(3)

Cool, Donald

From: Cynthia Jones NSIR
Sent: Friday, January 11, 2008 2:56 PM
To: Dennis Damon; Matthew Bartlett; Donald Cool; Jean-Claude Dehmel; Vincent Holahan; Patricia Holahan; Jocelyn Mitchell; Patricia Milligan; Sami Sherbini; Roger Pedersen
Cc: William Dean; Farouk Eltawila; Roy Zimmerman; Randy Sullivan; Jimi Yerokun
Subject: Re: SOARCA
Attachments: SOARCA LCFs CJ Comments V4.doc

Vince, et al-

My option for the paper is Option 5: six endpoints - LNT and truncate with multiple values between 0 and 5 rem (e.g., 0.01, 0.1, 0.5, 2, and 5 rem). While I originally leaned to selecting Option 4 [two endpoints - LNT and truncate at one value (e.g., 5 rem)], I am not comfortable with the technical decision for selection of 5 rem. This 5 rem value is technically indefensible (given the paper you forwarded today) and would be clearly a policy decision by the Commission. Accordingly, they too would need some technical analyses to make a decision and this paper just doesn't present the support for 5 rem. If the paper were to have shown that for the truncation of multiple values, say 10 mrem, 100 mrem, 500 mrem, 1 rem and 5 rem, and that the staff could present a technical argument for why a 5 rem threshold was chosen, then I could support that. However, the paper as written does not provide that technical basis.

Since I have not been involved with the review of other versions of this paper, I have also provided some quick comments & mark-ups on the attached for consideration of the final Commission paper. In general, where references are made, the date of the citation and the reference needs to be added to the paper, either as a footnote or endnote, so that the Commission can review these references on their own. Currently, the references are not included and it weakens the paper. Also, make sure all the English units are included next to the SI units for the Commission paper. Even though the quote may only include the SI unit, we can and typically do include English units in Commission papers.

Also, it is unclear why 1000 miles was selected for the criterion. Is this explained elsewhere? It should be clearer.

Lastly, the paper cites several different values for "low dose" :
Page 2 states that low dose radiation is <0.05 Sv (<5 rem)
Page 3 states that in the French study, very low doses are <1 rem and low doses are <10 rem
Page 4 states that 5 rem is a low radiation dose
As a note, I am not aware that there is a consensus by staff that a low radiation dose is 5 rem. So I would recommend rephrasing it as a "dose lower than the occupational limit," or something along those lines.

I am in agreement that in order to perform more realistic offsite consequence analyses, that LNT should not be the only criterion and we need to move out of that box. In SECY 05-0202, (staff's report on BEIR VII) we noted that "The primary finding of the BEIR VII Committee is that the current scientific evidence is consistent with the hypothesis that there is a linear, no-threshold dose-response relationship between the exposure to ionizing radiation and the development of cancer in humans." However, this Committee also stated that it could not definitively exclude the possibility of a threshold for radiation effects lower than 0.1 Sv (10 rem) of lifetime exposure in human studies and 20 mGy (2 rads) in DNA studies. It stated: "Epidemiologic studies are unable to provide direct evidence of any dose response relationship at very low doses [0 to 100 mSv (10 rem)] because of the lack of sufficient statistical power to detect a health effect."

I think we should work to develop the analyses to truncate with multiple values between 0 and 5 rem (e.g., 0.01, 0.1, 0.5, 2, and 5 rem), select a value as the threshold for LCF (my guess would be 10 mrem or the 100 mrem range) and move on from there.

T/67

Lastly, I also think you should add your name to the paper, given the amount of work you have put into it. Its one of the most technical issues that the NRC has had to deal with in a long time.

Cyndi

>>> Vincent Holahan 01/11/2008 9:27 AM >>>
All,

My apologies for the short notice, but Jack Grobe has requested that RES poll the SLs/Senior HPs from each of the program offices to get their view/vote on assessing offsite latent cancer mortality. Several alternatives have been proposed. Your view/vote on the best alternative is requested. If I could receive a response in the next couple of hours, it would be appreciated.

The alternatives are:
1) linear, no threshold
2) truncate effective dose at 10 mrem (100 microSv)
3) truncate effective dose at 5 rem/yr; 10 rem lifetime
4) two endpoints - LNT and truncate at one value (e.g., 5 rem)
5) six endpoints - LNT and truncate with multiple values between 0 and 5 rem (e.g., 0.01, 0.1, 0.5, 2, and 5 rem)

If you have any questions, give me a call.

cheers,
Vince

E. Vincent Holahan, Jr. Ph.D.
Senior Level Advisor for Health
Effects Research Programs
Office of Nuclear Regulatory Research
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

(301) 415-8715 voice
(301) 415-5389 fax

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 (1) preliminary findings from the state-of-the-art reactor consequence analyses (SOARCA), (2) a discussion of the technical issues associated with assessing offsite latent cancer fatalities (LCF) in SOARCA reports, and (3) a staff recommendation, for notation vote, on calculating and reporting offsite LCF.

CONTACTS: *Jocelyn Mitchell, RES*
301-415-5289

January 7, 2008; 1530 hrs

BACKGROUND:

In SECY-05-0233, "Plan for Developing State-of-the Art Reactor Consequence Analyses" (SOARCA), the staff provided its proposed plan to perform an updated realistic evaluation of severe reactor accidents and their offsite consequences. The plan describes the staff's intention to incorporate the significant improvements in understanding and modeling of severe accident phenomenology which have been developed through research conducted by the U.S. Nuclear Regulatory Commission (NRC) and abroad over the last 20 years. The plan describes the staff's intent to include in their analysis both the plant improvements (e.g., systems, training, and procedures) which have significantly lowered the likelihood of severe accidents and offsite emergency response capability which lowered the offsite health consequences of such events. Another objective of this study is to provide effective communications of the results to all stakeholders based on realistic estimates of the more likely outcomes.

The SOARCA development plan focuses on dominant events in order to provide proper risk perspective. The staff identified those dominant events as scenarios (i.e., groups of similar sequences) which have a core damage frequency of 10^{-6}/reactor year or containment bypass scenarios which have a frequency of 10^{-7}/reactor year, based on guidance from the Commission, general consistency with risk informed criteria for assessing plant changes, and insights from our initial SOARCA examinations. The portrayal of health consequences in terms of discrete quantities (e.g., early fatalities and latent cancer fatalities), rather than as individual risk (e.g., likelihood of an individual's death), was proposed for this study. This was seen as necessary insofar as the public is exposed to media or advocacy group characterizations of health consequences which cite absolute numbers of fatalities, and not as an expression of individual risk.

When considering how to more realistically perform the offsite consequence analysis, the staff originally planned to use a linear, no threshold (LNT) dose response model and a range of dose threshold values (i.e., dose truncation values) varying from 0 to 50 mSv (5 rem) for estimating offsite latent cancer fatalities. All offsite consequence calculations use the same LNT model and cancer risk coefficients. However, in those instances where a dose threshold is used, LCF attributable to individual exposures that do not exceed the threshold are excluded from further consideration and exposures above the threshold are further evaluated. Thus, a "threshold" model would assume zero effect below the truncation dose, and some other functional form above that value. This methodology was adopted by the SOARCA team in order to comply with previous Commission guidance (ML031340371) to present "latent cancer health effects estimates ... as a range of potential consequences" and to fulfill the overall intent of the SOARCA study to provide realistic estimates of the more likely outcomes.

There is, however, a significant difference of opinion among the NRC staff, and also within the external scientific community, regarding the dose response relationship between latent cancer mortality and exposure to low dose radiation (<0.05 Sv, <5 rem). Thus, there is significant staff disagreement on the existence, or absence, of a threshold in dose response model and the application of any dose truncation in SOARCA.

This debate will continue because of the biological and statistical uncertainties associated with low dose radiation-induced carcinogenesis. From an epidemiological standpoint, in most, if not all cases, the LCF attributable to radiation exposure from 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). For example, in 200X, the World Health Organization (WHO) add reference & date estimates that there will be 16,000 European cancer deaths attributable to radiation released from the 1986 Chernobyl nuclear power plant accident, but these predicted numbers are small relative to the several hundred million cancer cases that are expected in Europe up through 2065 due to other causes. Furthermore, WHO concluded that "it is unlikely that the cancer burden from the largest radiological accident to date could be detected by monitoring national cancer statistics."

In the absence of additional information, the in 200X, International Commission on Radiological Protection (ICRP) the U.S. National Academies, and the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) have each indicated that the current scientific evidence is consistent with the hypothesis that there is a linear, no threshold dose response relationship between exposure to ionizing radiation and the development of cancer in humans. Add references for ICRP report No, NAS report No, and UNSCEAR. You should also note that NRC's Reg Guide 8.29 also uses LNT as its current model for assessment of risk, so perhaps the 4th paragraph from page 5 should be moved here. The LNT dose response model and the linear quadratic dose response model are the two models incorporated into MACCS2.

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Conversely, in 200X, the French National Academy of Medicine (add reference) advocates that:

> "a linear no-threshold relationship (LNT) describes well the relation between the dose and the carcinogenic effect in this dose range (0.2 to 3 Sv) (add English units)where it could be tested. However, the use of this relationship to assess by extrapolation the risk of low and very low doses deserves great caution. Recent radiobiological data undermine the validity of estimations based on LNT in the range of doses lower than a few dozen mSv which leads to the questioning of the hypotheses on which LNT is implicitly based."

While the French National Academy of Medicine report raises doubts on the validity of using LNT for evaluating the carcinogenic risk of low doses Note: it would be clearer to state [< 100 mSv (<10 rem)] rather than (< 100 mSv, < 10 rem) and even more for very low doses [(< 10 mSv, 1 rem)] (< 10 mSv (< 1 rem)), it did not articulate what exact value should be ascribed to a dose threshold.

Ultimately, (explain *why* this is done) external and internal exposure to individual members of the public are converted to collective dose and latent cancer fatalities. For the linear, no threshold model, there is concern that the summation of hundreds to thousands of very small, almost trivial exposures ((e.g., 10's μSv (a few mrem) would may inappropriately attribute LCF to individuals residing within 1,000 miles of the accident site. While the possibility of LCF from very low doses cannot be ruled out, it is considered by some organizations (e.g., ICRP, National Council on Radiation Protection and Measurements) to be an inappropriate use of collective dose, these exposures.

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Nevertheless, there remain the issues of assessing public exposure, estimating offsite consequences, and communicating these assessments to the public for SOARCA. Several organizations, such as the ICRP, have addressed this issue. In its most recent 2007 recommendations (ICRP Report 103) (include reference or footnote with full citation), the ICRP

states:

> (161) Collective effective dose is an instrument for optimisation, 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 the assumptions implicit in the calculation of collective effective dose (e.g., when applying the LNT model) conceal large biological and statistical uncertainties. Specifically, the computation of cancer deaths based on collective effective doses 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.

Although the ICRP provides guidance regarding the situation where collective dose should not be used, no guidance was provided with regard to when these concepts actually are, and are not, appropriate, nor did they clearly articulate the boundary conditions within which the calculations are valid, as well as the dose ranges for which epidemiological and cellular or molecular data provide information on the health effects associated with radiation exposure.

DISCUSSION:

As the SOARCA study proceeded during the last year, the SOARCA steering committee, along with many of the SOARCA team members, expressed concern that the presentation of multiple offsite health consequence results for each accident sequence analyzed, using a range of dose truncation values, would be contrary to effective risk communication in that it might be difficult to provide a context for the multiple LCF estimates and make it difficult to articulate which of the estimates reflect the staff's estimate of the more likely outcome. For example, even though the 200X Sandia Siting Study (add date & reference) includes the results of consequence analysis for several scenarios with moderate or benign consequences, advocacy groups rarely mention these results and often quote the most severe and most unlikely outcomes of a highly improbable scenario. It can be argued that presenting different values would make it difficult for stakeholders to have a common understanding of the results, and could lead to selective misinterpretation. Thus, the SOARCA steering committee and team members determined that a single predictive approach would provide a better communication vehicle for the SOARCA results. Further, these staff members believe that use of a single truncation dose and exclusion of low radiation exposures to members of the public (e.g., < 0.05 Sv, < 5 rem) is the more appropriate and realistic description of offsite health consequences >>Note: most technical staff do not believe 5 rem to be a "low radiation dose"; consider rephrasing. This truncation was considered as justifiable by most members of the SOARCA team because SOARCA is not a regulatory analysis, but rather an effort to model severe accidents, and their offsite health consequences, more realistically.

Another principal SOARCA objective is to better communicate the likely outcomes (and risk) from a severe accident whose probabilities are on the order of 10^{-6} to 10^{-7} per reactor year. Some SOARCA team members believe that communicating risk should not be based on worst case projections for highly improbable events and that the use of such worst case modeling distracts from any important findings related to risk (and effective Emergency Preparedness),

ultimately wastes resources by the eventual need to provide context, and frequently results in unnecessary public fear. Conversely, other staff does not believe that use of the LNT model represents worse case modeling; rather, it represents an age-averaged, gender-averaged risk estimation of the U.S. population, as reflected in the 1990 population census, exposed to low dose and low dose rate radiation exposure.

How should low dose consequences be estimated?

In 200X, The U.S. National Academies reported (provide reference and citation) that "the magnitude of estimated risk for total cancer mortality or leukemia has not changed greatly from estimates in past reports such as BEIR (provide reference. Is this BEIR V or BEIR VII?- be clear) and recent reports of the United Nations Scientific Committee on the Effects of Atomic Radiation and the International Commission on Radiological Protection (add dates & references). New data and analyses have reduced sampling uncertainty, but uncertainties related to estimating risk for exposure to low doses and dose rates and to transporting risks from Japanese A-bomb survivors to the U.S. population remain large." The National Academies go on to conclude "that current scientific evidence is consistent with the hypothesis that there is a linear, no-threshold dose-response relationship between exposure to ionizing radiation and the development of cancer in humans."

Many groups acknowledge the uncertainties associated with estimating risk for exposure to low radiation doses. The question which remains is what offsite health consequences are attributable to very low radiation exposure. The ICRP in their most recent recommendations (Report 103), as described above, warn that the computation of cancer deaths based on collective effective doses involving trivial exposures (<1 mrem) Note: can we add the value and use the definition of trivial dose from NRCP or international recommendations?) is not reasonable and should be avoided, but do not explicitly state which exposures should not be considered. However, in ICRP Report 104 (add date & citation), Scope of Radiological Protection Control Measures (in press), the ICRP concludes that the radiation dose which is of no significance to individuals should be in the range of 20-100 μSv (2-10 mrem) per year whole body dose. The International Atomic Energy Agency (IAEA) has stated that an individual dose *is likely to be regarded as trivial if it is of the order of some tens of microsieverts per year.* Although there is no scientific basis for defining what a trivial dose might be, these definitions of trivial dose may provide a basis in order to address truncation of offsite radiation exposure and attributable health consequences.

Alternatively, in 2004, the U. S. Health Physics Society (HPS) developed a position paper, "Radiation Risk in Perspective," (add citation from web site to references)~~revised August 2004~~) to specifically address quantitative estimation of health risks. This paper concludes that quantitative estimates of risk should be limited to individuals receiving a whole body dose of 0.05 Sv (5 rem) in one year or a lifetime dose of 0.1 Sv (10 rem), in addition to natural background. *They also conclude that below these doses risk estimates should not be* conducted. The position paper further states that low dose expressions of risk should only be qualitative, thus emphasizing the inability to detect any increased health detriment. The difference between the HPS view and those expressed by ICRP and IAEA is detectability of an offsite consequence versus exposure to trivial doses.

Staff concerns about estimating LCF

As discussed above, the LNT model provides a viewpoint that is consistent with NRC's recommendations in Regulatory Guiode 8.29, "Instruction Concerning Risks form Occupational Exposure." ~~the regulatory approach of the agency.~~ This model is used by NRC~~the agency~~ to calculate ~~LCF~~risks form occupational exposures. With respect to the SOARCA analyses, the ~~That is to say,~~ MACCS2 code ~~has used and continues to~~ uses the LNT dose response model to

calculate LCF. If there is a desire to compare SOARCA analyses with past results, continued use of the LNT model without any dose truncation is necessary.

As a matter of policy, however, the NRC can use different "approaches" for different applications. The use of a truncation dose criteria will not, and should not, impact the underpinnings of our regulatory "defense-in-depth" approach to protect public health and safety, which is based on LNT. Any future SOARCA reports could emphasize that radiation protection standards and policy are not being changed or contemplated as a result of an approach taken in this study to characterize offsite health consequences for low probability events. Regarding comparison with previous studies, the benefit gained by performing calculations using the LNT model without dose truncation, which would allow comparison on the same methodological basis, has to be weighed against the disadvantages of using such a collective dose model in what we intend to be a "state of the art" model.

The SOARCA steering committee and several SOARCA team members expressed concern that the health consequence estimations conducted by MACCS2 are dominated by small exposures to large numbers of individuals. Furthermore, these staff members are concerned about their inability to present ~~these~~ offsite consequences in a context that compares SOARCA results with the existing rates of cancer mortality among the exposed resident population. To address these concerns, it has been proposed that exposures to the public could be truncated to exclude all LCFs attributable to exposure less than some selected value (e.g., 5 rem).

On the other hand, some~~other~~ NRC staff are concerned that the truncation of exposure, even exposures above a trivial dose, ~~and subsequent exclusion of offsite health consequences~~ will be perceived by some NRC stakeholders as disingenuous or even deceitful in that many individual exposures (and some future latent cancer deaths) will be arbitrarily, or deliberately, excluded from consideration and will not be reported as an offsite consequence. These staff members believe that this will significantly undermine public confidence in NRC's ability to objectively evaluate and report offsite consequences and thus impartially regulate the civilian use of nuclear materials. Furthermore, the necessity to defend a truncation value may obscure the technically justified changes that have been made in the source term and offsite consequence model used in SOARCA.

There is general agreement that it is difficult to characterize cancer risk for some tissue sites, owing to the low statistical precision associated with relatively small numbers of excess cases. This can limit the ability to estimate trends in risk. However, new findings have been published from analyses of fractionated or chronic low-dose exposure to low-LET radiation; in particular, a study (add dates & references) of nuclear workers in 15 countries, studies of persons living in the vicinity of the Techa River in the Russian Federation who were exposed to radioactive waste discharges from the Mayak Production Association, a study of persons exposed to fallout from the Semipalatinsk nuclear test site in Kazakhstan (add dates & references), and studies in regions with high natural background levels of radiation. Cancer risks are generally compatible with, although in some studies they are somewhat higher than, those derived from the Japanese atomic bomb data. Most recent results from analyzing this data are consistent with a linear or linear-quadratic dose-response relationship of all solid cancers together and with a linear-quadratic dose response relationship for leukemia. Consequently, there is little or no scientific basis to support the selection of a dose below which no adverse consequences can be assessed. Therefore, rejection of the LNT dose response model and the selection of an alternative method for assessing and reporting offsite health consequences may ultimately be

viewed as a policy decision; one with no scientific basis.

In the absence of clear scientific evidence concerning health effects attributable to low dose radiation exposure, and the concerns about using the LNT model and with calculating multiple estimates of offsite LCFs, the staff is seeking alternatives for presenting the results of the SOARCA analyses.

Alternatives for addressing offsite latent health consequences

To address these difficulties, the staff considered several options for presenting estimated LCF results and analyzed four in some depth. For three of the alternatives, the assessment of LCF would include dose truncation of a linear dose-response model.

(1) Use a range of dose truncation values, from 0 to 0.05 Sv (5 rem) to assess LCF. This option was proposed to the Commission in SECY-05-0233. Under this option, several doses are selected, below which all individual doses are excluded from further consideration. LCFs are only calculated for those individuals who received exposures that exceed the selected truncation dose.

This option offers the following advantages:

- It would include the LNT risk model and multiple truncation points.
- It is consistent with the draft 2007 ICRP recommendations in that some of the estimates presented do not rely on use of collective dose at low dose levels.
- The range of answers might be perceived as providing the most complete picture of information.
- A zero truncation will allow comparison with previous offsite consequence analyses.

The disadvantages of this option include the following:

- It includes an estimate which calculates collective dose including very small exposures to large population groups.
- The use of different truncation values for assessing LCF for the same scenario could be difficult for stakeholders to understand.
- The presentation of multiple results could be poor for risk communication purposes because it would not facilitate common understanding by stakeholders and would invite selective misinterpretation in both the underestimation and possible overestimation of offsite health consequences. That is, the results could be interpreted in various ways according to stakeholder view.

(2) Use only an LNT model to assess LCF.

This option offers the following advantages:

- It could 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 recommendations of the U.S. National Academies and employed by the World Health Organization.
- It is consistent with the Commission's regulatory policy.

The following are the disadvantages of this option:

- It includes an estimate which calculates all doses, including very small exposures to large populations, which would be contrary to the statements of the ICRP and HPS that such calculations are inappropriate.
- It might be perceived as not providing the most complete picture of the information.

(3) Estimate the number of LCF using a single 0.05 Sv (5 rem) per year, 0.1 Sv (10 rem) lifetime dose truncation value.

This option has the following advantages:

- It could promote a common understanding among stakeholders by providing a single consequence for each scenario analyzed.
- It could be viewed as consistent with ICRP statements on the use of collective dose, although the ICRP does not state what truncation value it would advocate.
- It focuses attention where health effects may be more likely to be observed.
- It is consistent with the US Health Physics Society position.

This option has the following disadvantages:

- It is not consistent with the previous practice of using LNT (with or without truncation) to estimate LCF, hence direct comparison of offsite consequences with previous studies will not be possible.
- It is not consistent with NCRP recommendations using collective dose to assess latent health effects (NCRP Report 121).
- It may be perceived as advocating a threshold for LCF induction, even though it is intended only to facilitate the presentation of the most meaningful offsite consequences.
- Most of the collective dose is excluded from consideration, hence, this alternative may be perceived as not providing "complete" information or a deliberate misinterpretation of the offsite consequences.

(4) Estimate the number of LCF using a single 100 μSv (10 mrem) per year dose truncation value.

This option has the following advantages:

- It could promote a common understanding among stakeholders by providing a single consequence for each scenario analyzed.
- It is consistent with the new ICRP recommendations (Report 103)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 ICRP and IAEA views of trivial exposure.

This option has the following disadvantages:

- It is not consistent with the previous practice of using LNT (with or without dose truncation) to estimate LCF, hence direct comparison of offsite consequences with previous studies will not be possible.
- It is not consistent with NCRP recommendations using collective dose to assess latent health effects (NCRP Report 121), hence, this alternative may be perceived as not providing "complete" information.
- It is not consistent with the HPS position that health effects attributable to radiation exposure should not be quantitatively considered below 0.05 Sv (5 rem) in a year, 10 rem in a lifetime.
- Some collective dose is excluded from consideration, hence, this alternative may be perceived as not providing "complete" information or a deliberate misinterpretation of the offsite consequences.

Preliminary Results

The SOARCA results (for the two plants analyzed) using state-of-the-art analytical techniques, improved plant characterization, and improved treatment of emergency planning have demonstrated that plant risk has decreased and that core damage or significant offsite release can be averted using available plant equipment, including the new mitigative measures that have been added or are in the process of being implemented. In these instances, there are no predicted early fatalities. For the sensitivity analyses, which assume the failure of many of the new mitigative features that have been added, the results indicate no early fatalities. The number of LCF depends on the scenario and the truncation dose used in the consequence calculation. The inputs into the MACCS2 code for the SOARCA analyses have improved the estimate of latent health effects and reflect more realistic estimates of the dominant accident sequences, in-plant accident progression, radiological releases, and the associated doses received by the exposed public. Many other MACCS2 code input parameters are being scrutinized to ensure that they represent best estimates and are not biased.

Conclusion

There are both scientific and communication issues that will need to be addressed in the presentation of the results to stakeholders. The staff recognizes that a calculation of LCF using a LNT model without dose truncation will be done, if not the NRC staff, then by others. If these calculations are performed by NRC stakeholders, significant resources may need to be expended in an attempt to explain what NRC provided, and why this was the most appropriate presentation. The staff will have to make clear that the presentation of any results based on dose truncation does not discount the possibility of LCF at low doses and thereby may be an incomplete estimate of LCF. That is, the staff recognizes that the selection of any particular truncation value is not supported by any specific scientific information regarding the induction of cancer. If a dose truncation is used in the final SOARCA report, a discussion of the reasoning behind the value selected would be included along with the reasoning behind why portrayal of risk may appropriately consider a threshold.

RECOMMENDATION:

[Insert staff recommendation here.]

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

Attachment: as stated

RECOMMENDATION:

[Insert staff recommendation here.]

RESOURCES:

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

COORDINATION:

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Luis A. Reyes
Executive Director
for Operations

Attachment: as stated

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