NUCLEAR REGULATORY COMMISSION: Potential Changes to Radiation Protection Regulations - NRC-2009-0279

Landauer Response

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A. Introduction and Landauer Background

Landauer is pleased to submit responses to the Nuclear Regulatory Commission on its Advance Notice of Proposed Rulemaking with comments on the Potential Changes to Radiation Protection Regulations. We appreciate the opportunity to respond on behalf of our stakeholders who represent the majority of U.S. hospitals and other health care organizations, the military, nuclear power plants, laboratories, and other industrial clients.

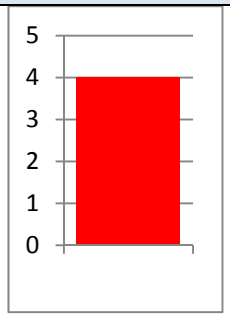
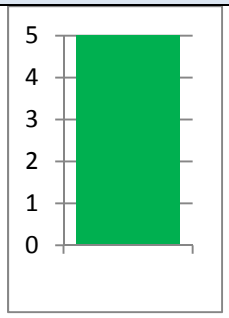
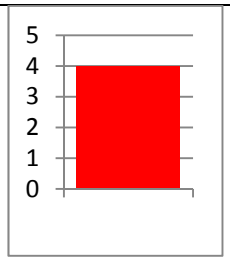
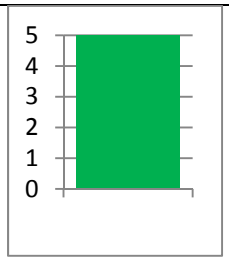
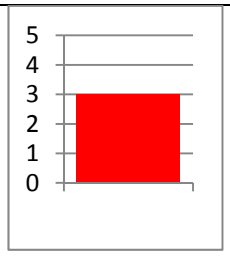
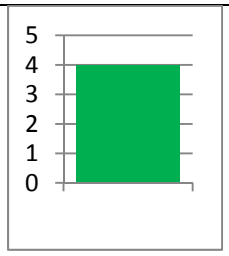
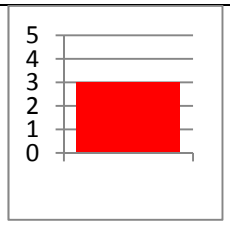
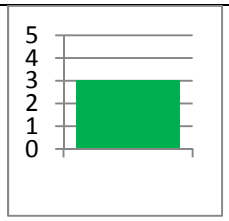
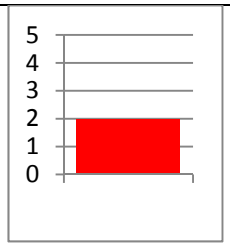
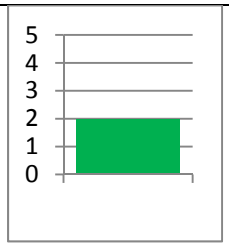
For more than 60 years, Landauer has served these organizations as a radiation safety partner with occupational radiation monitoring and with accurate data and analytics to optimize the health and safety of workers and patients alike.

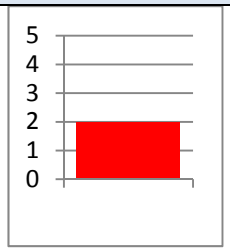
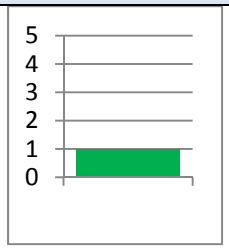
Landauer appreciates the opportunity to present its thorough analysis of the NRC's proposed revisions to 10CFR20, and respectfully submits the following for NRC review and consideration.

Summary

The following table lists the specific issues identified by the NRC for revision along with the major impacts related to each of the issues. A relative ranking, 1 (low) to 5 (high) of associated Licensee implementation costs and effort is also provided for each NRC proposal.

The remaining sections of this document, sections B-G provide a more detailed response for each of the proposals.

Proposed Revision Issues	Impact of Proposed Regulations	Licensee Implementation Costs	Licensee Implementation Effort
Occupational Dose Limit for the Lens of the Eye	• Implementation of new conversion factors and monitoring methodologies • Eye dosimeter required. Possible implementation of additional new dosimeter type for personal monitoring • Implementation of reduced dose limit and lifetime dose record keeping		
Individual Protection – ALARA Planning	• ALARA planning requirement could complicate radiation protection programs • High cost to Licensee to implement		
Reporting of Occupational Exposure	• Reporting to National Dose Registry • High work load dependent upon reporting frequency and detail required		
Update to 10CFR part 20 to align with ICRP Publication 103	• Modification to current reporting procedures to comply with ICRP 103 verbiage and methodologies		
Dose Limit for Embryo/Fetus	• No increased costs or effort needed for current methodologies • Implementation of ICRP methodologies could require software modifications		

Proposed Revision Issues	Highlights of Proposed Regulations	Licensee Implementation Costs	Licensee Implementation Effort
Metrication	• **Harmonization with rest of international radiation protection community** • **Reduced risk of miscommunication**		

B. Update 10 CFR Part 20 to align with ICRP Publication 103 methodology and terminology

Landauer Response

In general, Landauer supports the implementation of ICRP 103 methodologies and terminologies in any revision of 10CFR20 regulations. Landauer supports the use of the most up-to-date methodologies, terminologies and models. However, specific issues relative to the specification of the limiting quantities must be clearly stated in the regulation revisions involved in the conversion of total effective dose equivalent (TEDE) to effective dose (ED). Effective dose is defined by the ICRP as a protection quantity which cannot be measured directly or assessed for an individual. As a result, the ICRP and ICRU have defined operational quantities as surrogates for the protection quantities. These operational quantities are personal dose equivalent for personal monitoring and ambient dose equivalent and directional dose equivalent for area monitoring. It is the operational dose quantities that are measured by dosimetry systems, used by licensees to demonstrate compliance with the limits and permit traceability to national metrological standards. A problematic issue concerning the use of protection quantities and operational quantities is that the same dose units are used for both quantity types, the Sievert. This issue requires a clear description of the intended dose quantity accompanying any regulatory dose limit to distinguish the intent of the limit and how compliance can be demonstrated. Specific regulations must be included indicating that all dose records be maintained and reported as operational quantities, particularly as they relate to external dose measurements.

The implementation of any alignment with ICRP 103 methodologies should be restricted until all revisions to dose coefficients by the ICRP have been completed. Similarly, the personal dosimetry performance standard, ANSI N13.11 would need to be updated to reflect the new operational dose quantities prior to implementation of revised regulations. Neutron conversion factors would need to be updated in any revision of the standards.

C. Occupational Dose Limit for the Lens of the Eye

Landauer Response

Landauer believes that a closer alignment of Lens of Eye dose limits with ICRP 118 would be appropriate in any 10CFR20 revision. Several technical dosimetry issues require resolution prior to the implementation of ICRP 118 lens of eye dose limits. While ICRP 118 specifies the operational quantity Hp(3) as the controlling quantity for Lens of Eye dose, specific factors needed to measure the operational quantity are not specified. Dose conversion factors, angular response factors, radiation weighting factors and phantom description need specification prior to implementation of the new limits. The NRC needs to develop operational guidance concerning acceptable practices for the measurement of Lens of Eye dose prior to implementation. Guidance is needed for the location of dosimeters on the body, number of dosimeters needed, use of a combination of Hp(10) and Hp(0.07) dose to determine Hp(3) dose, and the influence of protective shielding on Hp(3) determination. The dosimetry performance standard ANSI N13.11 would need revision to include performance testing standards incorporating the previous requested conversion factors, irradiation phantoms and operational guidance.

Landauer believes that the rolling 5 year average dose limit as suggested by the ICRP would allow sufficient flexibility for Licensees to maintain cumulative doses ALARA while limiting the restrictions on those high dose occupations of interventional radiologists and radiographers.

Implementation costs associated with the proposed Lens of Eye dose limit would be dependent upon operational guidance for the measurement of Lens of Eye dose. If required to determine the dose to both eyes individually, using multiple dosimeters, then a significant expense for the development of the dosimeter and modification of dosimeter record software would result.

D. Dose Limit for Embryo/Fetus of a Declared Pregnant Occupational Worker

Landauer Response

The current methodologies for controlling the dose to an Embryo/Fetus for the gestation period have shown to adequately limit the dose to the Embryo/Fetus and should be retained for any future regulatory revisions. The entire gestation period is considered in the current methodologies, while the ICRP methodologies only consider doses after declaration. Additionally, the current monitoring methodologies can be more restrictive, 500uSv for women with doses >50 mSv pre-declaration, than the ICRP's post declaration limit of 1 mSv. Legally in the U.S., a women's exposure pre-declaration cannot be restricted below the normal individual dose limits. The Landauer historical dose database indicates 98% of the doses after declaration are below 1 mSv and the mean fetal monitoring period was four months. Typically, only half of a normal pregnancy is being declared and monitored, therefore the methodology that looks at the total gestation dose and is more restrictive post-declaration is the most conservative and would provide the best protection to the fetus.

The current dose methodologies have the advantage of being already implemented and being well understood by the radiation protection community. All costs associated with the implementation of the current methodologies have been recognized and there should be no

additional operational costs other than normally experienced. Implementation of the ICRP recommendations would require modifications to record keeping programs and the education of the radiation worker population explaining the rational and methodology associated with the new limits.

A dose limit methodology not suggested in the NRC's proposal would be adoption of the Department of Energy's practice of limiting a pregnant work to 1 mSv for the entire gestation period. Adoption of the DOE methodology would harmonize the application of embryo/fetus dose control between the two major regulatory agencies in the US.

E. Individual Protection - ALARA Planning

Landauer Response

Structured ALARA Program

Landauer recommends that the addition of specific prescriptive ALARA planning and implementation requirements be limited to those radiation environments at the highest risk and a historical precedent for occupational doses at or near the annual limit. Historical dose trends demonstrate that in general, most occupational exposures are ALARA, except in a few limited radiation environments, nuclear medicine and interventional radiology, and then only for a few individuals. A number of efforts are currently underway in the medical setting to limit patient dose. Occupational doses would be expected to also benefit from these efforts, by association. Specific control limits for these high dose groups could be implemented in an effort to lower their exposures while not impacting the general population of radiation workers.

Development of Cumulative Dose Criterion

Cumulative dose criterion can be viewed as the least restrictive method of insuring that occupational exposures are ALARA. Exceeding annual dose limits would trigger increased control of an individual's cumulative exposure for a specified time period. Implementation of a cumulative ALARA control limit would control the risk of highly exposed individuals while providing the greatest flexibility to individuals who remain below the control limits.

Individuals receiving doses greater than the annual limit to a member of the public should be monitored (1mSv). The implementation of any dose regulation should be prescriptive for clarity and assurance of implementation.

Concurrent Occupational Doses

Any implementation of a system to account for concurrent occupational doses will require the establishment of a "real time" National Dose Registry. The current design of the REIRS dose registry is not conducive to the control of individual doses due to the REIRS annual reporting timeframe. Significant implementation and maintenance cost would be associated with any dose registry. Maintaining current total dose records would be unattainable without a dose registry due to possible cross jurisdiction employment and reliance on individual notification of exposures. Landauer estimates the current cost for reporting and resolving discrepancies

associated with the Canadian national dose registry and the United Kingdom dose registry to be $0.40 per participant.

F. Metrication - Units of Radiation Exposure and Dose

Landauer believes the conversion to the International System of Units (SI) should be implemented and the use of traditional units retired. The advantages to the sole use of SI units are many, including the harmonization of radiation measurements performed in the United States with the rest of the world, a reduced risk of miscommunication due to the mixing of units and the removal of business cost and complications associated with designing goods and services capable of operating under two systems of units. The public image of the Radiation Safety Industry would be enhanced with a consistent global message only obtainable thru the use of a common set of meteorological standards.

As an international business, Landauer has been operating using two systems of measurements, traditional units for U.S. customers and SI units for international customers. The costs associated with the implementation of SI units for U.S. customers would be minimal. The long term business cost savings associated with the implementation of SI units would be significant.

G. Reporting of Occupational Exposure

It is the understanding of Landauer that the objective of this proposed revision is to improve the data quality reported to the NRC. The intended use of the reported data is to preform epidemiological studies and historical assessments of radiological control practices. The compiling of this data would be of limited use to the individual Licensee for controlling or limiting personnel exposures. Care must be taken to insure that the expansion of reporting requirements does not have an adverse effect on the quality of the data collected, especially if no tangible benefit to the Licensee's radiation program can be demonstrated.

The current REIRS dosimetry database is a collection of annual dose summaries. The data contained in the REIRS database would need to be updated more frequently for a Licensee to use the information to control cumulative and concurrent exposures. Additionally, a unique identifier for each radiation worker would need to be developed for cumulative and concurrent dose tracking. Currently, only 38% out of approximately 1.8 million individuals in the Landauer database provide social security numbers for personnel identification. Landauer continues to receive customer requests to delete personal data from our database due to identity theft concerns, which will only serve to lessen Landauer's ability to uniquely identify individual dose histories across customer accounts. A solution to the unique identifier issue may be the development and assignment of a lifetime "Radiation Worker" number to each monitored individual. The Radiation Worker Number would provide a means to uniquely identify an individual within the REIRS database or any other dose registry for determining cumulative and/or concurrent doses.

Landauer further recommends the improvement of Licensee compliance of current regulations prior to any expansion of reporting requirements to additional Licensee categories. This compliance improvement should include Agreement State compatibility as one of the improvement methods. Any increase in the enforcement of reporting requirements will result in a significant increase in operational costs to the Licensee. These increased costs do not only include the original reporting of the occupational dose but the effort required to resolve data conflicts between submitted records and the dose registry database. The implementation of a unique identifier for each radiation worker may reduce the database conflicts, but data resolutions will always need to be resolved.