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Managing the Back-end of the Nuclear Fuel Cycle: Lessons for New and Emerging Nuclear Power Users From the United States, South Korea and Taiwan

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This article examines the consequences of a significant spent fuel management decision or event in the United States, South Korea and Taiwan. For the United States, it is the financial impact of the Department of Energy's inability to take possession of spent fuel from commercial nuclear power companies beginning in 1998 as directed by Congress. For South Korea, it is the potential financial and socioeconomic impact of the successful construction, licensing and operation of a low and intermediate level waste disposal facility on the siting of a spent fuel/high level waste repository. For Taiwan, it is the operational impact of the Kuosheng 1 reactor running out of space in its spent fuel pool. From these, it draws six broad lessons other countries new to, or preparing for, nuclear energy production might take from these experiences. These include conservative planning, treating the back-end of the fuel cycle holistically and building trust through a step-by-step approach to waste disposal.

Keywords: Disposal, Storage, Spent fuel, Dry cask, Repository

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1. Introduction

This article examines spent nuclear fuel management in the United States, South Korea and Taiwan. All three have mature nuclear energy programs: the United States first generated commercial nuclear power in 1957 (Shippingport), South Korea in 1978 (Kori 1) and Taiwan in 1977 (Chinshan 1). All plan to construct repositories to dispose of their nuclear waste yet none has done so and each has a different spent fuel storage configuration: the United States has transferred almost half of its spent fuel from pools into dry storage at sixty six sites; just over a third of South Korea's spent fuel is in dry storage at one plant; Taiwan has no operational dry storage. The intent is not to present a comprehensive history of the waste programs of each or provide a set of recommendations for future storage/disposal planning and operations. Rather the article focuses on the consequences of a specific decision or event in each and draws some broad lessons other countries new to, or preparing for, nuclear energy production might take from these experiences. In 2020, IAEA Director General Rafael Grossi anticipated "a solid group of around 10–12 new countries added to the list of those which are at the moment producing nuclear energy" within a decade [1].

In the United States, the case study is the financial impact of the Department of Energy's inability to take possession of spent fuel from commercial nuclear power companies as directed by Congress. In South Korea, the case study is the potential financial and socioeconomic impact of the successful construction, licensing and operation of a low and intermediate level waste disposal facility on the siting of a spent fuel/high level waste repository. In Taiwan, the case study is the operational impact of the Kuosheng 1 reactor running out of space in its spent fuel pool. The overarching theme is the need for governments to embrace the spent fuel management mission institutionally and engage the public at the beginning of their nuclear programs and not ignore the problem until it has become exorbitantly expensive, jeopardizes reactor operations or threatens to undermine the entire nuclear enterprise.

A note on spent fuel management: it is a small fraction of the overall cost of electricity generated by nuclear power. The World Nuclear Association estimates that the back-end "of the fuel cycle, including used fuel storage or disposal in a waste repository, contributes up to 10% of the overall costs per kWh [kilowatt hour], or less if there is direct disposal of used fuel rather than reprocessing [2]." However, it becomes an increasingly expensive the longer a disposal solution remains elusive and the sociopolitical consequences of continued inaction, delays and/or failure are potentially even more significant.

2. The United States

By the time Shippingport came into service, "there was a growing recognition that deep geologic disposal was the best available option for permanently isolating highly radioactive wastes. Every nation that has pursued nuclear power has subsequently come to the same conclusion: deep geologic disposal is the preferred option for isolating spent nuclear fuel and high-level radioactive waste [3]." Until the 1970s, the expectation was that US nuclear plants would operate a closed fuel cycle; that is, the unused fissionable material from spent fuel would be recycled into new fuel with the concomitant high level waste immobilized in borosilicate glass and placed in standardized stainless-steel canisters [4]. Utilities anticipated that they would have to store the spent fuel they discharged for a year or less before it was shipped to the Western New York Nuclear Service Center near West Valley, New York or the Barnwell Nuclear Reprocessing Plant in South Carolina. As a result, the pools were not designed for life of reactor spent fuel storage; indeed, "most at-reactor storage pools were originally designed to hold one full core plus one or two refueling discharges [4]." But West Valley operated from 1966 to 1972 before being closed for modifications and, by 1976, the operator had handed the facility over to New

York State and quit the reprocessing business while Barnwell was built in the 1970s but never licensed to operate [5-6]. In October 1976, President Ford announced the deferral of commercial reprocessing due to the proliferation risk of separated plutonium; in April 1977 President Carter extended the deferral indefinitely for economic and nonproliferation reasons [7-8]. This raised the specter that reactor operators would have nowhere to discharge spent fuel once the pools reached capacity; "Wall Street investment houses recognized this danger by 1977 – a major factor in their decision to advise clients against investing in nuclear utilities [9]." The reprocessing deferral was reversed by President Reagan in 1981 but that did not revive its commercial fortunes [10]. Storage space in spent fuel pools can be, and was, increased by rod consolidation ("mechanically removing the spent fuel rods from the fuel assembly hardware and placing them in either another grid with closer spacing or in a close-packed array") and/or installing high-density racks but the size of the pool doesn't change so this only postpones the time when it reaches capacity [4]. Consolidated wet storage, such as Morris discussed below or, more intentionally, Clab in Sweden, can enable reactors to keep operating when the pools are full by creating space for new fuel to be discharged but it is still a temporary solution [11]. The longer-term storage method chosen in the US was onsite dry cask storage.

The first dry storage installation was licensed by the Nuclear Regulatory Commission (NRC) in 1986 at the Surry Nuclear Power Plant in Virginia [12-13]. Most reactor pools have been full since approximately 2012; as a result, pool storage of newly discharged fuel at most locations requires transferring older, cooler fuel to dry storage. As of the end of 2019, almost 47% of the commercial spent fuel inventory is in dry storage [4]. In addition, two companies have applied to the NRC to build and operate consolidated interim storage facilities (CISFs) – Interim Storage Partners in Texas and Holtec International in New Mexico. The NRC issued a final environmental impact statement recommending Interim Storage Partners be granted a license to construct a CISF in Andrews County, Texas; it is still reviewing Holtec's application to construct a similar facility in Lea County, New Mexico [14-15]. The US does have one away-from-reactor consolidated storage facility already. Something of an accident of history, the Morris CISF, adjacent to the Dresden Nuclear Power Plant in Illinois, started life as a reprocessing plant – the Midwest Fuel Recovery Plant. The then-Atomic Energy Commission licensed the plant in 1971 but terminated the construction permit in 1974. The CISF, which consists of two interconnected, water-filled basins, received its last spent fuel shipment in 1989 and is full. The Nuclear Regulatory Commission issued storage licenses in 1982 and 2002 and is currently reviewing an application from GE Hitachi to renew the license through May 2042 [16].

2.1 The Price of Spent Fuel Storage

The Nuclear Waste Policy Act (NWPA) of 1982 forged an accord: in return for the utilities paying a fee (0.1 cents/kWh) into a Nuclear Waste Fund, the Department of Energy would dispose of the high-level waste or spent nuclear fuel generated at their plants beginning January 31, 1998 [17]. The fifteen year deadline was Congressionally-driven and prompted by two declarations in 1980: (1) a February Presidential Message to Congress that the federal government "should be ready to select the site for the first full-scale repository by about 1985 and have it operational by the mid-1990s"; and (2) the Department of Energy's April "Statement of Position" to a proposed NRC waste storage and disposal rulemaking predicting the "establishment of operating geologic repositories within the time range of 1997 [in salt] to 2006 [in hard rock] ⋯ assuming licensing schedules recently forecast by the NRC [18]." Despite warnings from such trusted advisers as its own Office of Technology Assessment that a more conservative approach was prudent, staff made clear that Congress would never accept a date after the turn of the century and chose to enact the most bullish estimate, one that was predicated on everything going right and nothing going wrong.

The NWPA was amended in 1987 and DOE was directed to “terminate all site specific activities (other than reclamation activities) at all candidate sites, other than the Yucca Mountain site [17].” The so-called ‘Screw Nevada Bill’ united that state’s Congressional delegation and state legislature in effective opposition to hosting a repository [19]. As a result, DOE could not begin taking spent fuel in 1998 and utilities began suing, successfully, for damages.

As of December 2019, it is estimated that the U.S. has 83,598 metric tons of heavy metal of commercial spent fuel located – “stranded” – at 121 sites across 39 states. Taxpayers are assessed between $600 million and $800 million annually (approximately $2 million per day) because of the federal government’s failure to meet its obligation [20]. Apart from the two plants in Minnesota, where the state imposes an additional charge per dry storage cask that cannot be recouped (Xcel Energy transfers $500,000 per year to a renewable development account for each dry storage cask at the Prairie Island Nuclear Plant and $350,000 per year for each dry storage cask at the Monticello Nuclear Plant), utilities recover the full cost of storage to that point every time they sue DOE for breach of contract [21]. This status quo persists in large part because guaranteed reimbursement of storage costs disincentivizes plant operators from seeking alternatives and the payments don’t impact DOE’s budget because they come from the Judgment Fund, a permanent, indefinite Congressional appropriation administered by the Department of the Treasury [22].

3. South Korea

All 20,053 bundles of spent fuel from Korea’s 22 pressured water reactors (PWR) are located in pools at the reactors. Korea Hydro & Nuclear Power Company (KHNP) plans to construct an 11,000 tons of heavy metal capacity ISFSI for the PWR fleet’s spent fuel but because the project has been delayed, high density racks were installed at Kori units 3 and 4, Hanul units 1, 2, 3 and 4 and Hanbit units 1, 3, 4, 5 and 6 while installation is underway at Hanul units 5 and 6 [23-24]. No on-site dry storage licenses have yet been applied for at the PWR plants. All 474,176 bundles of spent fuel from Korea’s four pressurized heavy water reactors at the Wolseong plant are also on-site but a little less than one-third (151,976 bundles) sits in pools while the remainder (322,200 bundles) is in dry storage – 60 percent in silos (which have reached capacity) and 40 percent in Modular Air-Cooled Storage (MACSTOR) cylinders [23]. Construction of the dry storage facility was completed in February 2010 and the MACSTOR capacity is being expanded. According to the Nuclear Safety Act, and like the United States, on-site storage is classified as a “relevant facility” to a reactor and as such only requires the approval of the regulator for licensing [25].

3.1 Estimating the Price of Spent Fuel Disposal

Construction of the first phase of the Wolseong Low- and Intermediate-Level Radioactive Waste Disposal Center (WLDC) in Bonggil-ri, Yangbuk-myeon, Gyeongju-si began in 2007, was completed on schedule in 2014 and the Center began operation in July 2015. The roughly 0.8 square mile cave site contains a disposal facility with an initial capacity of 100,000 200-liter drums plus a 7,000 drum capacity examination compound. Disposal occurs 262–426 feet below ground in six 89×164 foot silos. Each silo holds 16,700 drums. Sets of 16 drums are encased in concrete boxes. Each silo will be capped with crushed rock and shotcrete; the construction and operations tunnels will be plugged with concrete and crushed rock. The second phase of construction, 764,000 square feet of near-surface vaults and galleries with a 125,000 drum capacity, will commence once the Nuclear Safety and Security Commission/Korea Institute of Nuclear Safety licensing review is complete and is expected to be finished by the end of 2023. A third construction phase, trench-type disposal, is estimated to be complete by the end of 2026. Total planned capacity for the Center is 800,000 drums [26-28].

While it is impossible to predict the cost of siting and constructing a spent fuel/high level waste repository, it is certain to be more than a low and intermediate level waste disposal facility. The first phase of the WLDC was built at a cost of ₩1.53 trillion (US $1.53 billion); it is estimated that the second phase will cost ₩240 billion (US $240 million) and the third ₩150 billion (US $150 million). In addition, the central government: provided a ₩300 billion (US $300 million) grant to the Gyeongju government; will provide an additional ₩670,000 (US $670) for each waste drum received until the site reaches its 800,000 drum capacity; relocated KHNP headquarters to, and established the Korea Multi-purpose Accelerator Complex (KOMAC) operated by KAERI in, Gyeongju; and promised to provide long-term support for community projects which will likely cost roughly ₩3.3 trillion (US $3.3 billion). On the latter, fifty-five community projects have been identified by KRMC. More than half have been completed at a cost of US $1.3 billion and the remaining projects, which have evolved significantly over time, are expected to cost US $2 billion [28-29]. This is highly likely to be the floor from which potential host communities will start the negotiating process for a repository and none of the above includes the costs of operating and eventually decommissioning the facility. Other waste management organizations should also expect potential host communities in their countries to be aware of these details.

However, monetary cost is not the only way to look at the potential impact of the WLDC. If KORAD runs the Center safely, the organization will build invaluable public trust and goodwill that could be leveraged to help site a spent fuel storage facility and/or a repository elsewhere. The organization got off to a good start with the first phase of the facility being built on schedule and on budget. The engineering that went into the Center, particularly the six disposal silos that have more in common with a deep geological repository than a typical near-surface low level waste disposal facility, presents an opportunity for the organization to demonstrate its ability to manage a complex nuclear infrastructure project and fulfill its obligation to protect the public. There is no guarantee that this will happen – the siting and operation of the Waste Isolation Pilot Plant (WIPP) that receives transuranic waste from defense programs in New Mexico, for example, did not have a salutary effect on Yucca Mountain – but KORAD can now point to more than studies and experiments when it makes its case for a spent fuel/HLW repository.

4. Taiwan

At its peak, Taiwan Power Company (Taipower) operated six reactors at three sites: Chinshan (two reactors) in New Taipei City; Kuosheng (two reactors) in New Taipei City; and Maanshan (two reactors) in Pingtung County [30-31]. In addition, two mothballed Lungmen reactors in New Taipei City await the outcome of an August 28 referendum on whether to restart the plant. Only three of those reactors – Kuosheng 2, Maanshan 1 and Maanshan 2 – are still operating [32-33]. All 18,888 spent fuel assemblies from the six reactors are stored in pools at the plants sites [34]. Taipower is endeavoring to begin operation of two independent spent fuel storage installations (ISFSIs):

- Approval of a 1,680 fuel assembly capacity ISFSI at the Chinshan plant was granted by the Atomic Energy Council (AEC) in January 2008 and construction was completed in February 2013. The first stage of pre-operations (dry run) was carried out in 2012 and approved by the AEC in September 2013 which allowed for the second stage of pre-operations (hot test) to be undertaken. However, because the New Taipei City government has not approved the soil and water reservation facilities, hot testing cannot be carried out.
- A construction license for a 2,349 fuel assembly

capacity ISFSI at the Kuosheng plant was approved by the AEC in 2015 but the runoff wastewater pollution reduction plan has been blocked by the New Taipei City government – see below [35].

4.1 Kuosheng 1 and Spent Fuel Storage

Located roughly 25 miles from New Taipei City, the Kuosheng Nuclear Power Plant consists of two boiling water reactors (BWRs), each with a 985 MWe capacity. Unit 1 began commercial operation in December 1981 and unit 2 in March 1983 [36]. The spent fuel pools at both units had been retrofitted with high density storage racks in 1992 to accommodate additional discharged fuel assemblies and then again with higher density racks in 2005 [37]. But further re-racking was not possible, meaning pool storage capacity would run out before the end of the reactors' operating licenses so Taipower began investigating alternatives.

4.1.1 Dry Storage [35, 38]

The favored option was onsite dry cask storage – at both the Chinshan and Kuosheng plants (see above). Taipower's Environmental Impact Assessment for the Kuosheng ISFSI was reviewed and approved by Environmental Protection Agency in January 2010. In November, Taipower invited construction bids and CTCI Machinery Corporation and NAC International were selected. The facility, located north of the plant, is designed to store 2,349 spent fuel assemblies – 27 MAGNASTOR concrete casks capable of storing 87 spent fuel assemblies each.

In 2014, Taipower submitted a safety analysis report (SAR) to the AEC to apply for the construction license for the facility. The SAR was approved and the construction license issued on August 7, 2015. The Kuosheng plant site is categorized as "hill land" in accordance with Taiwan's land use laws. For new facilities such as an ISFSI to be built on this category of land, a water and soil conservation plan is required to be submitted to the local government for prior approval but, under certain conditions, such a plan can be submitted directly to the Council of Agriculture (COA), the central government regulatory authority. The regulations were revised to allow this in December 2014 and Taipower submitted its plan directly to the COA. The COA approved the water and soil conservation plan on December 14, 2015 and issued the water and soil conservation construction permit on February 2, 2016.

However, in accordance with relevant regulations, before starting construction of the facility, a runoff wastewater pollution reduction plan (RWPRP) must be submitted to the local government for review and approval. Such a review and approval is the exclusive domain of the local government and cannot be overridden by a central government authority. In June 2016, Taipower submitted the RWPRP to the New Taipei City government for review. The government either sent back or denied the RWPRP without reviewing it twelve times. Taipower finally resorted to filing a lawsuit against the government to seek a way to move forward. On April 26, 2021, after several rounds of court proceedings, a Taipei High Administrative Court decision nullified the New Taipei City government's denial of the RWPRP and ordered it to review the plan accordingly. The government responded that it would consult lawyers and deliberate on the need to lodge an appeal but has not, as of yet, announced how it will proceed. Back in 2016, operations reached a crisis point.

The May 2015 fuel discharge from the core to the pool was the last Kuosheng 1 could undertake before its spent fuel pool reached capacity. This meant there would not be enough space to accommodate the scheduled November 2016 refueling. Anticipating the New Taipei City government's rejection of the RWPRP that the company would submit in June 2016, or at the least not leaving anything to chance, company engineers at the plant came up with the idea of using the cask loading pools to create enough storage space for the reactors to continue operating until the end of their licenses (2021 and 2023). Helpfully, compatible fuel storage racks were sitting unused at the mothballed

Lungmen plant. As the Kuosheng cask loading pools are part of the existing spent fuel pools, the installation of new racks is simply a change-out of equipment inside the existing facility. Such activities are wholly within the realm of nuclear safety regulation. As a result, Taipower did not need to go through the environmental impact assessment or water and soil conservation plan processes again. The company needed only to submit the design change request to install four new 11×10 storage racks in the cask loading pool of each unit and an accompanying safety analysis report to the AEC for review in order to receive an installation permit. Taipower did so in August 2016 and received approval eight months later. Installation of the racks at Kuosheng 1 was completed in May 2017. Refueling was completed on June 9 and the reactor reached full power again on June 19 ⋯ after being forced to shut down for seven months.

The New Taipei City government's reason for refusing to review the RWPRP was/is that, given Taipower has not yet identified a site for the final disposal of spent fuel, the dry cask ISFSI at the Kuosheng reactor site could become permanent. In making the case that the ISFSI would be for storage, i.e. temporary, Taipower faced a central public relations dilemma of long-term storage – how do you assure the host government and population that the facilities will not become permanent in the absence of a viable disposal solution? Quoting Article 27 of the Enforcement Rules for the Nuclear Materials and Radioactive Waste Management Act, Taipower explained that the valid period for an operation license "is up to 40 years for treatment facilities or storage facilities of radioactive waste." In the environmental assessment documentation for both Kuosheng and Chinshan, Taipower committed to honor the 40-year limit and assured the New Taipei City government that the facilities would not be converted into final disposal sites. Taipower further noted that according to the Regulations on the Final Disposal of High Level Radioactive Waste and Safety Management of the Facilities, highly radioactive waste must be placed 300–1,000 meters underground in an appropriate geological environment, which is completely different from the geological conditions of surface dry storage facilities. All of which is correct and legally exactly what they are required to do but the company is unable to answer the basic question: what happens at the end of 40 years? Taipower is working to find a solution (some outside observers have suggested shipping the Chinshan and Kuosheng spent fuel in dry casks to the Maanshan plant for long-term storage [39]) but has no intention of drilling through the concrete slab the casks sit on to mine a repository. The New Taipei City government surely understands this but it argues, also correctly, that there is nowhere for the fuel to be moved to (at least at present), even on a further temporary basis, once the license expires so the dry casks will in effect become permanent storage containers.

In a regrettably fitting postscript, Kuosheng 1 was taken offline permanently on July 1, 2021 – almost 6 months ahead of its licensed December 27 retirement – as the spent fuel pool had reached capacity [40-41].

4.1.2 Reprocessing

It is worth noting that Taipower also tried an alternative to buy time. In October 2014, a government task force had recommended that spent fuel from Chinshan and Kuosheng be sent abroad for reprocessing and in February 2015 Taipower published a notice seeking bids to reprocess 1,200 bundles – 480 from Chinshan and 720 from Kuosheng – with the vitrified high level waste being returned to Taiwan in 20 years. The campaign was expected to cost NT$11.257 billion (US $355.5 million). The company explained that "by validating the feasibility of reprocessing abroad through a small-scale trial, [Taipower] hopes to provide more diverse choices and flexibility to the domestic strategy for long-term used nuclear fuel management [42]." However, the Legislative Yuan's Economic Committee blocked the tender, citing a lack of parliamentary oversight and misuse of the back-end management fund before legal guidelines governing its administration had been drawn up [43].

5. Lessons Learned

What can new and emerging nuclear energy countries take from these experiences? Six lessons are offered:

5.1 Planning and Dialogue

The overarching takeaway is the importance of planning for the back-end of the fuel cycle at the beginning of the nuclear energy program and building some redundancy from the start rather than waiting until storage pools are almost full and reactor operations are threatened. Finding a willing host community to dispose of the waste at the outset is unlikely but a full and frank dialogue between government and interested segments of the public about the requirements, estimated costs, expected timelines and uncertainties involved in managing the back-end is paramount.

5.2 Timelines and Public Trust

While repositories are highly complex engineering projects, the technical challenges are understood even though not all of them are solved. However, it is the politics of finding a willing host community that has proved particularly intractable. Aggressive planning for such a sensitive and unpredictable endeavor as siting a spent fuel/HLW repository most often leads to failure quite quickly and missing early deadlines can undermine public trust, sometimes irrevocably. Most countries have come to realize that a flexible, phased and adaptable participatory approach to siting is most likely to yield the best results but this is not particularly amenable to fast-tracked timelines. This is not to suggest that key milestones should not be set and timelines should not exist; they should, informed by a transparent decision-making process and overseen by a strong and independent regulator. Conservative planning may not guarantee success but it provides the best chance of avoiding the sorts of institutional mistakes that often lead to programmatic failure.

5.3 Treating the Back-end Holistically

While the facilities may be physically separated, interim storage and disposal of spent fuel/HLW are parts of a larger whole. Kuosheng 1 shutting down (twice) demonstrated this dramatically and the Swedish Nuclear Fuel and Waste Management Company (SKB) is warning of a similar dynamic following the government's decision to approve an expansion of the Clab interim storage facility while continuing to consider the repository construction and operation license application. SKB's integrated 'KBS-3' system consists of Clab and an encapsulation plant forming an integrated facility called Clink, transportation of the encapsulated fuel and a final repository and the constituent parts have been described as links in a chain [44-45]. CEO Johan Dasht explained the company's concern: "It has never happened before that a government separated an application which will then be forwarded to the Land and Environmental Court. The intermediate storage does not stand on its own two feet but is part of a coherent system. There is now a great risk that the case will get stuck in the Land and Environmental Court, which is the next step in the process. The government is also driving over Oskarshamn municipality, which opposed extended interim storage without a final repository decision [46]." The Governors of Texas and New Mexico used this argument amongst others in opposing consolidated storage in their states [47-48]. Anti-nuclear groups also make this argument in the hope that onsite storage space is exhausted before a disposal solution can be found thus bringing to a close the entire nuclear enterprise. Only by treating the back-end as a system can waste management organizations make a credible argument that storage facilities are not de facto repositories.

5.4 Maximize Storage Options

Regardless of whether an open or closed nuclear fuel cycle is chosen, direct disposal of spent fuel, disposal of HLW from reprocessing or some combination of the two will be required. Including space onsite for a dry cask ISFSI in the plant design provides both storage flexibility and protects against Kuosheng-type reactor shutdowns in the event disposal facilities are not available in a timely manner or reprocessing campaigns are delayed.

5.5 A Dedicated Funding Stream

Ensure funding is sufficient to cover the costs of storage and disposal under a range of contingencies, not just the most optimistic, and is only available for that purpose. The US Nuclear Waste Fund created just such as dedicated pool of money but, as the Blue Ribbon Commission on America's Nuclear Future explained in 2012, a "series of executive branch and congressional actions has made annual fee revenues (approximately $750 million per year) and the unspent $27 billion balance in the Fund effectively inaccessible to the waste program [49]." More than $45 billion is in the Nuclear Waste Fund today even though utilities are no longer contributing their fee [20]. When funding is not fenced off or becomes inaccessible, the longer-term consequences for both the fate of the disposal program and the reputation of the disposal agency can be calamitous.

5.6 A Step-by-step Approach

As discussed, the WLDC could help KORAD build the public trust it will require to site a spent fuel/HLW repository. The NRC recently recommended that Interim Storage Partners, a joint venture of Orano USA and Waste Control Specialists (WCS), be granted a license to construct its spent fuel CISF at the existing WCS low level radioactive waste disposal site in Andrews County, Texas. Similarly, Spain's radioactive waste management agency ENRESA has pursued a very deliberate strategy of demonstrating safe operations at its El Cabril disposal facility for very low, low and intermediate level waste to build public confidence in the organization's ability to construct and operate an interim SNF storage facility and eventually develop a deep geological repository [50]. Demonstrating competence through responsible stewardship of lower categories of radioactive waste is an ideal way for an organization (public, private or some combination of the two) to build public trust in its ability to safely dispose of spent fuel and high level waste.

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