water level itself is not required, monitoring of it is also not required (at least per the existing technical specifications, not per reality).

The actions requested by this petition seek to improve the technical specifications by changing all the "No" and "Maybe" entries in the above table to "Yes," thus better managing the risk from irradiated fuel stored inside the spent fuel pools.

<u>**Specific Actions Requested**</u>

The Brunswick Steam Electric Plant has two reactor units licensed by the NRC to operate. The requested actions are based upon the Unit 1 Technical Specifications (Reference 1) and are also requested for the similar Unit 2 Technical Specifications (Reference 2). The convention used to designate individual sections within the Technical Specifications will be TS n.n.n (e.g., TS 3.4.2 refers to Technical Specification 3.4.2). This petition seeks to have the NRC take enforcement action that results in the following revisions to the technical specifications for the subject operating licenses.

1) **Revise TS 2.1, Safety Limits, to include a requirement like the one in TS 2.1.1.3 that the water level shall be greater than the top of active irradiated fuel in the spent fuel pool.**

   <u>Justification</u>: TS 2.1.1.3 requires that the water level inside the reactor vessel be maintained above the top of irradiated fuel. Per Reference 6, the bases for this requirement are to provide core cooling capability. When the reactor is shut down, "If the water level should drop below the top of the active irradiate fuel during this period, the ability to remove decay heat is reduced. This reduction in cooling capability could lead to elevated cladding temperatures and clad perforation … . The reactor vessel water level SL [Safety Limit] has been established at the top of the active irradiated fuel to provide a point that can be monitored and to also provide adequate margin for effective action."

   TS 4.2.1 limits the number of irradiated fuel assemblies in the reactor core to 560. TS 4.3.3 allows up to 1,803 irradiated boiling water reactor fuel assemblies and 160 pressurized water reactor fuel assemblies to be stored in the spent fuel pool. During refueling outages, the entire reactor core inventory of 560 irradiated fuel assemblies can be offloaded into the spent fuel pool to join 1,403 irradiated fuel assemblies already stored there. Currently, no Safety Limit requires water level be maintained above irradiated fuel in the spent fuel pool. The hazard requiring TS 2.1.1.3 is neither eliminated nor lessened when irradiated fuel assemblies are offloaded to the spent fuel pool. Thus, proper management of this hazard necessitates a Safety Limit for water level above the top of irradiated fuel in the spent fuel pool as is presently provided for water level above irradiated fuel in the reactor core.

   For example, Technical Specifications License Condition P(2)(7) requires measures be developed to mitigate damage to fuel in the spent fuel pool. These mitigating measures most likely rely on an assumed water level in the spent fuel pool. If the water level fell below the top of irradiated fuel in the spent fuel pool, the associated lack of shielding from the missing water could render the mitigating measures unviable while the lack of water inventory could affect the timing and flow rate of makeup water to the pool.

In its safety evaluation for the operating license amendment that established the current limit on spent fuel storage for Unit 1 (Ref. 13), the NRC staff stated "The design of the storage pool is such that the fuel will always be covered with water. The top of the stored fuel is at an elevation lower than the bottom of the pool gate which separates the reactor well from the storage pool." Amendment No. 170 to the Unit 1 operating license established the design minimum inadvertent drainage level to correspond to 115' 11" site elevation (Ref. 14). But TS 3.7.7 (see Requested Action (9) below) would not preclude intentional drainage or unmitigated boil-off of the spent fuel pool water level below this point.

The requested Safety Limit protects irradiated fuel in the spent fuel pool as TS 2.1.1.3 currently protects irradiated fuel in the reactor vessel.

2) **Revise footnote (b) for TS Table 3.3.6.2-1, Secondary Containment Isolation Instrumentation, to require the Reactor Building Exhaust Radiation – High function to be applicable whenever irradiated fuel is stored in the spent fuel pool.**

<u>Justification</u>: Per Reference 8, the Reactor Building Exhaust Radiation – High function initiates closure of the secondary containment isolation devices and automatic start of the standby gas treatment system to limit the release of fission products. Reference 8 further explains that "High secondary containment exhaust radiation is an indication of possible gross failure of the fuel cladding. The release may have originated from the primary containment due to a break in the RCPB [reactor coolant pressure boundary] or the refueling floor due to a fuel handling accident."

Per Reference 10, the NRC "determined that loss of SFP [spent fuel pool] coolant inventory greater than 1 foot occurred at a rate of 1 event per 100 reactor years" while "Loss of SFP cooling with a temperature increase greater than 20°F occurred at a rate of approximately 3 events per 1000 reactor years." Reference 10 stated "these events resulted in several feet of SFP coolant level, some of the events have lasted longer than 24 hours." Loss of water inventory from the spent fuel pool or loss of cooling capability for its water can lead to gross failure of the fuel cladding.

A fuel handling accident, wherein an irradiated fuel assembly is damaged from being dropped or banged into something, could result in release of radioactivity in amounts requiring the automatic isolation of secondary containment and the automatic start of the standby gas treatment system to limit the offsite radiation doses. Reference 10 showed that the probability of spent fuel pool water inventory or cooling loss is not so low as to be dismissed or neglected. Furthermore, the fuel handling accident's consequences are limited to the radioactive source term in a relatively small number of fuel rods (i.e., only those fuel rods in the single fuel assembly dropped plus the fuel rods in the fuel assemblies it impacts before coming to rest). A spent fuel pool accident initiated by loss of water inventory may yields a much larger radioactive source term (i.e., the fuel rods in at least the irradiated fuel assemblies recently discharged from the reactor core).

Thus, the protection afforded by the Reactor Building Exhaust Radiation – High function when recently irradiated fuel is being moved in secondary containment is also needed whenever irradiated fuel is in the spent fuel pool.

3) **Revise footnote (a) for TS Table 3.3.7.1-1, Control Room Emergency Ventilation (CREV) System Instrumentation, to require the Control Building Air Intake Radiation – High function to be applicable whenever irradiated fuel is stored in the spent fuel pool.**

<u>Justification</u>: Per Reference 8, the Control Building Air Intake Radiation – High function automatically starts the Control Room Emergency Ventilation (CREV) System. Air within the control room is recirculated through filters to remove radioactivity and sufficient outside air in

drawn to maintain the control room's pressure slightly above atmospheric pressure. The CREV System is "designed to provide a radiologically controlled environment to ensure the habitability of the control room for the safety of control room operators under all plant conditions" to ensure "that the radiation exposure of control room personnel, through the duration of any one of the postulated accidents, does not exceed the limits set by GDC [general design criterion] 19 of 10 CFR 50, Appendix A."

As described in the justification for Requested Action (2) above, irradiated fuel in the spent fuel pool can be damaged due to loss of water inventory or cooling. The operators need equal protection in that event.

Thus, the protection afforded by the Control Building Air Intake Radiation – High function when recently irradiated fuel is being moved in secondary containment is also needed whenever irradiated fuel is in the spent fuel pool.

4) **Revise the APPLICABILITY for TS 3.6.4.1, Secondary Containment, to include whenever irradiated fuel is stored in the spent fuel pool.**

Justification: Per Reference 8, the purpose of "secondary containment is to contain and hold up fission products that may leak from primary containment following a Design Basis Accident (DBA). In conjunction with operation of the Standby Gas Treatment (SGT) System and closure of certain valves whose lines penetrate the secondary containment, the secondary containment is designed to reduce the activity level of the fission products prior to release to the environment…".

Per Reference 10, losses of spent fuel pool water inventory and cooling have been routinely experienced at U.S. reactors. Loss of spent fuel pool water inventory or cooling can result in damage to irradiated fuel assemblies stored therein due to overheating. Per Reference 11, the offsite consequences due to radioactivity released from irradiated fuel assemblies damaged in a spent fuel pool can be considerable.

Thus, the protection afforded by the Secondary Containment being operable when recently irradiated fuel is being moved in secondary containment is also needed whenever irradiated fuel is in the spent fuel pool.

Alternatively, the APPLICABILITY for TS 3.6.4.1 could be revised to "During operations with a potential for draining the reactor vessel (OPDRVs) or the spent fuel pool." This would permit secondary containment not to be operable during Modes 4, 5, and defueled as long as nothing was ongoing that had the potential to drain the spent fuel pool. If spent fuel pool cooling became lost, the potential it introduced to boil away and drain the spent fuel pool would invoke the requirement to restore secondary containment to operable status. Likewise, this APPLICABILITY would require secondary containment to be operable before initiating movements of heavy loads over the spent fuel pool or other activity that might cause the loss of water inventory from the spent fuel pool.

5) **Revise the APPLICABILITY for TS 3.6.4.2, Secondary Containment Isolation Dampers, to include whenever irradiated fuel is stored in the spent fuel pool.**

Justification: See the description for Requested Actions (2) and (4) above.

6) **Revise the APPLICABILITY for TS 3.6.4.3, Standby Gas Treatment (SGT) System, to include whenever irradiated fuel is stored in the spent fuel pool.**

Justification: See the description for Requested Action (4) above.

7) **Revise the APPLICABILITY for TS 3.7.3, Control Room Emergency Ventilation (CREV) System, to include whenever irradiated fuel is stored in the spent fuel pool.**

Justification: See the description for Requested Action (3) above.

8) **Revise the APPLICABILITY for TS 3.7.4, Control Room Air Conditioning (AC) System, to include whenever irradiated fuel is stored in the spent fuel pool.**

Justification: See the description for Requested Action (3) above.

9) **Revise the APPLICABILITY for TS 3.7.7, Spent Fuel Storage Pool Water Level, to be whenever irradiated fuel is stored in the spent fuel pool instead of only when irradiated fuel assemblies are being moved in the spent fuel pool.**

Justification: TS 4.2.1 limits the number of irradiated fuel assemblies in the reactor core to 560. TS 4.3.3 allows up to 1,803 irradiated boiling water reactor fuel assemblies and 160 pressurized water reactor fuel assemblies to be stored in the spent fuel pool. During refueling outages, the entire reactor core inventory of 560 irradiated fuel assemblies can be offloaded into the spent fuel pool to join 1,403 irradiated fuel assemblies already stored there.

If 559 of the 560 irradiated fuel assemblies in the reactor core were offloaded to the spent fuel pool during a refueling outage, the sole irradiated fuel assembly remaining in the reactor vessel would require (a) the water level inside the reactor vessel to be above the top of the irradiated fuel within that fuel assembly per TS 2.1, (b) AC power sources to be available per TS 3.8.2, (c) DC power sources to be available per TS 3.8.5, (d) power distribution systems to be available per TS 3.8.8, and (e) one residual heat removal shutdown cooling subsystem to be operable and in service per TS 3.9.7 and TS 3.9.8. But when that last irradiated fuel assembly was offloaded into the spent fuel pool, all of these requirements would be removed. And TS 3.7.7 would not require any water level to be maintained in the spent fuel pool as long as no irradiated fuel assemblies were being moved. It is nonsensical that a single irradiated fuel assembly within the reactor core would invoke all those safety requirements while it along with 1,962 other irradiated fuel assemblies inside the spent fuel pool would invoke none of them.

Per Reference 10, losses of spent fuel pool water inventory and cooling have been routinely experienced at U.S. reactors. Loss of spent fuel pool water inventory or cooling can result in damage to irradiated fuel assemblies stored therein due to overheating. Per Reference 11, the offsite consequences due to radioactivity released from irradiated fuel assemblies damaged in a spent fuel pool can be considerable.

Thus, the protection afforded by the spent fuel pool having a minimally allowable water level when recently irradiated fuel is being moved is also needed whenever irradiated fuel is in the spent fuel pool.

10) **Revise the APPLICABILITY for TS 3.8.2, AC Sources – Shutdown, to be whenever irradiated fuel is stored in the spent fuel pool instead of only when irradiated fuel assemblies are being moved in secondary containment.**

Justification: See the description for Requested Action (9) above.

11) **Revise the APPLICABILITY for TS 3.8.5, DC Sources – Shutdown, to be whenever irradiated fuel is stored in the spent fuel pool instead of only when irradiated fuel assemblies are being moved in secondary containment.**

    Justification: See the description for Requested Action (9) above.

12) **Revise the APPLICABILITY for TS 3.8.8, Distribution Systems – Shutdown, to be whenever irradiated fuel is stored in the spent fuel pool instead of only when irradiated fuel assemblies are being moved in secondary containment.**

    Justification: See the description for Requested Action (9) above.

13) **Revise TS 3.9.7, Residual Heat Removal (RHR) – High Water Level, and/or TS 3.9.8, Residual Heat Removal (RHR) – Low Water Level, or add a new Limiting Condition for Operation to require one RHR subsystem to be operable whenever the entire reactor core is offloaded into the spent fuel pool.**

    Justification: When the entire reactor core's inventory of irradiated fuel assemblies is offloaded into the spent fuel pool, the decay heat load "results in a maximum bulk pool temperature of 124.6°F if the RHR system supplements the SFPCS [spent fuel pool cooling system]. A maximum pool temperature of 197.2°F is expected if only the spent fuel pool cooling system is used." The NRC staff approved the increase in the Unit 1 spent fuel storage capacity that yields these values based explicitly on this condition: "Thus the RHR system will be operational and crosstied with the SFPCS prior to the discharge of a full core inventory into the pool" (Ref. 13, page 7).

    TS 3.9.7 requires one RHR shutdown cooling subsystem to be operable and in service during refueling (Mode 5) with irradiated fuel in the reactor vessel and the reactor vessel water level more than 21 feet 10 inches above the vessel flange. TS 3.9.8 requires two RHR shutdown cooling subsystems to be operable with one in service in this situation if the reactor vessel water level drops below 21 feet 10 inches above the flange. But neither technical specification, nor any other, requires the RHR system to be operational as assumed by the NRC in its safety evaluation.

    The requested action ensures the RHR system is operational when needed.

Bottom Line

The current technical specifications for the Brunswick Unit 1 and 2 reactors are based on the assumption that the sole scenario involving damage to irradiated fuel outside of the reactor vessel is that resulting from a fuel handling accident involving recently irradiated fuel (i.e., fuel that was within a critical reactor core within the past 24 hours). That event is the reason the technical specifications require secondary containment, the control room emergency ventilation system, and several other safety features to be operable when recently irradiated fuel is being moved. Because no other scenarios are considered, the technical specifications do not require these safety features to be operable when irradiated fuel is not being moved. In fact, the technical specifications literally do not require any water to be maintained inside the spent fuel pool even when it is filled to maximum capacity with irradiated fuel assemblies – as long as no irradiated fuel assembly is being moved.

But loss of water inventory from the spent fuel pool or sustained loss of its cooling capability can also result in damage to irradiated fuel. And the potential extent of that damage and the amount of radioactivity released from damaged fuel can be considerably larger than that resulting from a fuel handling accident. Because the probability of spent fuel pool water inventory or cooling loss is not so low as to be neglected, the technical specification provisions that currently manage the risk from a fuel handling accident must be extended to also cover other credible spent fuel pool events.

The actions requested by this petition will rectify this safety requirement imbalance.

Sincerely,

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11) Nuclear Regulatory Commission, NUREG/CR-6451, "A Safety and Regulatory Assessment of Generic BWR and PWR Permanently Shutdown Nuclear Power Plants," August 1997.

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13) Nuclear Regulatory Commission License Amendment No. 61 to the Brunswick Unit 1 operating license, December 15, 1983. (http://adamswebsearch2.nrc.gov/webSearch2/main.jsp?AccessionNumber='ML020380374')

14) Nuclear Regulatory Commission License Amendment No. 170 to the Brunswick Unit 1 operating license, May 2, 1994 (http://adamswebsearch2.nrc.gov/webSearch2/main.jsp?AccessionNumber='ML020350654')

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Spent Fuel Pool Problem at Brunswick

SUMMARY

The Problem

While concerns about nuclear power safety often focus on the fuel in the reactor core, spent fuel stored in pools can also be a major source of radioactivity during an accident. Many safety requirements protect workers and the public from potential hazards of nuclear fuel when it is in the reactor core. But ironically, once the nuclear fuel is moved from the reactor core to the spent fuel pool, nearly all the safety requirements vanish. The hazard remains, but protection against it is greatly diminished. This dangerous situation exists for historical reasons that no longer apply, and should be corrected.

The Brunswick nuclear plant in North Carolina has radioactive fuel in two reactor cores and also in two spent fuel pools. Each reactor core at Brunswick holds about 100 tons of nuclear fuel. Each spent fuel pool contains three times as much as each reactor core—more than 300 tons in each pool. This radioactive material poses a threat to workers and the public for thousands of years into the future, and ensuring strong safety measures is essential.

Lack of Safety Requirements on Pools

A reactor operates for 18 to 24 months and then shuts down for refueling. During refueling, about one-third of the nuclear fuel in the reactor core is moved to the spent fuel pool and replaced with new fuel. The new fuel remains in the reactor core for up to six years.

The Brunswick spent fuel pools are 38 feet deep with thick concrete walls and floor. The pools are located within the reactor buildings, or secondary containment structures (Figure 1). Metal racks near the bottom of the pool hold the spent fuel. The water in the pool shields workers from radiation and cools the spent fuel by carrying heat away from it. To keep the water from getting too hot, pumps remove water from the pool, cool it, and return it to the pool.

When operators are moving spent fuel from the reactor core to the spent fuel pool, the reactor's Technical Specifications require a set of strict safety measures to be in place. For example, they require that a certain level of water be maintained in the spent fuel pool, that secondary containment is intact, that the standby gas treatment and control room emergency ventilation systems are operable, and that both alternating and direct current power are available. Collectively, these safety requirements protect workers and the public from radioactivity released if spent fuel is damaged during the transfer. For example, the secondary containment and standby gas treatment system remove more than 99 percent of the radioactivity released into the reactor building before it gets to the environment.

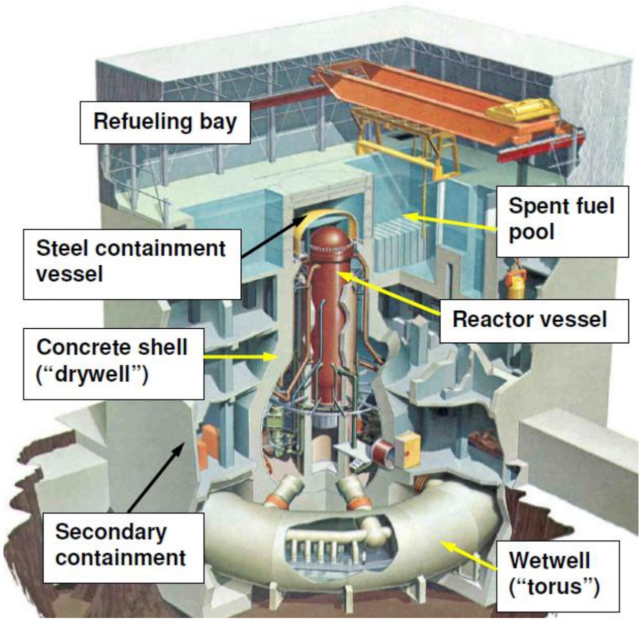

Figure 1. *A cutaway view of the containment structures for a boiling water reactor like those at Brunswick. The drywell and wetwell form the primary containment. The reactor building constitutes the secondary containment. During refueling, the drywell head is removed, the refueling cavity is flooded with water, and spent fuel is moved underwater from the reactor core into the spent pool.*

However, once the spent fuel has been moved into the pool, NONE of these safety measures is required. In fact, the Technical Specifications no longer require that any water be maintained in the spent fuel pool. Studies performed by the national laboratories for the Nuclear Regulatory Commission (NRC) have consistently shown that if the spent fuel pool's water were to be lost for even a few hours or its cooling interrupted for several days, the spent fuel could overheat and its cladding could break open, releasing radioactive material. And because the pools are located outside the thick, concrete containment walls, it is more likely that this radioactive material would reach the environment. Studies have also shown that the amount of radioactivity released from overheating damage could be much larger than that released from a fuel-handling accident that might occur when the spent fuel was being moved into the pools.

Consequently, current safety requirements do not adequately protect workers and the public from spent fuel stored in pools. The potential hazard posed by spent fuel is so high that stringent safety requirements must be in place whenever spent fuel is in the pool, not just when it is being moved.

***Figure 2**. Fuel being moved in a spent fuel pool.*

Background

How did this situation arise? In the 1970s, Brunswick's owner applied for licenses to operate the two reactors. Federal regulations required the applications to include two documents: (1) the Final Safety Analysis Report (FSAR) and (2) the Technical Specifications. The FSARs detailed the plant's design and summarized safety studies showing how the reactors complied with regulations, both due to design and operation.

The Technical Specifications contains key parameters from the FSARs such as the number of emergency cooling pumps for the reactor core and the pump flow rates assumed in the safety studies. The Technical Specifications also defines testing requirements for safety equipment, and sets limits on how long the reactor can continue operating with safety components unavailable due to damage, testing, or maintenance. It also contains requirements to protect workers and the public from radioactivity released during accidents. The operating licenses for the Brunswick reactors include the Technical Specifications as an appendix. Revising the Technical Specifications requires formal review and approval by the NRC.

When the operating licenses for the Brunswick reactors were originally issued in the 1970s, the expectation was that spent fuel would remain in the spent fuel pools for only a few months before being shipped away for either reprocessing or disposal. Each spent fuel pool only had storage capacity for 720 fuel assemblies, or enough for an entire reactor core of 560 fuel assemblies plus 160 spent fuel assemblies. The primary concern at that point was moving the fuel, rather than storing it. As a result, the only accident involving spent fuel described in the FSAR was a fuel-handling accident – spent fuel dropped onto other spent fuel or damaged by striking something while being moved. And therefore the Technical Specifications only contained requirements to protect workers and the public from radioactivity released during a fuel-handling accident. The document dismissed other potential scenarios leading to damage of spent fuel in the pools, like loss of water or cooling capability. The rationale was that small amounts of spent fuel were intended to be stored in the pool for small amounts of time.

However, with neither reprocessing nor disposal available in the United States, spent fuel has instead been stored for many years in the pools at nuclear plants. The spent fuel has accumulated and the stored amount has grown significantly beyond what the pools were designed to hold. The fuel racks in spent fuel pools at Brunswick were changed to accommodate nearly 2,000 fuel assemblies instead of the original 720.

When this change was made at Brunswick, the FSAR and Technical Specifications were revised to reflect the increased spent fuel pool storage limits. But they were not revised to reflect accidents that might occur when so much spent fuel is stored in the spent fuel pools for so many years.

The Solution

UCS and two other organizations, NC WARN and NIRS, have petitioned the NRC to order changes to the Technical Specifications for the Brunswick reactors, under the provisions of §2.206 in Title 10 of the Code of Federal Regulations. These changes would essentially extend the existing safety requirements that apply when spent fuel is being moved to the spent fuel pool so that they also apply whenever spent fuel is being stored in the pool.

These revisions will not significantly affect operations at Brunswick, but will significantly reduce potential risks from spent fuel stored in the spent fuel pools, and will better protect workers and the public.

July 2012

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June 2012

Printed on recycled paper using vegetable based inks