12 September 2021

Mr. James Park
Environmental Project Manager
Environmental Review Materials Branch, RE&FS/NMSS
Nuclear Regulatory Commission
Washington, DC 20555-0001

SUBJECT: RE: [Docket No. 72–1050; NRC–2016–0231] Environmental Impact Statement for Interim Storage Partners LLC's License Application for a Consolidated Interim Storage Facility for Spent Nuclear Fuel in Andrews County, Texas, Final Report, NUREG-2239, July 2021

Dear Jim,

I hope this letter finds you well. I'm providing comments pursuant to the Texas Citizens Participation Act[1] protections regarding matters of public concern and in support of the United States government's investigation into the proposed project's environmental impacts.

It has been disappointing to read the NRC staff's generally defensive responses to the many legitimate concerns that have been raised as well as generally failing to acknowledge the concerns of advisory bodies (e.g., the NWTRB) or the uncertainties surrounding plausible accident scenarios and the consequences that accompany them.

There are significant matters that the NRC has unfortunately failed to address. Given the importance of this project and the public concerns surrounding it, the NRC needs to make sure the critical technical aspects are adequately addressed.

Finally, the NRC staff have adopted risk assessments methods and terminology that create meaningless terms and outcomes and are unsupported by national and international standard-setting bodies. This errant practice needs to be restored to a traditional risk assessment approach to ensure the validity of findings.

My comments are attached.

Very Respectfully

Michael S. Ford, CHP
Owner/Analyst

Attachment

[1] Texas Civil Practice and Remedies Code, Title 2, Subtitle B, Chapter 27

ATTACHMENT

Comments on NUREG-2239 — Docket NRC-2016-0231

Introduction

The importance of properly and fully investigating matters of public concern regarding the project under review in NUREG-2239 cannot be understated. While the public is poised to reject nuclear power again if any nuclear mishap affecting the public or environment occurs, the crucial role of the NRC in properly discharging its mission to protect the public and the environment is more critical than ever. Based on the following comments, the NRC is not properly carrying out its mission in several key areas of the FEIS.

Comments fall under four general categories:

1. The impacts of the U.S. Nuclear Waste Technical Review Board July 2021 High Burnup Fuel (HBF) Report, specifically as the report pertains to
    a. The potential for cladding failure during Normal Conditions of Transport (NCT)
    b. The increased, unanalyzed potential for criticality events due to cladding failure following a transportation accident
    c. Potential impacts to spent fuel retrievability following transportation due to cladding failures in HBF.
2. The unsupported concept of "dose risk" and misleading on risk quantification
3. The failure to properly evaluate major points of view raised by other federal agencies, elected officials, and previous commenters
4. Assorted technical shortcomings

Impacts of the U.S. Nuclear Waste Technical Review Board (NWTRB) July 2021 HBF Report

The July 2021 HBF report by the NWTRB raised several critical issues that the NRC did not consider in the Final EIS (FEIS). While the FEIS transportation evaluations evaluated the applicant's analyses and compared them with staff analyses, what is missing from the document is the consideration that fuel will be transported under a Department of Energy (DOE) program and at the DOE's direction. Indeed, working closely with the DOE in the management and storage of SNF is integral to the applicant's stated business plan in their application.

The NWTRB report raises the distinct possibility of cladding failure of HBF during NCT, thereby drawing into question the ability of the HBF to meet the retrievability requirement in 10 CFR 72. Despite numerous concerns raised regarding the specific cladding failure concerns with HBF, the NRC staff are steadfast in their position that HBF poses no peculiar hazard for NCT or accident conditions.

From the FEIS:

> [1] "The NRC has conducted several risk assessments and other analyses to evaluate the safety of SNF transportation during the past four decades. The transportation risk assessment in NUREG–2125 was published in 2014 and remains the most recent NRC analysis of its kind. The analyses in NUREG–2125 are reasonably current and applicable for the assessment of potential radiological impacts of the transportation of SNF." [FEIS, D.2.9.20]
>
> [2] "Within the context of the EIS transportation impact analysis, increasing burnup would not affect estimated incident-free doses because the calculated doses are based on the dose rate at a 1 m [3.3 ft] distance from the cask, and that parameter in the EIS analysis is assumed to be at the maximum dose rate allowed by regulation." [FEIS, D.2.9.23]
>
> [3] "Under accident conditions, the increased inventory from high-burnup SNF could affect doses from accidents involving a release of radioactive material; however, the EIS analysis did not evaluate accidents involving release of radioactive material based on the technical analyses of cask responses to severe accident conditions in NUREG–2125." [FEIS, D.2.9.23]
>
> [4] "Additionally, because the NUREG–2125 analysis indicates that the applicable cask system effectively prevents the release of radioactive material under accident conditions, the corresponding accident risk would not be affected by potential changes to the integrity of cladding, which is part of the SNF that is within the cask." [FEIS, D.2.9.23]
>
> [5] "The analysis in NUREG–2125 did not quantitatively estimate risks from accidents involving high-burnup SNF but it did provide a qualitative description of expected impacts on the results and concluded that the effect would not change the conclusions of the study. " [FEIS, D.2.9.23]
>
> [6] "Overall, the effect of changing burnup assumptions would not change the results or conclusions of the EIS impact analysis." [FEIS, D.2.9.23]

> [7] "The NRC continues to study the effects of increasing burnup on the safety of SNF, canisters, and casks to inform its regulatory decisions." [FEIS, D.2.9.23]

The NRC contentions in [1] through [7] are directly contradicted by the findings of the NWTRB in the HBF Report that concluded in part:

> [A] "If the SNF cladding experiences a fracture during a transportation accident, the fissile material (i.e., the fuel) might possibly change its location inside the cask or canister in a manner that would increase the possibility of criticality. To evaluate the potential for criticality under hypothetical accident conditions, it is necessary to perform criticality calculations ***assuming the cladding is damaged and the SNF is in a geometry that would maximize the potential for criticality***. Furthermore, ***if there is a gross breach***, more fission gas and particulates could be released to the cask or canister interior. ***If the cask or canister leaks after an accident***, there could be unacceptable quantities of radioactive gases and particulates released to the environment." [HBF Report, 3.2]

The contrasting language highlights the following concerns:

- The 2014 NRC analyses are not current, and the report's conclusions require reconsideration in light of the NWTRB report.
- Under the NRC's definition of incident-free NCT, the NWTRB noted that "one HBF cladding specimen was subjected to a transient shock, equivalent to a 30 cm (1 ft) drop prior to fatigue testing. It was found that this drop load shortened the fatigue lifetime of the specimen by approximately 50%. ... In its requirements applicable to transport packages containing commercial SNF (10 CFR Part 71), the NRC specifies a 30 cm (1 ft) drop as the maximum shock *to be expected and evaluated* for NCT." (emphasis added)

  Hence, "incident-free NCT" for HBF may induce sufficient physical shock to lead to a greatly accelerated cladding failure timeline.
- This enhanced propensity for cladding failure in HBF manifests a concern for creating conditions of criticality that could not be ruled out to occur under NCT.
- The NWTRB says that the assumption should be made that sufficient cladding damage will occur to produce an arrangement of fuel pellets that would maximize the potential for criticality. Indeed, the NRC goes to great lengths to constrain the possibility of a criticality event to the presence of a large volume of water that the SNF canister could be submerged in when there is a multitude of other scenarios (e.g., loss of geometry control) capable of creating the conditions for criticality.

- While the NRC has emphatically stated in the FIES that an atmospheric release of radioactive materials is not possible, the NWTRB, which could have maintained the same conclusion, repeatedly raises the possibility of gross breaches and cask or canister breaches that require analyses. The failure to acknowledge these potential and significant exposure pathways is a significant failing of the FEIS.

The Unsupported Concept Of "Dose Risk" & Misleading On Risk Quantification

The concepts of "dose risk" and "collective dose risk" have no basis in either science or epidemiology but are merely a mathematical manipulation of individual and collective doses to diminish the radiological consequence of a particular activity under evaluation. In NUREG-2125, the NRC proudly states its analyses demonstrate a reduction in transportation risk of five(5) orders of magnitude. This is very easy to accomplish when you arbitrarily multiply a 1 x 10^{-5} event probability with an individual or collective radiation dose to produce a meaningless number that has nothing to do with the actual consequences of the activity or the risk associated with its conduct.

From NUREG-2125, the NRC states, "The calculated collective dose risk (the summation of dose to all exposed individuals times the probability of the accident) from accidents has decreased with each successive risk assessment."

No kidding.

This concept of creating "dose risk" or "collective dose risk" by multiplying the individual/collective dose by the event probability has no basis in practice in either NCRP or ICRP standards. In fact, while both the Sv and rem are expressions of risk on their own, they are expressions of Latent Cancer Fatality (LCF) risk and can be directly computed by the conversion factor of 5.7 E-2 LCF/Sv, as employed by the NRC in the FEIS and NUREG-2125. But that is where any conversion should stop.

Conversion of radiation doses to LCF allows the direct comparison of radiological and non-radiological health impacts (cancers, injury, deaths, etc.)

In Section D.2.9.3, the NRC relates the following:

> [8] "Commenters suggested that the EIS analysis minimized or underestimated the impacts of accidents. Some commenters referred to past studies that modeled accident scenarios involving releases of SNF and estimated high consequences." [FEIS, D.2.9.3]
>
> [9] "Another commenter objected to the risk assessment approach of multiplying accident consequences by probability estimates as is done in NUREG–2125. They

> referred to the approach as a faulty logic assumption, noting that if the accident occurs, the full consequences would occur." [FEIS, D.2.9.3]

To which the NRC responded:

> [10] "EIS Section 4.3.1.2.2.3 evaluated the radiological impacts to workers and the public from SNF transportation accidents. The EIS accident analysis considered the most recent NRC evaluation of SNF accident risks in NUREG–2125 (NRC, 2014). Using risk to evaluate the environmental impacts of SNF transportation is consistent with NRC guidance in NUREG–1748 (NRC, 2003) and is a longstanding NRC practice (NRC, 1977; NRC, 2001). Risk accounts for both the probabilities and consequences of accidents and therefore provides a reasonable and appropriate method for evaluating the impacts of SNF transportation accidents." [FEIS, D.2.9.3]

For clarity, these are the references the NRC cites as the basis for expressing risk as "dose risk" listed in chronological order of publication:

> *NUREG–0170, "Final Environmental Statement on Transportation of Radioactive Material 18 by Air and Other Modes." Volume 1. ADAMS Accession Nos. ML022590265 and 19 ML022590348. Washington, DC: U.S. Nuclear Regulatory Commission. 1977.*
>
> *NUREG–1714, "Final Environmental Impact Statement for the Construction and Operation of an Independent Spent Fuel Storage Installation on the Reservation of the Skull Valley Band of Goshute Indians and the Related Transportation Facility in Tooele County, Utah." ADAMS Accession No. ML020150170. Washington, DC: U.S. Nuclear Regulatory Commission. 2001.*
>
> *NUREG–1748, "Environmental Review Guidance for Licensing Actions Associated with NMSS Programs." ADAMS Accession No. ML032450279. Washington, DC: U.S. Nuclear Regulatory Commission. 2003.*
>
> *NUREG–2125, "Spent Fuel Transportation Risk Assessment, Final Report." ADAMS Accession No. 14031A323. Washington, DC: U.S. Nuclear Regulatory Commission. 2014.*

Upon review of each of the cited documents, the following conclusions can be made:

- NUREG-0170 has no mention of "dose risk" and properly expresses the consequences of the evaluated activities in terms of LCFs.
- NUREG-1714 computes the doses from each evaluated activity, independent of probability, and terms that "dose risk." The "dose risk" numbers are then used to compute LCFs, which are then used as the basis of comparison for the impacts of the activities under review. Event probabilities are not used to modify dose calculations.

- NUREG-1748 contains no mention of "dose risk" or the combination of individual/collective dose with event probabilities. The only discussion of "probability" tied to an accident scenario defers such analyses to SERs.
- NUREG-2125 is the <u>*only*</u> document where the errant concept of "dose risk" also used in NUREG-2239 is formally defined — "the summation of dose to all exposed individuals times the probability of the accident" — and employed throughout the document.

Therefore, one can conclude that the NRC assertion of "a longstanding NRC practice" of multiplying individual and collective doses (consequences) by accident probabilities is provably false. And indeed, if it were a longstanding practice, it would <u>*still*</u> be scientifically invalid.

Risk is a bi-dimensional expression of the relationship between (1) the probability that a given event will occur and (2) the consequence(s) of that event. It is generally represented as a spectrum of outcomes as follows:

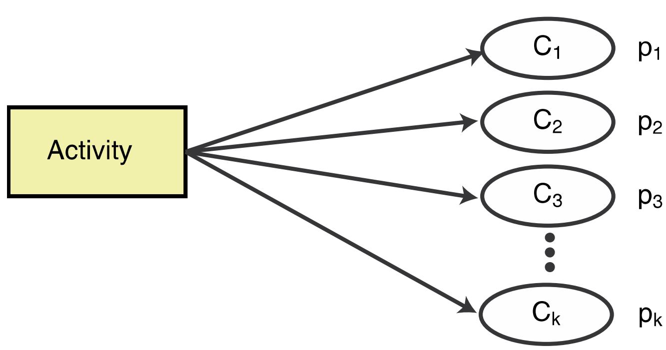
$$R = \{\langle p_i, C_i \rangle\}$$

where

p_i is the probability of event, *i* and

C_i is the consequence of event, *i*

The "Consequence spectrum" (or risk picture) is a listing of potential consequences and associated event probabilities.



Therefore, the NRC practice of computing a "dose risk" as the <u>*product*</u> of a radiological dose and an event probability is unfounded and grossly misrepresents the risk picture of the activities under evaluation, in violation of (i) 10 CFR 51.70(b) in that the necessary environmental analyses have not been made and (ii) 10 CFR 51.71 in that it does not comply with national or international standards[2] regarding the determination of radiological consequences from a postulated event.

Failure to Properly Evaluate Major Points of View Raised by Other Federal Agencies, Elected Officials, & Previous Commenters

As stated in 10 CFR 51.90, Final environmental impact statement—general,

> "After receipt and consideration of comments requested pursuant to §§ 51.73 and 51.117, the NRC staff will prepare a final environmental impact statement in accordance with the requirements in §§ 51.70(b) and 51.71 for a draft environmental impact statement. The format provided in section 1(a) of appendix A of this subpart should be used."

Among the six specific requirements found in Section 51.71, paragraph (b) states the following:

> "(b) Analysis of major points of view. To the extent sufficient information is available, the draft environmental impact statement will include consideration of major points of view concerning the environmental impacts of the proposed action and the alternatives, and ***contain an analysis of <u>significant problems and objections</u> raised by other Federal, State, and local agencies, by any affected Indian Tribes, and by other interested persons***" (emphasis added)

Among the "major points of view" absent from the DEIS *<u>and</u>* FEIS analyses are the following:

A. The stated opposition of the Texas Governor to the project under review by the NRC (ML20309A385), now to include a law banning the proposed activity in the state of Texas, and

B. Concerns raised as high priority knowledge gaps by the DOE in a December 2019 report that call into question the long-term integrity of confinement systems and highlights the lack of knowledge regarding the actual consequences of a loss-of-confinement event on the public and the environment.

These major points of view received only the cursory considerations by the NRC in response to comments (D.2.35.3 and D.2.27.1) and no modification to the analyses in the body of the FEIS.

Regarding the documented opposition of both the Texas Governor and Legislature to the activity under review by the NRC in the form of a new state law, the legal precedent recently established in *Virginia Uranium v. Warren* would undoubtedly lead one to believe that the

[2] E.g., ICRP Publication 147 or NCRP Report 180.

passage of a state law banning the proposed practice would constitute a "major point of view," especially as it relates to the approvals necessary for the authorization of the project and the court's view that a state ban on an NRC-licensed activity is valid.

In the matter of the DOE's documented concerns in SAND2019-15479R[3] regarding the ability of authorized DSC systems to maintain their confinement integrity for the anticipated life of the project, the DOE — the federal agency responsible for the possession and transportation of SNF to and from national storage and repository facilities — declared *numerous* gaps that were assigned the highest priority for the future efforts of the agency:

Gap Analysis to Guide DOE R&D in Supporting Extended Storage and Transportation of Spent Nuclear Fuel: An FY2019 Assessment
December 23, 2019 iii

SUMMARY

The U.S. Department of Energy (DOE), Office of Nuclear Energy (NE), Spent Fuel and Waste Science and Technology (SFWST) program is performing research and development (R&D) in a number of areas related to the storage, transportation, and disposal of spent nuclear fuel (SNF) and high-level radioactive waste. R&D under the Storage and Transportation control account is addressing issues of extended or long-term storage and transportation of commercial SNF, with a focus on high-burnup (HBU) fuels.

This report is a condensed version of previous reports (Hanson et al. 2012 and Hanson and Alsaed 2019) identifying technical gaps that, if addressed, could be used to ensure the continued safe storage of SNF for extended periods and support licensing activities. This report includes updated gap priority assessments because the previous gap priorities, from Hanson and Alsaed (2019), were based on R&D performed through 2017. Much important work has been done since 2017 that requires a change in a few of the priority rankings to better focus the near-term R&D program. Background material, regulatory positions, operational and inventory status, and prioritization schemes are discussed in detail in Hanson et al. (2012) and Hanson and Alsaed (2019) and are not repeated in this report. One exception is an overview of the

Thermal Profiles, Stress Profiles, Drying Issues & Cladding — H2 Effects: These concerns directly relate to the stability of canistered SNF in both storage and transportation environments and call into question the validity of the assertions made by the NRC in the FEIS, specifically as it relates to the stability of the SNF in storage and NCT and how cladding failures may adversely affect retrievability.

[3] SAND2019-15479R, Gap Analysis to Guide DOE R&D in Supporting Extended Storage and Transportation of Spent Nuclear Fuel: An FY2019 Assessment

Welded Canister Atmosphere Corrosion: From the SAND report:

> "Welded Canister Corrosion ([new] Priority 1)— Three main parameters have been shown to affect stress corrosion cracking (SCC): environment (salt content, salt stability, humidity, and temperature); material (stainless steel(SS)304/304L is used in dry storage canisters); and loading (high tensile stresses in weld zones could support through-wall SCC). Surface samples from canisters at several different sites indicated soluble salt deposition, but the concentrations varied widely, and the presence of corrosion-inducing chloride also varied widely. Four-point bend tests on SS 304L coupons loaded with sea salt did not indicate enhanced pitting densities as a function of stress. Ongoing work will continue to focus on the three main parameters. This includes(1)quantifying the brine stability of salts present in the environment, (2)understanding material and surface environment effects on electrochemistry and pit formation, and (3)tensile stress tests to identify characteristic features controlling pit-to-crack transition. A major push will be to evaluate pit formation and SCC initiation and growth rates (i.e., pit-to-crack transition) as a function of environmental parameters (salt load, temperature, and salt/brine composition), material properties (e.g., degree of sensitization, surface roughness, degree of cold work), and stress state and to investigate the consequences of gas and particle transport in through-wall cracks."

As pointed out by previous DEIS commenters, the proposed project location is in an area of high surface salt deposits. In NRC reports regarding the problem of CI-SCC and its effects on DSC confinement integrity, the NRC has cautioned licensees and CofC holders that even "salted roads" may present a source of corrosion for the destructive phenomenon of CI-SCC.

Inexplicably, the NRC states concerns related to CI-SCC are beyond the scope of the EIS while at the same time stating, "[t]he EIS evaluates the potential environmental impacts that could result from construction, operation, and decommissioning of the proposed CISF." How is it possible that a potential environmental impact caused by loss of confinement due to CI-SCC in an area of the country replete with the materials necessary to initiate the phenomenon is "out of scope" for the FEIS?

When a regional environment has the potential to initiate a chain of events that would adversely impact the engineered function of a confinement system, that seems to be precisely what the EIS should analyze, particularly from the Major Point of View perspective.

Understandably, the NRC is very desirous of keeping CI-SCC concerns under wraps to avoid causing undue public alarm in regions of the country where CI-SCC is not a possibility. However, that should not prevent the NRC from performing the requisite analyses when the regional environment is replete with the necessary initiating agents — especially when such analyses could potentially adversely impact the NRC's findings on “small” environmental impacts.

Consequence Assessment of Canister Failure: From the SAND Report

> “Consequence of Canister Failure ([new] Priority 3)— The focus is to develop ***technically defensible assessment of gaseous and particulate releases and radiological consequences*** through SCC breaches.”

As previously discussed with the issues raised by the NWTRB report, the DOE has been joined by the NRWTRB and has abandoned the NRC position that a canister breach is not possible and has moved to the appropriate posture of evaluating both the mechanisms and consequences of canister failures. The only discussion of a breach in the FEIS occurs in the context of “rare severe accident conditions” and not in NCT or storage configurations. The absence of revised breach analyses consistent with DOE and NWTRB views is a significant defect in the FEIS that violates 10 CFR 51.

Monitoring – External: From the SAND Report

> “Monitoring (Priority 3)— The focus is on robotic- and sensor-based non-destructive examination(NDE) techniques to detect SCC of canister welds.”

The current inability to monitor all exterior surfaces of proposed DSC canister types directly undermines the EIS findings of “SMALL” impacts from the proposed operations and is a major defect in the government’s analysis. It is inconceivable that the NRC would consider concluding a review as favorable when the means to ensure the viability of an engineered confinement system does not exist.

Public confidence in NRC licensing decisions and environmental impact analyses requires that the NRC fully and fairly assess all known limitations in monitoring critical safety barriers. Given the NRC’s public pronouncements regarding this matter, the absence of any assessment of this vulnerability in the EIS is inexplicable.

Fuel Transfer Options: From the SAND Report

> “Fuel Transfer Options (Priority 3)— Data is needed to support facility design concept for opening a cask for inspection and transfer/repackaging.
>
> “What we still need to learn to close this gap: This priority has been raised recognizing the need for data to support a surface facility design concept for opening a cask for inspection or repackaging at a consolidated interim storage facility. Work continues on cask drying issues (see Drying Issues gap)and hydride effects through the sister pin testing.”

This final matter raised by the DOE in the SAND Report is significant in that there are no planned facilities that would facilitate “opening a cask for inspection or repackaging.” Indeed, given the issues raised by the NWTRB and DOE regarding potential cladding failures incurred during NCT, the potential for loss of fuel geometry controls, and the potential for loss of confinement due to CI-SCC, a facility that would facilitate the inspection and transfer of fuel should have been a significant topic of discussion in the FEIS to demonstrate that the “criteria for maintaining safe operations regarding criticality, confinement, retrievability, and instruments and control systems” can be met.

Notably, in section 2.3.1 of the FEIS, “Alternatives Eliminated from Detailed Analysis - Storage at a Government-Owned CISF the U.S. Department of Energy (DOE) Operates,” (pg 2-22), the NRC states that a government-owned CISF “would include facilities and other key infrastructure needed to safely manage SNF from commercial nuclear reactors.” Notably, the NRC is silent on any comparisons between a future DOE CISF and the CISF under review in the FEIS.

Assorted technical shortcomings

Throughout the FEIS, there is inconsistent use of significant figures that do not comply with scientific and engineering practices and imply a higher degree of precision than can be supported in the analyses.

As an example, Table 4.3-2 below shows the undisciplined use of significant figures in just one instance in the FEIS

Table 4.3-2 Comparison of NRC Staff’s Estimated Population Doses and Health Effects from Proposed Transportation* of SNF to the Proposed CISF Along a Representative Route with Nonproject Baseline Cancer

	Incident-Free			Accident (No Release)		
Exposed Population	Collective Dose (person-Sv)	Health Effects[1]	Nonproject Baseline Cancer[2]	Collective Dose-Risk (person-Sv)	Health Effects[1]	Nonproject Baseline Cancer[2]
Occupational						
Phase1	1.1	0.061	250	Emergency Responder (consequence) 0.92 mSv [92 mrem]		
All Phases	8.6	0.49	250			
Public						
Phase 1	0.15	0.0088	440,000	0.028	0.0016	440,000
All Phases	1.2	0.071	440,000	0.22	0.013	440,000

*425 shipments of SNF (Phase 1) occurring over an approximated 2.5 year operational period; approximately 3,400 shipments of SNF (All Phases) occurring over an approximated 20 years of operational periods within a 40 year license term.

[1]Health effects includes fatal cancer, nonfatal cancer, and severe hereditary effects. Estimated by multiplying the collective dose by the health risk coefficient of 5.7×10^{-2} health effects per person-Sv.

[2]Nonproject baseline cancer is estimated by multiplying the exposed population by the U.S. risk of getting a cancer (1/3) (EIS Section 3.12.3). Estimated occupational population (748 total) includes 3 crew and 1 escort on each of 12 trains (48 total), and 2 rail yard workers at each of 2 classification stops per shipment at 100 different rail yards (400 total) to account for dispersed actual routes, and 1 inspector at 3 stops per shipment at 100 different rail yards (300 total). Public population is based on NUREG-2125 reported population along representative route of 1,321,024.

To convert Person-Sv to Person-Rem, multiply by 100

As seen from the example above, results for the same categories vary from 2 to 5 significant figures. This practice does not conform to the US government-adopted standards of reporting analytical results. Most of the results related to the reporting of cancer incidence should be limited to one (1) or two (2) significant figures, consistent with ICRP and NCRP guidelines.