

**PREDECISIONAL
BEING PROVIDED TO SUPPORT THE 2/7/2017 ACRS REGULATORY
POLICIES AND PRACTICES SUBCOMMITTEE MEETING
AND NOT TO SOLICIT EXTERNAL STAKEHOLDER FEEDBACK**

FOR: The Commissioners

FROM: Victor M. McCree
Executive Director for Operations

SUBJECT: PROPOSED REVISION TO NUREG-1530,
"REASSESSMENT OF NRC'S DOLLAR PER PERSON-REM
CONVERSION FACTOR POLICY"

PURPOSE:

In this paper, the staff requests Commission approval to publish the final version of NUREG-1530, Revision 1, "Reassessment of NRC's Dollar per Person-Rem Conversion Factor Policy" (Enclosure 1). Revising NUREG-1530 is one element of the staff's plan for updating its cost-benefit guidance, as previously approved by the Commission. This paper does not introduce any new commitments or resource implications.

SUMMARY:

The staff has incorporated updates to the dollar per person-rem conversion factor and has established a method for keeping this factor up-to-date in NUREG-1530, Revision 1. The U.S. Nuclear Regulatory Commission (NRC) uses the dollar per person-rem conversion factor in cost-benefit analyses to determine the monetary valuation of the consequences associated with radiological exposures. The staff proposes to update the dollar per person-rem conversion factor from \$2,000 to \$5,200 based on the application of an updated best estimate value of statistical life (VSL) of \$9.0 million and a cancer mortality risk coefficient of 5.8×10^{-4} per rem used by the U.S. Environmental Protection Agency (EPA). Proposed changes to the implementation process have also been incorporated into NUREG-1530, Revision 1.

CONTACT: Pamela S. Noto, NRR/DPR
301-415-6795

BACKGROUND:

The NRC applies the dollar per person-rem conversion factor from NUREG-1530 in a variety of regulatory applications that require the determination of the monetary valuation of the consequences associated with radiological exposures. These regulatory applications include the evaluation of routine effluent releases from nuclear power plants, accidental releases, and radiation protection practices, as well as regulatory analyses, backfit analyses, and environmental analyses.

In 2009, the staff initiated research on the bases for the determination of the VSL and performed outreach with other Federal agencies on their values and use. The VSL is not a value placed on a human life, but a value that society would be willing to pay for reducing health risk. The concept of a VSL is used throughout the Federal government to monetize the health benefits of a safety regulation. Subsequently in 2011 the magnitude of the societal effects of the accident at the Fukushima Dai-ichi nuclear power plant in Japan led the NRC to evaluate how its regulatory framework considers offsite property damage and the associated economic consequences that could be caused by a significant radiological release from an NRC-licensed facility.

Following this evaluation, the staff recommended in SECY-12-0110, "Consideration of Economic Consequences within the U.S. Nuclear Regulatory Commission's Regulatory Framework," dated August 14, 2012 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML12173A478), that the NRC enhance the currency and consistency of the existing framework through updates to cost-benefit guidance documents that would assist in harmonizing cost-benefit guidance across the agency. The staff also requested Commission approval to continue work on updating the 1995 dollar per person-rem conversion factor in NUREG-1530. In the March 20, 2013, staff requirements memorandum associated with SECY-12-0110 (ADAMS Accession No. ML13079A055), the Commission approved the staff's recommendation to enhance the cost-benefit analysis framework. The Commission also approved the request to continue with ongoing staff activities described in SECY-12-0110 to update guidance documents, including the NRC's dollar per person-rem conversion factor policy.

As described in SECY-14-0002, "Plan for Updating the U.S. Nuclear Regulatory Commission's Cost-Benefit Guidance," dated January 2, 2014 (ADAMS Accession No. ML13274A519), the staff is updating NUREG documents that provide cost-benefit analysis guidance; developing new guidance, as needed; and maintaining guidance through periodic updates. The staff identified NUREG-1530 as one of the NUREG documents that required revision. Other cost-benefit topics that the staff identified as needing improvements in methods and technology are: cost or benefit attributes that are difficult to quantify, the treatment of uncertainty in cost-benefit analyses, and the incorporation of best practices for developing realistic estimates.

The staff held a Category 3 public meeting on April 2, 2015, to discuss the update to NUREG-1530. The NRC presentation can be found in ADAMS under Accession No. ML15098A649. In response to this meeting, the Nuclear Energy Institute submitted a letter to the NRC providing comments on the proposed update. This letter and the

associated attachment are publicly available in ADAMS under Accession Nos. ML15126A489 and ML15126A498, respectively.

The draft NUREG-1530, Revision 1 was issued for public comment in the *Federal Register* (80 FR 53585, dated September 4, 2015). The staff received 11 comment submissions with a total of 38 individual comments from industry and members of the public. The NRC responses to these public comments are provided in Enclosure 2. External participants also expressed views on the update to NUREG-1530 during the July 26, 2016, Commission meeting with NRC stakeholders.

DISCUSSION:

The following describes the proposed updates made in NUREG-1530, Revision 1:

1. Updated Values

- Dollar per Person-Rem Conversion Factor: Revision 1 of NUREG-1530 provides the staff's basis for proposing the new dollar per person-rem conversion factor (increasing from \$2,000 to \$5,200) as a monetary value of the cancer mortality risk resulting from radiation exposure. As such, the proposed dollar per person-rem conversion factor considers the VSL and a cancer mortality risk coefficient that establishes the probability for cancer mortality health effects attributable to radiation exposure. The resulting dollar per person-rem conversion factor is expected to apply to situations where populations are exposed to low doses that collectively result in calculated excess cancers. Deterministic health effects are valued on a case-by-case basis.
- VSL: Based on the literature reviews and outreach to other Federal agencies, the staff proposes to update its VSL base year value best estimate from \$3.0 million to \$9.0 million (2014 dollars). The staff's recommended VSL is the average of the U.S. Department of Transportation's VSL (\$9.3 million) and EPA's VSL (\$8.7 million) in 2014 dollars.
- High and Low Dollar per Person-Rem Conversion Factor Estimates: Consistent with best practice, the staff provides a range of dollar per person-rem conversion factors for use in sensitivity analyses. These analyses are performed to evaluate the impact on cost-benefit analysis results of using plausible alternative values for this conversion factor. For this purpose, the staff recommends varying the dollar per person-rem conversion factor by plus or minus 50 percent. This results in a range of conversion factors with a low value of \$2,600 per person-rem and a high value of \$7,800 per person-rem. This range of values is reasonable for performing sensitivity analyses for addressing plausible alternatives for the VSL estimate or the cancer mortality risk coefficient.

- EPA Cancer Mortality Risk Coefficient Approach: The staff received public comments regarding the continued use of the International Commission on Radiological Protection (ICRP) nominal risk coefficient versus using the EPA cancer mortality risk coefficient. The ICRP value includes a global average risk of fatal cancers, non-fatal cancers, and severe heritable effects. However, on the VSL portion of the calculation, only cancer mortality is monetized. Therefore, to increase coherence between the risk coefficient and VSL, the staff recommends discontinuing the use of the ICRP nominal risk coefficient of 7.3×10^{-4} per-rem and adopting the EPA's cancer mortality risk coefficient of 5.8×10^{-4} per-rem to better align with the monetized mortality value of the VSL. Using the EPA's cancer mortality risk coefficient strengthens the basis for the revised dollar per person-rem conversion factor because it is specific to the U.S. population (rather than a global average).¹

2. Proposed Method for Maintaining Conversion Factors

- VSL: In maintaining the VSL in current dollars, the staff proposes to apply annual changes in inflation and real income growth when conducting cost-benefit analyses.
- Cancer Mortality Risk Coefficient: The staff would inform the Commission if the EPA adopts a new cancer mortality risk coefficient. Following Commission direction, the staff would update the cancer mortality risk coefficient used in the dollar per person-rem conversion factor policy.
- \$1,000 Trigger: The staff will reevaluate its baseline values for VSL and cancer mortality risk coefficient (including monitoring the parameters used by other Federal agencies) periodically and will provide a recommendation to the Commission whether to update guidance and regulations if the conversion factor is expected to change by more than \$1,000 per person-rem. This practice is consistent with other Federal agencies' initiatives to establish formalized processes for re-baselining VSL.

3. Implementation Updates

- Significant Figures: Historically, the NRC has rounded the dollar per person-rem conversion factor to the nearest thousand dollars for the purposes of estimating monetary valuation. Given the large uncertainties inherent in this approach, annual updates to account for inflation and real income growth would have little to no impact on this value between periodic baseline reviews. The recommended value of \$5,200 uses two significant figures, enabling the staff to make annual updates that align with economic changes in a gradual manner.

¹ The staff notes that morbidity and heritable effects would need to be considered separately in cost-benefit analyses. The revision to NUREG/BR-0058, "U.S. Nuclear Regulatory Commission Guidance on Performing Cost-Benefit Analyses," currently being developed by the staff would, if approved by the Commission provide a method for estimating the values of radiation-induced morbidity and heritable effects.

- Dose and Dose-Rate Effectiveness Factor (DDREF): Most human evidence and risk coefficients for radiation health effects are developed from epidemiology studies of populations exposed to ionizing radiation at high doses or high dose rates for short periods of time. For example, atomic bomb survivors provide evidence that radiation is a carcinogen at high doses delivered at near instantaneous dose rates. However, most radiation protection situations involve planned activities that include low-dose exposures over a longer period of time (e.g., a year or a career). The EPA developed a DDREF for low-dose and dose rate exposure scenarios. The staff recommends that for high-rate exposure scenarios, the DDREF should be removed from the cancer risk coefficient to account for a higher dose or dose rate when the total accumulated effect does not fall within the range that would produce acute health effects. Revision 1 of NUREG-1530 would provide guidance for adjusting the cancer risk coefficient for high-rate exposure scenarios.
- Application and Backfit: The staff proposes applying the updated conversion factors consistent with NRC's Principles of Good Regulation, including reliability, clarity, and efficiency.

With respect to implementation, the staff may begin using the revised dollar per person-rem conversion factor upon issuance of NUREG-1530, Revision 1. Licensees and applicants would be able to use the updated values in all regulatory applications discussed in Section 3 of NUREG-1530, Revision 1, except for regulatory applications discussed in Section 3.1, "Routine Liquid and Gaseous Effluent Releases from Nuclear Power Plants." Prior decisions will not be reviewed as a result of this update.

Applicants for reactor licenses under 10 CFR Parts 50 and 52, and the staff in its review of such applications, are still required to use the current conversion factor of \$1,000 per total body man-rem and \$1,000 per man-thyroid-rem in Section II.D of 10 CFR Part 50, Appendix I, until it is formally changed through a rulemaking.

RECOMMENDATIONS:

The staff recommends that the Commission approve final publication of NUREG-1530, Revision 1. If approved, the staff would publish a notice in the *Federal Register* informing the public of the availability of NUREG-1530, Revision 1.

COORDINATION:

The Office of the General Counsel has reviewed this package and has no legal objection. The Office of the Chief Financial Officer reviewed this package and determined that there is no financial impact.

The staff has informed the Advisory Committee on Reactor Safeguards of the proposed changes to NUREG-1530. The staff plans to brief the Advisory Committee on Reactor Safeguards on NUREG-1530, Revision 1, in conjunction with a discussion of proposed changes to NUREG/BR-0058, on February 7, 2017.

Victor M. McCree
Executive Director
for Operations

Enclosures:

1. NUREG-1530, Revision 1
2. NRC Staff Responses to Public Comments on Draft NUREG-1530, Revision 1

COORDINATION:

The Office of the General Counsel has reviewed this package and has no legal objection. The Office of the Chief Financial Officer reviewed this package and determined that there is no financial impact.

The staff has informed the Advisory Committee on Reactor Safeguards of the proposed changes to NUREG-1530. The staff plans to brief the Advisory Committee on Reactor Safeguards on NUREG-1530, Revision 1, in conjunction with a discussion of proposed changes to NUREG/BR-0058, on February 7, 2017.

Victor M. McCree
Executive Director
for Operations

Enclosures:

1. NUREG-1530, Revision 1
2. NRC Staff Responses to Public Comments on Draft NUREG-1530, Revision 1

ADAMS Accession Nos.: Pkg: ML16147A293; SECY: ML16147A319

NUREG-1530: ML16147A392 Comment Response: ML16147A501

*Concurrence via E-Mail

OFFICE	NRR/DPR/PRMB*	QTE*	NRR/DPR/PRMB*	NRR/DPR/PRMB*	NRR/DPR/PRMB
NAME	PNoto	CHsu	FSchofer	GLappert	MKhanna
DATE	05/02/2016	05/24/2016	05/31/2016	6/6/2016	6/28/6016
OFFICE	NRR/DPR/DD*	NRR/DRA/DD*	NRR/DLR/D*	NRO/D*	RES/D*
NAME	MGavrilas	RFelts	JMarshall	JUhle	MWeber
DATE	08/04/2016	08/29/2016	08/17/2016	08/17/2016	08/18/2016
OFFICE	NMSS/D	NSIR/D*	ADM*	OCIO*	OGC (NLO)*
NAME	MDapas	BHolian	LTerry	JFlanagan	CEngland
DATE	08/16/2016	08/18/2016	08/08/2016	08/05/2016	10/13/2016
OFFICE	NRR/D	EDO			
NAME	WDean	VMcCree			
DATE	11/2/2016				