Cool, Donald

From: Randy Sullivan / NSIR
Sent: Tuesday, December 04, 2007 3:13 PM
To: Donald Cool; Sami Sherbini
Cc: Vincent Holahan; Jimi Yerokun
Subject: Latest draft of paper
Attachments: SOARCA_Dose Threshold SECY-07-xxxx_.doc; SOARCA_revised PXM COMMENTS.doc

I have taken the liberty of sending the paper with Sami's comments and Trish's answer to them for your convenience. Also attached is a clean copy of the paper, I think

Don

I will e-mail you NRR comments which I think you will perhaps be answering with your input?

Thanks

Randolph L. Sullivan, CHP

T/65

FOR: The Commissioners

FROM: Luis A. Reyes
Executive Director for Operations

SUBJECT: STATE-OF-THE-ART REACTOR CONSEQUENCE ANALYSES—REPORTING LATENT CANCER FATALITIES

PURPOSE:

The purpose of this paper is to provide the Commission with the staff's approach regarding the reporting of estimated latent cancer fatalities (LCF) in state-of-the-art reactor consequence analyses (SOARCA) reports and to seek the Commission's approval to implement this approach.

CONTACT: Randolph L. Sullivan, NSIR
301-415-1123

BACKGROUND:

In Staff Requirements Memorandum–SECY-05-0233, "Plan for Developing State-of-the Art Reactor Consequence Analyses," (4/14/06) the Commission approved the staff's plan to develop the SOARCA. The plan states that the staff would use a range of dose thresholds including LNT for reporting consequences. The staff believes that SOARCA consequence results should include estimates of early fatalities and LCF to facilitate comparison with past analyses and that those estimates should serve to focus attention on optimum mitigative action preparedness. However, the staff is concerned that consequence estimates based on LNT place undue emphasis on the non-definitive health effects of low doses and consequently will present an inappropriate characterization of public risk from severe accidents.

In past analyses the staff has calculated consequences at great distances (1000 miles) and used the LNT dose-response model to estimate LCF consequences. This technique gives equal importance to very low doses received by a large number of individuals and higher doses received by a few individuals. This approach indiscriminately adds highly uncertain and speculative health effect estimates to those from well established and accepted models based on higher doses. While the possibility of health effects from low doses can not be ruled out, they should not be treated in a manner that obscures health effects that are more predictable and that could inform the prioritization of protective measures.

Further, the staff believes that the use of LNT for severe accident consequence estimates is a misapplication of the concept of collective dose. The International Commission on Radiological Protection (ICRP) addressed this issue in its most recent 2007 draft recommendations (currently in process for publication):

> (161) Collective effective dose is an instrument for optimization, for comparing radiological technologies and protection procedures. Collective effective dose is not intended as a tool for epidemiological studies, and it is inappropriate to use it in risk projections. This is because of the assumptions that have to be made, e.g. when applying the LNT model, due to which the biological and statistical uncertainties involved are too great. Specifically, the computation of cancer deaths based on collective effective dose involving trivial exposures to large populations is not reasonable and should be avoided, such computations based on collective effective dose were never intended, are biologically and statistically very uncertain, presuppose a number of caveats that tend not to be repeated when estimates are quoted out of context, and are an incorrect use of this protection quantity.

In addition the U. S. Health Physics Society (HPS) has developed a position paper, "Radiation Risk in Perspective," (8/04), that concludes that estimates of risk should be limited to individuals receiving a dose of 5 rem in one year or a lifetime dose of 10 rem, in addition to natural background. The basis of the HPS position is consistent with the ICRP statement above.

NSIR

In most, if not all cases, the LCF attributable to accidental releases from a severe accident would not be detectable above the normal rate of cancer fatalities in the exposed population (i.e., the excess cancer fatalities predicted are too few to allow the detection of a statistically significant difference in the cancer fatalities expected from other causes among the same population). However, in the past, consequence estimates from NRC studies based on collective dose were used without proper context to misrepresent risk to the public from severe accidents. The staff believes that even if the appropriate qualifiers and context are provided such consequence estimates would not foster effective risk communication because they are based on speculative low dose health effects and would divert focus from optimum mitigative action preparedness.

For the purpose of radiation protection regulation, the NRC treats radiation-induced health effects stochastically. In this treatment, the likelihood of occurrence increases with incremental increase in radiation exposure with no threshold. The staff supports this conservative approach for regulatory purposes and this paper does not attempt to identify a threshold for cancer induction or to propose changes to NRC regulatory philosophy (e.g., 10 CFR 50.36.a). Instead, the establishment of a dose threshold for reporting consequence estimates will focus public policy on more likely outcomes, rather than on speculative estimate associated with assigning risk from collective dose. The staff believes this is appropriate because SOARCA is not a regulatory analysis, but rather an effort to model consequences realistically using risk communication techniques to facilitate a common understanding among stakeholders. Therefore, the staff believes that the use of collective dose and LNT for predicting LCF is neither appropriate nor required.

DISCUSSION:

In SECY-05-0233, the staff stated that the latent health effects analyses will cover a range of dose models with thresholds from 0 to 5 rem. However, the staff became concerned that reporting a range of values would not support risk communication efforts, as it would provide many answers for each scenario analyzed and obscure focus on the optimum mitigative action preparedness.

The staff identified several options for presenting estimated LCF results and analyzed three in some depth:

(1) Use a range of dose thresholds, from 0 to 5 rem to assess LCF

This option offers the following advantages:

- It would not affect cost or schedule.
- It is consistent with SECY-05-0233.
- It would include multiple risk models and end points.
- It is consistent with the 2007 ICRP recommendations in that no single dose threshold is proposed.
- The range of answers would reflect uncertainty regarding dose effects.

The disadvantages of this option include the following:

- It aggregates collective dose by including trivial exposures to large population groups thus obscuring focus on optimum mitigative action preparedness accident.
- The use of different thresholds for assessing LCF for the same scenario could be difficult for stakeholders to understand and accept.
- It would be poor for risk communication purposes because it would not facilitate common understanding by stakeholders and would invite misinterpretation.
- The results of a single analysis could be interpreted in various ways according to stakeholder view.
- It would not facilitate the presentation of the staff's estimate of consequences.
- It would not focus attention on optimum mitigative action preparedness

(2) Use an LNT model to assess LCF

This option offers the following advantages:

- It would reduce cost and support the existing schedule.
- It would promote a common understanding among the stakeholders by providing a single consequence for each scenario analyzed.
- It is consistent with the models used in previous consequence analyses.
- It is consistent with the recommendations of the National Council on Radiation Protection and Measurement (NCRP) in Report 121, "Principles and Application of Collective Dose in Radiation Protection".
- It is consistent with analysis recommended by the U.S. National Academies of Science and employed by the World Health Organization.
- It is consistent with the Commission's policy for developing regulations to protect public health and safety.

The following are the disadvantages of this option:

- It would require the staff to estimate potential LCF in individuals who have received doses below public and occupational worker limits.
- It would inappropriately aggregate collective dose by including trivial exposures to a large population.
- The ICRP and HPS do not support its use for estimating LCF; rather, it is considered a misapplication of the use of collective dose.
- It would not represent the staff's realistic estimate for LCF.

(3) Estimate the number of detectable LCF using the thresholds proposed by the HPS

This option has the following advantages:

- It would reduce cost and support the existing schedule.
- It would improve common understanding among stakeholders by providing a single consequence number for each scenario.
- It is consistent with new (draft) ICRP recommendations which state that the computation of cancer deaths based on collective effective doses involving trivial exposures to large populations is not reasonable and should be avoided.

- It is consistent with the official position statement of the Health Physics Society (HPS) entitled, "Radiation Risk in Perspective," (PS010-1, August 2004) which recommends not assessing risk below 5 rem per year or 10 rem lifetime exposures.
- It avoids the issue of a threshold for LCF induction.
- It focuses policy attention where health effects may be more likely to occur.
- It focuses attention on optimum mitigative action preparedness.

This option has the following disadvantages:

- It is not consistent with SECY 05-0233 or the previous practice of using LNT to estimate LCF.
- It is not consistent with NCRP recommendations using collective dose to assess latent health effects (NCRP Report 121) because it uses a single dose (i.e., 5 rem) to truncate collective effective dose calculation.

The staff considered the use of expert elicitation panels for determination of a cancer induction threshold and the dose threshold for detectable LCF. The staff did not pursue these methods as they were not likely to resolve the issue, could not support the schedule and the reporting of SOARCA results do not require determination of a cancer induction threshold.

RECOMMENDATION:

The staff recommends that the Commission approve the following as the staff's approach for communicating SOARCA LCF results:

The staff believes that using the HPS dose threshold (option 3) for estimation of health risk provides the best approach for reporting SOARCA results. This is consistent with the SOARCA strategy of using "best-estimate" analyses to identify likely consequences. Further it would focus attention on optimum mitigative action preparedness. This approach would also facilitate risk communication by fostering a common understanding of the staff's estimate of potential severe accident consequences. The staff also believes that this approach comports with the Commission's use of LNT for regulatory processes because the usage here is only for the purposes of reporting analysis results. Where the threshold is used in final SOARCA report, a discussion of the reasoning behind the threshold would be included.

Note that in the October 1, 2007 Commissioner Technical Assistant briefing, the SOARCA project team reported initial results using the HPS threshold. However, the staff is prepared to modify analyses in accordance with any additional Commission direction.

RESOURCES:

The activities described in this paper were anticipated by the SOARCA project and the resources needed to support this effort are budgeted.

COORDINATION:

The Office of the General Counsel has no legal objection to this paper. The Office of the Chief Financial Officer has reviewed this paper for resource implications and has no objections.

Luis A. Reyes
Executive Director
for Operations

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Executive Director for Operations

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Although radiation may cause cancers at high doses and high dose rates, currently there are no data to unequivocally establish the occurrence of cancer following exposure to low doses and dose rates -- below about 10,000 mrem (100 mSv). Those people living in areas having high levels of background radiation -- above 1,000 mrem (10 mSv) per year-- such as Denver, Colorado have shown no adverse biological effects.

Even so, the radiation protection community conservatively assumes that any amount of radiation may pose some risk for causing cancer and hereditary effect, and that the risk is higher for higher radiation exposures. A linear, no-threshold (LNT) dose response relationship is used to describe the relationship between radiation dose and the occurrence of cancer. This dose-response model suggests that any increase in dose, no matter how small, results in an incremental increase in risk. The LNT hypothesis is accepted by the NRC as a conservative model for determining radiation dose standards recognizing that the model may over estimate radiation risk."

AND FROM http://www.nrc.gov/about-nrc/radiation/affect.html. " The time between radiation exposure and the detection of cancer is known as the latent period. Those cancers that may develop as a result of radiation exposure are indistinguishable from those that occur naturally or as a result of exposure to other chemical carcinogens. Furthermore, National Cancer Institute literature indicates that other chemical and physical hazards and lifestyle factors (e.g., smoking, alcohol consumption, and diet) significantly contribute to many of these same diseases.

Although radiation may cause cancer at high doses and high dose rates, public health data do not unequivocally establish the occurrence of cancer following exposure to low doses and dose rates — below about 10,000 mrem (100 mSv). Studies of occupational workers exposed to chronic low-levels of radiation above normal background have shown no adverse biological effects. Even so, the radiation protection community conservatively assumes that any amount of radiation may pose some risk for causing cancer and hereditary effect, and that the risk is higher for higher radiation exposures. A linear no-threshold (LNT) dose-response relationship is used to describe the relationship between radiation dose and the occurrence of cancer. This dose-response model suggests that any increase in dose, no matter how small, results in an incremental increase in risk. The LNT hypothesis is accepted by the NRC as a conservative model for estimating radiation risk."

In past analyses the staff has calculated consequences at great distances (1000 miles) and used the LNT dose-response model to estimate LCF consequences. This technique gives equal importance to very low doses received by a large number of individuals and higher doses received by a few individuals [No, it does not. The importance given to an exposure is proportional to the product of the probability of the effect and the magnitude of the exposure. Obviously, an exposure leading to a dose of 5 rem will have a much greater weight in the total than one leading to a dose of 1E-4 rem]. This approach indiscriminately adds highly uncertain and speculative health effect estimates to those from well established and accepted models based on higher doses [This statement is quite meaningless, or at least very misleading, and is contrary to the way these models are actually developed]. While the possibility of health effects from low doses can not be ruled out, they should not be treated in a manner that obscures health effects that are more predictable and that could inform the prioritization of protective measures [What doses are we talking about here? Treating effects at low doses using LNT does not obscure effects at high doses because we are dealing with a weighted total effect, the weighting factor being the dose. High dose exposures will have a much greater effect than low dose exposures, and in fact, the high dose exposures will make the low dose ones mathematically insignificant. Of course the population size exposed in each dose category is a factor, but the populations around plants are not that large].

Further, the staff believes that the use of LNT for severe accident consequence estimates is a misapplication of the concept of collective dose. The International Commission on Radiological Protection (ICRP) addressed this issue in its most recent 2007 draft recommendations (currently in process for publication):

> (161) Collective effective dose is an instrument for optimization, for comparing radiological technologies and protection procedures. Collective effective dose is not intended as a tool for epidemiological studies, and it is inappropriate to use it in risk projections. This is because of the assumptions that have to be made, e.g. when applying the LNT model, due to which the biological and statistical uncertainties involved are too great. Specifically, the computation of cancer deaths based on collective effective dose involving trivial exposures to large populations is not reasonable and should be avoided, such computations based on collective effective dose were never intended, are biologically and statistically very uncertain, presuppose a number of caveats that tend not to be repeated when estimates are quoted out of context, and are an incorrect use of this protection quantity. [The statement by ICRP is fine, but they fail to provide an alternative approach for use by regulators and others doing analyses to justify actions and to assess consequences. True, collective dose is meant to be used as a tool to compare options rather than make absolute determinations. However, the ICRP position does not lead to the conclusion that we should therefore use collective dose starting at 5 rem, THIS PAPER DOES NOT SUGGEST THAT THE ICRP STATES A 5 REM THRESHOLD, IT ONLY STATES THAT THE USE OF COLLECTIVE DOSE IS INAPPROPRIATE IN RISK PROJECTIONS ETC. THE POINT OF THIS PAPER IS THAT: 1)COLLECTIVE DOSE IS NOT AN APPROPRIATE TOOL TO USE AND 2) THERE IS SOME THRESHOLD BELOW WHICH DOSES SHOULD NOT BE CONSIDERED. as this paper proposes. In addition, what ICRP means by small doses is relative. Small doses could be doses up to maybe 20 rem or so 20 REM IS PROBABLY

> REASONABLE, HOWEVER IT WOULD BE POLITICALLY UNPALATABLE. Therefore, a better approach than proposed in this paper must be sought to permit SORCA. At the very least, the dose ranges should be divided into bins, *starting from very low doses and up, and the number of people exposed in each* bin should then be determined. The collective dose for each bin would then be determined, and the distribution of collective dose with bin interval plotted. It may turn out that the low-dose bins make relatively little contributions to the total, in which case this discussion is moot and unjustified. I don't know how it would turn out, but this examination should be part of any paper that justifies an approach to determining LCFs]. THE USE OF COLLECTIVE DOSE WHETHER "BINNED" OR NOT IS NOT AN APPROPRIATE TOOL FOR ESTIMATING RISK. IN ADDITION THIS TYPE OF ANALYSIS DOES NOT ADD TO CLARITY IN RISK COMMUNICATION RATHER LENDS TO CONFUSION-

In addition the U. S. Health Physics Society (HPS) has developed a position paper, "Radiation Risk in Perspective," (8/04), that concludes that estimates of risk should be limited to individuals receiving a dose of 5 rem in one year or a lifetime dose of 10 rem, in addition to natural background. The basis of the HPS position is consistent with the ICRP statement above. [True, but the HPS does not propose a threshold, and only recommends that effects at doses below 10 rem not be assessed quantitatively. This position does not lead to a 5 rem threshold]. PERHAPS WE ARE ATTEMPTING TO SPLIT HAIRS HERE OVER TERMINOLOGY; THE HPS PAPER STATES " **Limit Quantitative Risk Assessment to Doses at or Above 5 Rem per Year or 10 Rem Lifetime**

In view of the above, the Society has concluded that estimates of risk should be limited to individuals receiving a dose of 5 rem in one year or a lifetime dose of 10 rem in addition to natural background. In making risk estimates, specific organ doses and age-adjusted and genderadjusted organ risk factors should be used. **Below these doses,** risk estimates should not be used. Expressions of risk should only be qualitative, that is, a range based on the uncertainties in estimating risk (NCRP 1997) emphasizing the inability to detect any increased health detriment (that is, zero health effects is a probable outcome)." IT IS REASONABLE TO BELIEVE FROM READING THE PAPER THAT THE ABOVE BOLDED WORDS CONSTITUTES A DEMARCATION POINT BELOW WHICH DOSES SHOULD NOT BE CONSIDERED.. IS THAT A THRESHOLD? PERHAPS NOT, IT IS HOWEVER A LINE IN THE SAND FOR PURPOSES OF RISK ESTIMATE. WE CAN CHANGE THE WORDS FROM THRESHOLD TO "LINE IN THE SAND" OR "DEMARCATION POINT" OR SOMETHING ELSE IF THE TERM THRESHOLD IS CAUSING A PROBLEM.

In most, if not all cases, the LCF attributable to accidental releases from a severe accident would *not be detectable above the normal rate of cancer fatalities in the exposed population (i.e., the* excess cancer fatalities predicted are too few to allow the detection of a statistically significant difference in the cancer fatalities expected from other causes among the same population). However, in the past, consequence estimates from NRC studies based on collective dose were used without proper context, to misrepresent to the public from severe accidents risk [How is that so! EVEN THE AUTHORS OF THE1982 SANDIA SITING STUDY WERE COMPELLED TO ISSUE A PRESS RELEASE DECRYING THE MISUSE OF THE NUMBERS (LATENT CANCER FATALITIES/HEALTH EFFECTS) FROM THAT STUDY. THIS PRACTICE HAS CONTINUED UNABATED...A QUICK READ OF CONGRESSIONAL CORESPONDENCE OR A REVIEW OF THE WEB SHOWS HOW THESE NUMBERS ARE STILL BEING MISUSED... FOR

EXAMPLE, FROM THE UCS WEB SITE " September 8, 2004

New Study Predicts up to 44,000 Prompt Fatalities and 518,000 Long-Term Deaths From Indian Point Terror Attack
Large Radiation Release a Major Health Risk for 20 Million in New York Area"

It is not adequate to make a flat statement, presumably to be taken on faith, that past practices were misguided. We need to know why you think that]. **The staff believes that even if the appropriate qualifiers and context are provided such consequence estimates would not foster effective risk communication because they are based on speculative low dose health effects and would divert focus from optimum mitigative action preparedness** [the low dose health effects are far from speculative. They are just hard to quantify because of poor statistics at low doses. There is plenty of evidence and theoretical considerations that support LNT LNT IS A HYPOTHESIS, NOT A THEORY, IT IS NOW REFERED TO AS A "MODEL" WHICH NICELY SIDESTEPS THE PROBLEMS WITH HYPOTHESIS VS THEORY. PLEASE TO PROVIDE "EVIDENCE" OTHER THAN THEORETICAL CALCULATIONS.. THERE ARE MANY STUDIES THAT WOULD SUPPORT NO EFFECT OR EVEN HORMESIS... LIFE IN GENERAL SUPPORTS A "DEMARCATION POINT" .. WE ARE ALL CONTINUOUSLY EXPOSED TO LOW DOSES OF RADIATION AND YET WE ARE LIVING LONGER. THE CANCER RATES IN THE WESTERN WORLD ARE LARGELY ATTRIBUTED TO LIFESTYLE (DIET, EXERCISE, TOBACCO, ALCOHOL, SEXUAL ACTIVITY ETC) Besides, this is official agency policy, and is the basis for all our regulations. If this is all speculative, then how do we justify much of Part 20 and other NRC regulations?]. THE NRC HAS STATED ON ITS WEBSITE AND AS ITS OFFICIAL REGULATORY POSTURE. "This dose-response model suggests that any increase in dose, no matter how small, results in an incremental increase in risk. The LNT hypothesis is **accepted by the NRC as a conservative model** for estimating radiation risk." I WOULD ALSO SUGGEST A READ OF REG GUIDE 8.29 FOR SOME VERY STRONG WORDS ON RADIATION HEALTH EFFECTS... " In the absence of scientific certainty regarding the relationship between low doses and health effects, and as a conservative assumption for radiation protection purposes, the scientific community generally assumes that any exposure to ionizing radiation can cause biological effects that may be harmful to the exposed person and that the magnitude or probability of these effects is directly proportional to the dose...**If I receive a radiation dose that is** within occupational limits, will it cause me to get cancer? Probably not. Based on the risk estimates previously discussed, the risk of cancer from doses below the occupational limits is believed to be small, Assessment of the cancer risks that may be associated with low doses of radiation are projected from data available at doses larger than 10 reins (O.1 Sv) (Ref. 3). For radiation protection purposes, these estimates are made using the straight line portion of the linear quadratic model (Curve 2 in Figure 1). We have data on cancer probabilities only for high doses, as shown by the solid line in Figure 1. Only in studies involving radiation doses above occupational limits are there dependable determinations of the risk of cancer, primarily because below the limits the effect is small compared to differences in the normal cancer incidence from year to year and place to place. The ICRP, NCRP, and other standards-setting organizations assume for radiation protection purposes that there is some risk, no matter how small the dose (Curves 1 and 2). Some scientists believe that the risk drops off to zero at some low dose (Curve 3), the threshold effect, The ICRP and NCRP endorse the linear quadratic model as a conservative means of assuring safety (Curve 2). For regulatory purposes, the NRC uses the straight line portion of Curve 2, which shows the number of effects decreasing linearly as the dose decreases. Because the

scientific evidence does not conclusively demonstrate whether there is or is not an effect at low doses, the NRC assumes for radiation protection purposes, that even small doses have some chance of causing cancer. Thus, a principle of radiation protection is
to do more than merely meet the allowed regulatory limits; doses should be kept as low as is reasonably achievable (ALARA). This is as true for natural carcinogens such as sunlight and natural radiation as it is for those that are manmade, such as cigarette smoke, smog, and x-rays." NOTHING IN THIS PAPER IS CONTRARY TO NRC REGULATORY POSTURE. PERHAPS,HOWEVER, BASED ON THESE CONCERNS, NRC SHOULD CONSIDER CHANGING ITS POSITION ON LNT AND NOT MAKE SUCH STATEMENTS AS "CONSERVTIVE MODELS, NOT LIKELY TO DEVELOP CANCER ETC...

For the purpose of radiation protection regulation, the NRC treats radiation-induced health effects stochastically. In this treatment, the likelihood of occurrence increases with incremental increase in radiation exposure with no threshold. The staff agrees with this conservative approach for regulatory purposes and this paper does not attempt to identify a threshold for cancer induction or to propose changes to NRC regulatory philosophy (e.g., 10 CFR 50.36.a). Instead, the establishment of a dose threshold for reporting consequence estimates will focus public policy on more likely outcomes, rather than on speculative estimate associated with assigning risk from collective dose [Again, this statement is internally contradictory and, despite statements to the contrary, does in fact set a dose threshold.THIS PAPER DOES NOT PROPOSE ANY CHANGES TO REGULATORY POSITIONS The paper also ignores that fact that the basis for estimating LCFs above 5 rem is the same one used for estimating LCFs below 5 rem. There is no increased accuracy or reliability just because the dose is being calculated at 5 rem rather than at 0.5 rem. The dose coefficient used in both cases is the same, with the same level of uncertainty]. The staff believes this is appropriate because SOARCA is not a regulatory analysis, but rather an effort to model consequences realistically using risk communication techniques to facilitate a common understanding among stakeholders [This statement does not say anything useful and should be removed]. Therefore, the staff believes that the use of collective dose and LNT for predicting LCF is neither appropriate nor required.

DISCUSSION:

In SECY-05-0233, the staff stated that the latent health effects analyses will cover a range of dose models with thresholds from 0 to 5 rem. However, the staff became concerned that reporting a range of values would not support risk communication efforts, as it would provide many answers for each scenario analyzed and obscure focus on the optimum mitigative action preparedness.

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- It is consistent with the 2007 ICRP recommendations in that no single dose threshold is proposed.

- The range of answers would reflect uncertainty regarding dose effects.

The disadvantages of this option include the following:

- It aggregates collective dose by including trivial exposures to large population groups thus obscuring focus on optimum mitigative action preparedness accident.
- The use of different thresholds for assessing LCF for the same scenario would be difficult for stakeholders to understand and accept.
- It would be poor for risk communication purposes because it would not facilitate common understanding by stakeholders and would invite misinterpretation.
- The results of a single analysis could be interpreted in various ways according to stakeholder view.
- It would not facilitate the presentation of the staff's estimate of consequences.
- It would not focus attention on optimum mitigative action preparedness

(2) Use an LNT model to assess LCF

This option offers the following advantages:

- It would reduce cost and support the existing schedule.
- It would promote a common understanding among the stakeholders by providing a single consequence for each scenario analyzed.
- It is consistent with the models used in previous consequence analyses.
- It is consistent with the recommendations of the National Council on Radiation Protection and Measurement (NCRP) in Report 121, "Principles and Application of Collective Dose in Radiation Protection".
- It is consistent with analysis recommended by the U.S. National Academies of Science and employed by the World Health Organization.
- It is consistent with the Commission's policy for developing regulations to protect public health and safety.

The following are the disadvantages of this option:

- It would require the staff to estimate potential LCF in individuals who have received doses below public and occupational worker limits.
- It would inappropriately aggregate collective dose by including trivial exposures to a large population.
- The ICRP and HPS do not support its use for estimating LCF; rather, it is considered a misapplication of the use of collective dose.
- It would not represent the staff's realistic estimate for LCF.

(3) Estimate the number of detectable LCF using the thresholds proposed by the HPS

This option has the following advantages:

- It would reduce cost and support the existing schedule.
- It would improve common understanding among stakeholders by providing a single consequence number for each scenario.
- It is consistent with new (draft) ICRP recommendations which state that the computation of cancer deaths based on collective effective doses involving trivial exposures to large populations is not reasonable and should be avoided.
- It is consistent with the official position statement of the Health Physics Society (HPS) entitled, "Radiation Risk in Perspective," (PS010-1, August 2004) which recommends not assessing risk below 5 rem per year or 10 rem lifetime exposures.
- It avoids the issue of a threshold for LCF induction.
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This option has the following disadvantages:

- It is not consistent with SECY 05-0233 or the previous practice of using LNT to estimate LCF.
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RECOMMENDATION:

The staff recommends that the Commission approve the following as the staff's approach for communicating SOARCA LCF results:

The staff believes that using the HPS dose threshold (option 3) for estimation of health risk provides the best approach for reporting SOARCA results. This is consistent with the SOARCA strategy of using "best-estimate" analyses to identify likely consequences. Further it would focus attention on optimum mitigative action preparedness. This approach would also facilitate risk communication by fostering a common understanding of the staff's estimate of potential severe accident consequences. The staff also believes that this approach comports with the Commission's use of LNT for regulatory processes because the usage here is only for the purposes of reporting analysis results. Where the threshold is used in final SOARCA report, a discussion of the reasoning behind the threshold would be included.

Note that in the October 1, 2007 Commissioner Technical Assistant briefing, the SOARCA project team reported initial results using the HPS threshold. However, the staff is prepared to modify analyses in accordance with any additional Commission direction.

RESOURCES:

The activities described in this paper were anticipated by the SOARCA project and the

resources needed to support this effort are budgeted.

COORDINATION:

The Office of the General Counsel has no legal objection to this paper. The Office of the Chief Financial Officer has reviewed this paper for resource implications and has no objections.

Luis A. Reyes
Executive Director
for Operations

COORDINATION:

The Office of the General Counsel has no legal objection to this paper. The Office of the Chief Financial Officer has reviewed this paper for resource implications and has no objections.

Luis A. Reyes
Executive Director
for Operations

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