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Secretary Ernest J. Moniz
U.S. Department of Energy
1000 Independence Avenue S.W.
Washington D.C. 20585

June 23, 2015

Dear Mr. Secretary,

SEAB has requested that I respond to your letter of June 16, 2015 requesting

“...SEAB’s perspective on how DOE should pursue research on the question of a ‘linear’ or ‘threshold’ low-level radiation exposure model. Should DOE continue its efforts on this subject or leave it to other agencies such as EPA and NIH? Or is there a research effort that over time may lead to knowledge that will resolve the question of health effects of low-level radiation exposure to citizens and workers in the nuclear industry. Has the scientific community identified specific knowledge gaps that would be appropriate research priorities for DOE to pursue?”

This question of “linear” versus “threshold level” radiation exposure to low levels of radiation is important because its consequences for regulations governing radiation exposure to workers, and citizens in the vicinity of commercial nuclear power plants and associated fuel cycle activities, especially with regard to the increased likelihood of cancer fatality.

For human populations a plausible case can be made for a threshold below which there is no harm to exposure because the human population has forever been exposed and therefore adapted, to natural background levels of radiation. Organisms in the natural environment evolve biological mechanisms to repair radiation damage to cells at the molecular level, thus avoiding or reducing adverse radiation response. This suggests research on radiation damage at the cellular level to identify natural thresholds for radiation damage. However, if a precise understanding of the cellular level dose-response were reached, the challenges of scaling up this understanding to enable establishing a quantitative threshold for human dose-response would remain.

The most direct way to investigate low-level radiation damage is epidemiological studies on human populations exposed to different levels of radiation in one context or another (Denver versus Miami). Such studies do not rely on ‘controlled’ conditions to establish dose and response but rather attempt to infer the dose-response relationship from statistical information. This is a formidable task because as the dose level approaches zero the “noise” of random fluctuations that reflect different exposure circumstances becomes proportionally larger than the signal that one is seeking to detect.

Despite many years of diligent study on both these approaches there is insufficient evidence to justify replacing the linear low level radiation exposure behavior assumption with any other – in particular a threshold low level exposure behavior. It is highly unlikely – I would say impossible – that a group of experts would, after review and deliberation on the vast literature on this subject, come to a consensus or that consensus would resolve this question to the satisfaction of regulatory authorities or the public.

You have asked a further research program could fill “specific knowledge gaps” that would resolve this question of low-level radiation exposure on humans. Understandably, as a result of inconclusive results of the vast body of past DOE sponsored research, some Office of Science program officers are skeptical and advocate applying these resources to other purposes.

SEAB does not believe DOE should abandon its research effort on low-level radiation effects. There are several reasons. First, the subject is of importance to many DOE constituencies such as commercial nuclear power, stockpile stewardship, waste management, and the nuclear navy. Second, the DOE laboratories are undoubtedly the leading repositories of knowledge on this difficult, but important, subject. The DOE should maintain this expertise; if disbanded, it will be difficult to reassemble. Third, if the DOE were to withdraw from low-level radiation exposure research only the EPA and NIH would sponsor any remaining federal research activity; neither agency has the deep expertise in nuclear science or biological effects of radiation exposure that exists in DOE national laboratories.

Thus, SEAB recommends DOE continue to sponsor a small, sustained, high quality research program mainly in DOE laboratories but also at centers of excellence on this subject that exist in universities, medical schools, and hospitals.

SEAB does not believe it is the right group to put together such a research program. Low-level radiation exposure is a specialized subject and, experience shows, there is not an obvious research program that will yield decisive results. The Director of DOE’s Office of Science should be charged with commissioning a small group of experts (including a couple of smart outsiders to the subject) to propose a modest, multi-year, research program in low-level radiation exposure. If requested, SEAB would review this research plan and make suggestions to the Director of the Office of Science. However, you should not assume that the results of such a research program would be conclusive.

If you have any questions or comments, please do not hesitate to get in touch.

Sincerely yours,



John Deutch

CC: Undersecretary F. Lynn Orr
Members of SEAB
Karen Gibson